D0000389
RECHLORINATION PLANT
STANDARD SPECIFICATION

NOTES:

1. **This Specification is to be used by Designers for all Rechlorination Plant projects.**
2. **The content of this Specification must not be changed or altered.**
3. **This Specification is not intended to be a stand-alone document. Project specific documents and additional technical clauses must be included with contract documentation.**

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General

1.1 Scope

This document specifies the detailed design and construction requirements for a standard Sodium Hypochlorite (NaOCl) Rechlorination Plant (RCP). The primary function of the RCP is to accurately dose Sodium Hypochlorite to maintain the chlorine residual in the water supply. This specification pertains specifically to Rechlorination Plants that are co-sited with other assets on the supply network. Installations within treatment plants and filtration plants are not covered by this document

This Specification does not apply to temporary dosing units but may form the basis for the supply and performance requirements for temporary units. Temporary RCPs may only be used where approved by the Principal.

The document is to be used for the design, construction, installation and commissioning of both, transportable and permanently installed RCPs. The selection of type (transportable or permanent) shall be agreed with the Principal. In general, the units shall comply with the following;

Transportable RCP – *Total effective storage* is below 20 kL consisting of a two tank system, a storage tank (neat sodium hypochlorite) and a dosing tank (diluted sodium hypochlorite).

Permanent RCP – Installations whereby total effective storage at the plant is greater than 20kL. Where the technical requirements for the design and construction of the plant varies for a particular section these variations shall be clearly stated in this specification. Otherwise the Contractor is to comply with all sections for both transportable and permanent plant types.

1.2 Style of this Specification

This document is written in the directive style. Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Contractor. Therefore guidance on the allocation of tasks or separation of a contract into sub packages or work orders is not included in this specification. The specification shall outline the final requirements of the units however not dictate who shall undertake these works.

Where a submission, request, or proposal is required, and it is not stated who the recipient should be, it is to be provided to the Principal for approval.

Any discrepancies between this specification and other standards and/or regulatory requirements shall be clarified with the Principal.

1.3 New Designs and Innovations

This document provides an indicative solution for the Works. The Contractor may wish to develop the indicative solution shown, or produce their own design that will fully comply with the requirements of this Specification.

Any alternative materials, designs, methods of assembly, and processes that do not comply with the requirements of this Specification, or are not mentioned in it, but give equivalent performance outcomes to those specified, are not necessarily prohibited and will be considered by the Principal. Written approval from the Principal shall be sought with the design submission, prior to the commencement of construction.

1.4 Responsibilities

Responsibilities relating to the contractual terms and conditions, including financial matters and site issues are covered in the relevant contract documents. Specific responsibilities are noted in this document, but they do not necessarily describe all the activities required for the Works.

For the purpose of developer funded works, the words “Principal” and “Contractor” in this Document shall be replaced with the words “Sydney Water” and “Developer” respectively.

1.4.1 Contractor

The Contractor shall be fully responsible for the detailed design and construction being fully compliant with the requirements of this Specification, and provide a complete, functional RCP that meets all the relevant Australian Standards, Codes of Practice, industry standards, and all statutory requirements. The complete system shall include but is not limited to, all structures, pipework, fittings, valves, pumps, instruments and controls, from the point of bulk delivery to the point of chemical dosing into the process streams.

The Contractor should be aware that this specification is for a standard RCP. As sites vary each site must be assessed on an individual basis for site specific risks.

In addition, the Contractor shall provide the following:

- Design drawings and review of the RCP standard design.
- The Contractor shall submit RCP design drawings for Principal’s review at concept, 50% detailed design and 90% detailed design stages.
- A lifting plan for the installation and removal of the RCP.
- Review Principal supplied HAZOP report. Refer SWC Business Management Information System (BMIS).
- Carry out a total of two Construction Hazard Assessment Implication Review (CHAIR 1 & 2) workshops. CHAIR 1 shall be undertaken at the concept design stage, and CHAIR 2 at the detailed design stage. The CHAIR workshops shall be in accordance with Sydney Water Health and Safety Procedure, HSP-058: Risk Assessment in Design and the guidelines prepared by WorkCover NSW.
- Review Principal supplied CHAIR 3 report. Refer Appendix C.
- Review the Principal supplied Failure Mode, Effects and Critical Analysis (FMECA) workshop report. Refer BMIS.
- Commissioning plans including: Inspection & Test Plans and Defects Rectification Plan in accordance with Sydney Water’s Asset Commissioning Standard Administration Procedure (IMS0035).
- FAT testing (wet FAT/Pre SAT) in the factory prior to delivery to site.
- Update of Sydney Water information systems including:
    - Sydney Water’s Maintenance Management System (MAXIMO) asset listing to be completed and sent to Asset Knowledge (Data Creation), who will allocate asset numbers and notify the HYDRA Register & the Operational Technology Service (OTS). Refer to Section 2.15.
- O&M Manuals, Work As Constructed (WAC) drawings and other documentation necessary for the optimal operation and maintenance of the RCP, as detailed in Sydney Water’s

Maintenance Related Clauses for Capital and Operational Projects and the Principal supplied O&M manual shell document (refer Appendix E).

- All documentation submitted to the Principal shall be formatted such that it complies with Sydney Water's quality documentation requirements. Typically, electronic versions in PDF, Word and DWG formats need to be provided as well as two hard copies.
- Additional specific equipment as may be necessary for the operation, maintenance and cleaning of the Sodium Hypochlorite system being provided, or as specified by the Principal or recommended by the chemical supplier and regulatory bodies.
- Storage tanks, process pipes, drain and overflow pipes, fittings, valves, equipment and instruments constructed of materials compatible with Sodium Hypochlorite stored and conveyed. All materials of construction shall be non-corroding for Sodium Hypochlorite.
- Stairs, ladders and walkways, where appropriate, to allow ease of access to all storage tanks and equipment for maintenance purposes. All such stairs, ladders and walkways shall be constructed of appropriate corrosion resistant materials.
- Provide adequate access for maintenance purposes.
- Necessary facilities to ensure all spills and leakages are contained.
- Safety facilities, such as safety showers, eyewash stations, fire extinguishers and so on.
- Tags, labels, signs, and other markings, for all these systems which clearly indicate the individual system, chemical contents, hazards, warnings and any other pertinent information in accordance with the requirements of the relevant standards, Codes of Practice and statutory authorities.
- Safety Data Sheets (SDS) for Sodium Hypochlorite.
- Any additional items/equipment requested by the Principal.

1.4.2 Principal

The Principal (Sydney Water), through its appointed representative/consultant, will provide input for the development of the detailed design required in this Specification. The input includes, but is not limited to:

- This Specification;
- Items in this Specification that will be done by others.
- Deemed To Comply (DTC) drawings including Layouts and Process and Instrument Diagrams (PIDs);
- HAZOP documentation - refer to BMIS
- CHAIR 3 report. refer Appendix C
- Failure Mode, Effects and Critical Analysis (FMECA) workshop report. refer BMIS
- Standard general arrangements of the RCP; refer DTC drawings (listed in Appendix A).
- Safety Data Sheets (SDS) for Sodium Hypochlorite.
- Sample template for Operation and maintenance manuals – refer Appendix E.
- Contact details of SWC security systems contractor.
- General scope of civil works required at site for access and egress of service and delivery vehicles.
- Provide the information in the following table:

Parameter	Quantity/Requirements	Units
Type of dosing system;	Flow paced/ Set Dosing Rate within a chlorine residual window using Chlorine Residual Feedback	-
Type and properties of dosing chemical;	Sodium Hypochlorite 12.5%	Available Chlorine
Chemical supplier name and contact details		-
Location of the RCP	(Insert street address, asset number etc.)	-
Mobility requirement of the RCP Building;	TRANSPORTABLE / PERMANENT	-
Concentration of Supplied Chemical	12.5%	Available chlorine
Concentration of batched chemical for dosing		Available chlorine
Rate of chemical dosing minimum		Litres/hour
Rate of chemical dosing maximum		Litres/hour
Dilution/carrier water flow rate	X:1 with maximum chemical dosage rate	Litres/hour
Delivery Bund Sump Pump (if required)		Metres head
Pressure of available water supply for process water		Metres head
Pressure of available water supply for safety shower and eyewash;		Metres head
Delivery tanker size;		Kilolitres Length / Vehicle Type
Maximum temperature of the delivered chemical;		°C
Minimum chemical tank storage size;		kilolitres
Minimum Dosing Tank storage size		kilolitres
Location of the Chlorine Residual Analyser used to control dosing.		
Minimum target performance parameters, (for example, free chlorine/total chlorine residuals, before and after dosing).		-
Protective coating system to be applied (external)	PUR-B or PSL for Anti Graffiti ACL for Aesthetic PUR-A for Coastal Environment	-

Protective coating system to be applied (bund floor and wall)	NOV (Novolac Epoxy)	

1.5 Contents of this Document

Section 2 contains requirements for the standard design of the RCP.

Sections 3 to 6 contain requirements for the design of specific components of the standard Rechlorination system, namely the Chemical Unloading Bay, the RCP Building, the Chemical Storage and Dosing tank, and the Rechlorination system.

Sections 7 and 8 contain requirements for the submission of the design, and for the testing and commissioning of the RCP respectively.

1.6 Acronyms and Abbreviations

AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
BMIS	SWC Business Management Information System
ATWL	Above Top Water Level
CHAIR	Construction Hazard Assessment Implication Review
DTC	Deemed To Comply (drawing list)
FAT	Factory Acceptance Testing
FMECA	Failure Mode, Effects and Critical Analysis
FRP	Fibre Reinforced Plastic
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HAZOP	Hazard and Operability Study
HSP	Health and Safety Procedure
I&C	Instrumentation and Control
IICATS	Integrated Instrumentation, Control, Automation, and Telemetry Systems
I/O	Input/Output
MAICS	Maximo Asset Information Collection Software
MAXIMO	Sydney Water's Maintenance Management System
NPER	National Professional Engineers Registration
NTC	National Transport Commission

OHS	Occupational Health and Safety
OTS	Operational Technology Service
P&ID	Process & Instrumentation Diagram
PE	Polyethylene
PLC	Programmable Logic Controller
PN	Pressure Nominal, Pressure Rating
PVC	Polyvinyl Chloride
RCP	Rechlorination Plant
RPZ	Reduced Pressure Zone
RTU	Remote Telemetry Units
SAT	Site Acceptance Test
SDS	Safety Data Sheet
SOC	System Operations Centre
UV	Ultraviolet
VSD	Variable Speed Drive
WAC	Work As Constructed

1.7 Reference Documents

The following documents are to be referenced with this Specification:

AS	**Australian Standard**
AS 1319	Safety signs for the occupational environment
AS 1345	Identifications of the contents of pipes, conduits and ducts
AS 2129	Flanges for pipes, valves and fittings
AS 3500	National plumbing and drainage code
AS 3735	Concrete structures retaining liquids
AS 3780	Storage and handling of corrosive substances
AS 3996	Access covers and grates
AS 4130	Polyethylene (PE) pipes for pressure applications
AS 4775	Emergency Eyewash and Shower Equipment

AS/NZS	**Australian Standard/New Zealand Standard**
AS/NZS 3000	Electrical Installations (Australian/New Zealand Wiring Rules)
AS/NZS 4766	Polyethylene storage tanks for water and chemicals
ANSI	**American National Standards Institute**
ANSI Z358.1	Compliance requirements- Emergency shower and eye wash stations
EN	**European Standard**
EN 60529	Degrees of protection provided by enclosures (IP Code)

Austroads Design Vehicles and Turning Path Templates AP-G34-13 (3rd Edition).

Australian Design Requirements ADR 43/04 2006.

National Transportation Commission (NTC) – Australian Dangerous Goods Code (latest edition)

SafeWork NSW – Storage and Handling of Dangerous Goods: Code of Practice, 2005

Work Health and Safety Act 2011

Work Health and Safety Regulation 2017

NSW Protection of the Environment Operations Act, 1997, and its amendments

Orica (Ixom) Bulk Delivery Requirements

Orica (Ixom) Bulk Installation Guidelines

Orica (Ixom) On-Site Inspection Guidelines

Sydney Water's Asset Commissioning Standard Administration Procedure IMS0035

Sydney Water's Health and Safety Procedure HSP-058: Risk Assessment in Design

Sydney Water's Instrumentation and Control Standards TOG_TS01

Sydney Water Water Distribution Related Instrumentation and Control Standards TOG_TS02

Sydney Water's Maintenance Related Clauses for Capital and Operational Projects, MEFA0001

Water Services Association (WSA) Manual for Selection and Application of Protective Coatings, WSA 201

Sydney Water's Supplement to WSA 201 (ACP0166)

Sydney Water's Procedure for Disinfecting New Mains, WPIMS5027

Sydney Water's Technical Specification Part 1 – Civil Works, CPDMS0023

Sydney Water's Technical Specification Part 2 – Mechanical Works, BMIS0209

Sydney Water's Technical Specification Part 3 – Electrical Works, CPDMS0022

Sydney Water Electric Intruder Detection Specification EIDS

Sydney Water's Asset Data Management & Commissioning SAP

Sydney Water Health and Safety Procedure, HSP-058:

Sydney Water Business Management Information System (BMIS)

Risk Assessment in Design and the guidelines prepared by WorkCover NSW (CHAIR)

2 General Requirements

2.1 Containment Methodology

The RCP will include the development of a complete containment methodology for the chemical, from the delivery bay to and including the storage tank(s) to the dosing location(s), inclusive of the dosing point(s). The containment shall direct any leakage or spillage to a safe location where it may be managed appropriately. This methodology is to include appropriate locations for visual identification of leaks and leak detection at any low points.

The containment methodology is to be discussed and accepted by the Principal prior to implementation. The method may include proprietary product pipe in pipe, single run PE dosing lines inside PE/U-PVC pipe, leak detection pits or a combination of the above. Any other containment systems which are viable for the chemical and Site Acceptance Testing requirements will also be considered. The containment methodology is the responsibility of the contractor responsible for the construction of the plant as well as the civil contractor running dosing lines, unloading points, pump out locations and any other chemical pipework or pits.

Bunding shall be provided for the delivery bay and storage tanks to contain any chemical spillages as described in the following clauses.

2.2 Minimum Criteria

This specification represents the minimum requirements for the Rechlorination Plant.

The RCP shall be designed to:

- Provide a minimum service life of:
    - 50 years for structural elements
    - 20 years for tanks and pipework
    - 10 years for mechanical, pumping, electronic and control equipment
- Achieve a level of treatment according to the minimum requirements outlined in Section 1.4.2 of this Specification, over the designed service life;
- Comply with all relevant regulatory requirements, Standards, and Codes of Practice, including, but not limited to:
    - Work Health and Safety Act 2011
    - Work Health and Safety Regulation 2017
    - SafeWork NSW – Storage and Handling of Dangerous Goods Code of Practice 2005
    - National Transportation Commission (NTC) – Australian Dangerous Goods Code Edition 7.4 (2016)
    - AS 3780 – The Storage and Handling of Corrosive Substances
    - NSW Protection of the Environment Operations Act, 1997, and its amendments
    - All other referenced documents in this specification
- Not cause interruption to the normal operation of the Sydney Water water supply system;
- Have complete chemical receiving, storage, transfer, and dosing systems, and the necessary safety facilities;

- Be capable of automatic operation via Sydney Water's Telemetry System (IICATS);
- Be capable of local manual operation;
- Be capable of adjustment of the treatment level during operation;
- Be safe to operate, maintain and decommission;
- Contain all spills of the chemical being used and have a bund capacity of 9,000 litres or a minimum 110% of the chemical storage and dosing volumes, whichever is greater;
- Give effective process control under both routine and non-routine operations;
- Be self-contained, to allow transport and relocation;
- Allow for nominal 30 days storage of Neat Sodium Hypochlorite (12.5%);
- Provide a dosing tank for the batching, storage and dosing of diluted Sodium Hypochlorite. Transfer of the chemical to be undertaken on approximately 10 day intervals; and
- To be capable of delivering to and dosing from both storage tanks
- Have online Chlorine Residual Analyser monitoring installed downstream of the chemical dosing point, at a location nominated by the Principal, which is linked to the Sydney Water IICATS network.

2.3 Site Conditions

The site is normally subjected to temperate climate conditions, with an ambient temperature range of (minus) -6°C to 50°C, and humidity of up to 100%.

Additional consideration shall be given for sites that are subjected to strong wind and saltwater spray/mist, for example, marine conditions. Thus, all equipment shall be designed to accommodate and operate satisfactorily within these weather conditions.

Consideration must be given to Sydney Water's requirements for building over or close to Sydney Water sewer, water or stormwater assets.

2.4 Materials

2.4.1 General

All materials selected or adopted in the design shall be suitable for installation in the proposed environment, including contact with Sodium Hypochlorite and high humidity conditions. They shall be corrosion resistant and selected to match the relevant specified design life. Where required, materials shall be coated in accordance with the latest edition of Water Services Association Manual for Selection and Application of Protective Coatings, WSA201and Sydney Water's Supplement to WSA 201, ACP0166.

2.4.2 Corrosion Resistance

All internal parts in contact with the chemical substances are required to be corrosion resistant against Sodium Hypochlorite.

All bolts, nuts, and washers shall be made from stainless steel grade 316, or equivalent, which is deemed to be suitable for the application.

2.4.3 Adhesive, Sealants, and Gaskets

All adhesives and sealants shall be resistant to oil and water, non-supportive of microbial growth, and dimensionally stable. They shall also be resistant to chemical attack by Sodium Hypochlorite.

All gaskets shall be made from Viton rubber materials. Refer Appendix F: 'SWC Guide to Proven Products'.

2.5 Pipework and Fittings

Materials for pipe work and fittings shall be uPVC or cPVC ASTM Schedule 80 or Polyethylene PE to AS4130. All pipework within the chemical area (including the delivery bay area) of the Rechlorination Plant shall be uPVC/cPVC Schedule 80 only. Refer Appendix F.

Pipework for the dosing line to the dosing point shall be either:

- uPVC/cPVC George Fischer double containment system (Double-See™), or equivalent approved by the Principal
- PE100 polyethylene PN16 dosing pipe with PE100 polyethylene PN16 containment pipe, or
- PE100 polyethylene PN16 dosing pipe with DWV containment pipe

All pipes, including those in pipe trays and trenches, shall be painted in accordance with WSA201-Application of Protective Coatings and Sydney Water supplement ACP0166.

A solvent welding course is to be completed by the piping installation team to satisfy Principal's and pipework supplier's requirements.

The minimum pressure rating class of all pipes and fittings shall be PN 16. All pipework selected shall be designed specifically for use in the chemical industry and resistant to chemical attack.

All pipework, fittings and equipment installed and fabricated will be in accordance with the following;

- Sydney Water Technical Specification, Part 2 – Mechanical Works and the Sydney Water Procedure 724 - Solvent Cement Welding.
- Method of jointing polyethylene pipe work shall be electrofusion jointing. The manufacturer's recommendations must be followed with the correct specialised tools when installing pipes and fittings (no compression fittings to be used).
- All personnel undertaking pipework installation to be competent and have undertaken PVC installation training (SWC and supplier's), polyethylene electro-fusion jointing training and Sydney Water chemical dosing training.
- Pipe work jointing and installation shall be carried out in accordance with the manufacturer's specification and requirements, inclusive of pipe cutters, chamfering and de-burring tools.
- All pipework is to be painted (ACL system) or coloured and labelled as per Sydney Water Technical Specification: Part 2 – Mechanical Works and points a) to c) below:
    a. Below ground double contained pipework - only carrier pipework is required to be coloured and labelled.
    b. Above ground double contained pipework - double containment pipework must be coloured and labelled as per specification, carrier pipework is not required to be coloured and labelled.

c. All other non-pipe in pipe chemical pipework (i.e. single containment) is required to be coloured and labelled as per the Specification.

- Pipes less than 50 mm in diameter, located outside of the RCP structure shall be suitably lagged to prevent freezing at low weather temperature (< 6°C). Pipe trays located outside shall be supplied and installed with suitable covers.
- Buried non-metallic pipes shall have continuous metal tape placed in the trench above the pipe to allow detection.
- All chemical dosing lines external to the RCP (above ground or buried) shall be double contained arrangement. In addition to this, all chemical dosing and/or water lines passing through the RCP electrical controls room shall also be double contained arrangement. Where lines are installed in the RCP electrical controls room they shall be shielded with PE covers to prevent leakage spray reaching electrical cubicles and to direct any leakage onto the floor. A drain shall be installed to the outside.
- The arrangement of all pipes shall allow a leak to be readily identified and contained, and facilitate repair or replacement of the inner pipe. The arrangement of the pipework shall allow a leak to drain into the RCP bund or the dosing point.
- All drainage should be vermin proof.
- Underground dosing lines shall be designed so that the pipework can be replaced without the need for excavation.
- All ball valves shall be full-bore type. For throttling purposes, a diaphragm valve suitable to the specific application must be used. These, along with other non-standard pipework fittings shall be double union type to minimise damage during repair and maintenance. Appropriate space is to be left around unions to enable dismantling. Utilise spacers under pipe clips where attaching directly to flat surfaces.
- Valves, piping and fittings should be from the same supplier for a specific dosing system and where possible, for any existing chemical dosing system on site. All valves of the same size, duty and type supplied under the contract shall be identical.
- Joints shall be either solvent welded (glued), electro fused, or flanged. Screwed connections are not permitted.
- Only approved pipe glues (Weldon 724) and solvents (coloured primer) that are designed for use with the specific chemicals and piping systems are to be used. Minimum curing times for primers and glues, as specified by the manufacturer, are to be strictly adhered to.
- Potable water must be provided for the eyewash and safety shower at all sites. All potable water lines coming from Sydney Water mains shall be provided with Reduced Pressure Zone (RPZ) valves to prevent carrier water flowing back into the mains. RPZ device should be installed downstream of the supply feeding the potable water supply on site to prevent pressure loss to safety showers and eye washes.
- A separate RPZ shall be provided to ensure backflow from the RCP cannot enter the emergency shower and eye wash facilities. All RPZ devices are to be installed by a licensed plumber and appropriately tested in accordance with the requirements of AS3500. Where required, booster pumps or pressure reducing valves shall be installed based on the incoming water pressure and the pressure at the dosing point.

A generic RCP Site Layout General Arrangement for the Potable Water Supply is provided in the DTC drawings as listed in Appendix A of this Specification.

A list of proven products is included for reference in Appendix F. Products may be added to this list with the approval of Sydney Water.

2.5.1 Pipework supports

All pipework supports shall be suitable for contact with Sodium Hypochlorite. Metal support systems such as 'Unistrut' or metal brackets and clips shall not be used. Proprietary systems such as Georg Fischer shall be used where available.

2.5.2 Magnesium Hydroxide Pipework

Not used

2.6 Civil Works

The design and construction of the civil works shall be in accordance with the requirements contained in Sydney Water's Technical Specification Part 1 – Civil Works, unless specified otherwise in this document. Where necessary, relevant Dangerous Goods Regulations shall be complied with.

As a minimum for the transportable RCP, the foundation pad shall have a sub-base of 200 mm thick cement stabilised DGB20 road base (3% minimum cement content), any soft spots in the founding material shall be compacted to 98% of maximum dry density prior to laying sub-base. The top of the foundation pad shall be 50mm above the surrounding ground level and shall extend 150mm past the building perimeter. The RCP base shall be placed on 50mm of packing sand and a 0.25mm waterproof membrane double lapped and taped at joints. The waterproof membrane shall be increased to 2 layers for saline conditions. A 50mm layer of sand is required under the RCP to ensure the load is evenly distributed on the foundation pad. A geotechnical engineer or engineering geologist is to confirm the allowable bearing capacity of the foundation soil is sufficient for the requirements specified by the RCP supplier. If the foundation is not sufficient then the geotechnical engineer is to provide direction on ground improvement works required at site. The geotechnical engineer is to be engaged by the contractor undertaking the Civil works.

Where insufficient or unsuitable access to site is provided then a detailed design is to be undertaken in accordance with SWC Technical Specifications.

2.7 Mechanical Works

The design and construction of the mechanical works shall be in accordance with the requirements contained in Sydney Water's Technical Specification Part 2 – Mechanical Works, unless otherwise specified in this document.

2.8 Electrical Works

2.8.1 Scope of Work

The electrical scope of work of this contract is for the design, manufacture, supply, delivery, installation, testing and commissioning of all electrical equipment. This includes the incoming power supply system, communication, control, instrumentation, and all necessary accessories and associated equipment, for the proper functioning of the dosing system to be installed at the site.

This includes, but shall not be limited to the following:

- Where the RCP is a standalone plant install the power supply cables from the point of common coupling, and 3-phase power supply from the Electricity Authority supply, to the RCP connection point of the dosing system, including metering, termination, lightning and surge protections. Where the RCP is installed within a reservoir/water pumping station site the power supply shall be provided from the pumping station electrical switchboard via a separate circuit breaker. The electrical loading shall incorporate an extra allowance of 30% for future loads.
- Installation of a non-metallic cable tray around the complete inside perimeter wall of the dosing room. The cable tray shall have segregated sections for power and controls cable.
- Provision of IICATS interfacing signals;
- Provision of all cabling and wiring between the RCP and the SWC supplied IICATS RTU (Remote Telemetry Unit) including surge protection units;
- Provision of a touch screen HMI and cabling to connect to the SWC supplied IICATS RTU;
- Provision of internal and external lighting;
- Provision and installation of all equipment, materials, accessories, cabling, conduits, power poles/posts, connections and housings to enable the system to be fully operational;
- All necessary electrics are earthed to comply relevant aspects of AS/NZS 3000;
- Where non-standard RCP designs are used (in terms of DTC drawings and P&IDs) then the application specific settings in the standard Plain English Functional Description (PEFD) proforma shall be changed by the process designer and the Functional Design Specifications (FDS) shall be customised by OTS.
- Site testing and commissioning; and
- Provision of Work As Constructed (WAC) drawings.

2.8.2 Standards

The design and construction of the electrical works shall be in accordance with the requirements contained in Sydney Water's Technical Specification Part 3 – Electrical Works, unless specified otherwise in this document. The RTU panel is to comply with I & C Standard.

2.8.3 Electrical Equipment

All equipment shall be new and suitable for its purpose, comply with Australian Standards and be rated for continuous in service condition within a switchboard. All electrical equipment supplied should be available from suppliers within Australia.

All items of equipment shall be designed, manufactured and installed to perform their required functions reliably and efficiently. The Contractor shall take into consideration the conditions and functions of the equipment when designing the systems, and selecting equipment, to ensure the system could be operated safely and efficiently. Particular attention shall be given to equipment installed in an adverse environment and/or exposed to weather.

Temperature rise within electrical enclosures and cubicles must not exceed the maximum temperature specified for components inside those enclosures, including the thermostat and heater. Adequate ventilation shall be provided in the enclosures and cubicles. Switchboard ventilation fans should be considered for installations using dosing pumps with Variable Speed Drives.

A thermostat and heater shall be supplied to prevent condensation inside the electrical and controls enclosures and cubicles.

Live equipment and terminals shall be located behind removable covers or doors, and shrouded to prevent accidental contact when the control panel's front doors are open, including equipment mounted on doors.

The switchboard shall have touch protection included in the design.

Where more than one item of equipment is supplied and installed to perform a particular function, all such items of equipment shall be identical and completely interchangeable.

The site is subject to power failure. The equipment shall be designed for automatic restart when the power returns.

The Contractor shall develop electrical circuits, and submit the electrical circuit diagrams to the Principal's Representative for review prior to manufacture. Circuit design shall be in accordance with DTC electrical drawings provided at time of tender. This will be a hold point.

2.8.4 Battery Backup

The controls and RTU shall be provided with 2 off 24V battery backup units, one for the RTU modem and instruments and the other for the motorized and solenoid valves. The battery supplied for the RTU should be sized according the requirements in TOG_TS01. The battery for the valve power supply shall be sized to provide 2 complete operations for the maximum number of open motorized valves. The batteries shall be suitable for a life of at least 3 years continuous use with checks at 12 monthly intervals.

2.9 Instrumentation

All instrumentation including level transmitters, flow transmitter, flow switches and level switches shall comply with the TOG_TS01. If there is any discrepancy between this document and the TOG_TS01, it shall be raised to the Principal at the Design phase, to allow him / her to make an appropriate ruling on the matter. The Contractor shall resolve any issues of concern with the Principal and obtain written approval prior to proceeding with ordering and manufacture.

2.10 Telemetry & Control

The RCP is to be supplied as a package by the equipment supplier with all necessary control and instrumentation. The RCP shall be designed for connection into Sydney Water's Telemetry System. Telecommunications shall be provided as per TOG_TS01.

Specific requirements of telemetry and control for water disinfection by a RCP are detailed in Sydney Water's Water Distribution Related Instrumentation and Control Standards TOG_TS02. Unless directed otherwise, the digital and analogue inputs and outputs shall be provided as specified in TOG_TS02. If there is any discrepancy between this document and the TOG_TS02, it shall be raised to the Principal's Representative prior to design commission to allow him/her to make an appropriate ruling on the matter.

Telecommunications shall be provided by a 3G link to the mobile network. The Contractor shall supply a suitable 3G aerial mounted on the RCP building and cabled to the RTU panel. A surge protector should also be installed.

The selection and installation of field mounted electrical equipment within the chemical storage and dosing area of the RCP building must have a minimum IP54 rating and comply with the requirements of AS/NZS 3000 Section 6: Damp Situations.

2.10.1 RCP Controller

The primary control of the RCP shall be provided by a local RTU. The controlling RTU shall be to TOG_TS01.

The RCP shall be installed with monitoring and control equipment to Sydney Water Standards, which shall enable it to integrate into Sydney Water's IICATS.

2.10.2 RTU

Control and monitoring of the RCP shall be provided through the RTU which will be connected to the IICATS network. The RTU and IICATS network will provide the means for supervisory control and monitoring from remote workstation. Supervisory control shall permit overriding control from the SOC.

A stand-alone RTU shall be provided in the RCP control panel to control and monitor the plant. In this case;

- The RTU shall be installed in a segmented section of the control panel or in a separate fully accessible adjacent panel.
- The RTU power supply shall be provided by Dyne Industries with 8 hours battery back-up and sized as per TOG_TS01.
- Digital and analogue I/O shall be connected to the RTU in accordance with TOG_TS01. Hardwired signals shall be terminated through the knife switch terminals in the RTU panel. External inputs to the RTU (chlorine analyser, etc.) shall be connected through surge diverters.
- The supplier shall interconnect all telemetry components, including connection of the RTU equipment. (Refer TOG_TS01 for details).
- The RTUs and Modem, as well as configuration of this equipment, will be free-issued by Sydney Water. The contractor will be responsible to provide the external aerial for the site (COL7195/7199 with SMA Male Connector) mounted on j bracket external to the building, as per the I&C Standard.

2.10.3 HMI

A HMI shall be installed in the RTU cubicle door to enable local operator control of the RCP. The HMI shall be a Schneider Electric HMIGTO6310 12' Colour Touch Panel. The supplier shall connect the HMI to the RTU power supply and RTUs.

2.11 Internal Cable Tray

There shall be a non-metallic cable tray around the complete inside perimeter wall of the dosing room and into the electrical controls room. The cable tray shall have plastic divider segregated sections for power and controls cables. The power cable section will be 2/3 of the space and the controls cable section will be about 1/3 of the space. The cable try shall be spaced off the wall using spacer so that control cables will fit between the wall and cable tray where relevant. Power cables shall come out of the bottom of the cable tray and controls cables shall come out of the top or back of the cable tray. The cable tray shall be sealed with a removable compound where it penetrates through the wall between the dosing room and electrical controls room.

2.12 Services

Services to the RCP shall include potable water supply, electrical power, telephone connection (if required), and drainage. These services are to be identified as to their location relative to the dosing unit.

2.13 Security and Access Control

The Rechlorination Plant shall be supplied complete with a security and access control system in accordance with Sydney Water Technical Standard SWC EIDS-2. The security and access control to be provided and installed by the SWC's approved supplier). The Contractor shall engage the SWC security contractor as a nominated Sub-contractor to supply and install the system

This includes, but shall not be limited to the following:

- Security system controller;
- Passive infra-red sensors, door limit switches;
- At least one card reader; and
- Communications link to the Sydney Water security system network.

All doors shall be keyed for Sydney Water security key 5 (pink PCY key).

2.14 Facility and Equipment Identification and Labelling

All equipment shall have a unique identification number in accordance with ACP0055 Asset Numbering Standard Operating Procedure. Sydney Water designates unique identification numbers for all its asset and associated equipment and Sydney Water will assign these.

The facility and equipment identification and labelling shall be in accordance with Sydney Water's Specification SDIMS0026 Facilities Site Signage Specification and Maintenance Related Clauses for Capital and Operational Projects.

A standard Sydney Water facility asset sign shall be mounted on the outside of the RCP building.

2.15 Entering Asset Details into Maximo, IICATS & HYDRA

The Contractor shall provide information for the update of Sydney Water information systems including:

- Sydney Water's Maintenance Management System (MAXIMO) asset listing to be completed & sent to Asset Knowledge (Data Creation), who allocate asset numbers & notify the HYDRA Register & OTS.

Use the "Location Number Request Form for New/Existing Assets" form MEPR0063 (refer Appendix B) to add new assets and have asset numbers assigned to them by Asset Knowledge Data Creation group. MEPR0063 form is available from the Asset Knowledge page on iConnect.

Request new asset numbers from Asset Knowledge (Data Creation), then forward with P&IDs to OTS for IICATS updates.

The principal's representative shall ensure that HYDRA GIS is updated to include the location of the RCP and chemical dosing line, from the RCP to the dosing location. The dosing line shall be shown

in HYDRA as a pressure main with pipe size, pipe type, etc. noted. The chemical dosing line must have the term CHEMICAL DOSING LINE entered into the 'General Information' field in HYDRA.

2.16 Signage

Signage shall be erected as required in accordance with Facilities Site Signage Specification. These include, but are not limited to the following:

- Sydney Water Facilities' site signage Specification - Document Number: SDIMS0026
- For sites with capacity greater than 1 kL, a Hazardous Chemical (HAZCHEM) warning placard with UN number and chemical class to be placed on the main site entrances or on the RCP building as well as the storage (and dosing??) tanks, when a hazardous chemical is stored on site.
- Information panels as per current edition of the Australian Dangerous Goods Regulation shall be placed in prominent and visible locations. As a minimum, there shall be one each on the chemical storage and dosing tanks, and another on the inside of the door to the bunded area.
- Confined Space Entry Permit placard to be placed on the storage and dosing tank.
- Capacity of the storage and dosing tank stated on the tanks.
- A sign that identifies the chemical, specifies tank asset number, full tank capacity and safe tank fill volume must be placed adjacent to the fill point.
- Safety signage as per DTC Drawings must be placed at the front of the RCP building or inside the door.
- If required by National Construction Code (>100 square metres) luminous emergency EXIT sign placed inside above the exit door.

Other relevant OHS signs shall be installed in accordance with AS 1319. The signs may include, but are not limited to, safety shower, eye wash station, and non-potable water tap.

2.17 Fencing (if required)

To prevent access from the general public and protect against vandalism, a man proof, fence shall be supplied and installed with a gate at the perimeter of the RCP area. It shall be located so as not to interfere or restrict operational and maintenance activities, including chemical tanker delivery. Any fencing must allow the largest chemical delivery tanker servicing the site to park completely off the road to allow access gates to be opened and closed safely. The Principal will specify when fencing is required.

Fencing shall be designed in accordance with Sydney Water's Deemed to Comply (DTC) drawings – Facility Fencing. Where this fencing is not suitable due to gate span or other parameters the Contractor shall be responsible for providing a separate fence design to the Principal for approval during the design phase of the contract.

2.18 Elements of RCP

A RCP shall consist of the following elements:

- Chemical tanker delivery bay;

- RCP building, which contains two rooms; one for the electrical control panel and IICATS RTU, and the other a self bunded room for the chemical storage and dosing tanks, dosing pumps and pipe work;
- Electrical control panel with RTU and HMI;
- Chemical storage and dosing tanks;
- Transfer and Chemical Batching System;
    - Make-up Water Pumps (If pressure not sufficient at site);
    - Transfer Pumps;
    - Pipes;
    - Valves;
    - Instrumentation
- Dosing system;
    - Pumps;
    - Pipes;
    - Valves;
    - Instrumentation;
- Safety and wash down equipment

Specific requirements for each chemical dosing system and components of the RCP are detailed in the following sections of this Specification.

A set of RCP Process and Instrumentation Diagrams (P&ID), and general arrangement drawings and sketches are available as listed in Appendix A of this specification. The proposed design shall be conceptually similar to them, unless instructed otherwise by the Principal.

2.19 Maintenance Access

The layout of the equipment inside the RCP building shall be submitted to the Principal for approval prior to construction. This is to ensure that access hatches, level indicators, pumps and so on, can be easily reached by personnel for maintenance and operation. For standard general arrangements of the RCP; Refer DTC drawings.

3 Chemical Delivery Bay

A chemical delivery bay and associated roadworks or re-grading shall be designed and constructed to provide safe arrival, parking, off-loading, turning around (if necessary), and departure of bulk chemical tanker trucks. Refer to DTC drawings as listed in Appendix A.

3.1 Location

The delivery bay shall be located adjacent to the RCP building. Unless otherwise specified, the RCP building shall be located on the left side of the tanker.

The unloading point shall allow the chemical delivery tanker to be fully inside the delivery bay when unloading. The unloading hose connection point is typically located inside the RCP building, and shall be no more than 6m from the tanker connection point, as per the Dangerous Goods Code of Practice.

3.2 Access

The chemical delivery tanker shall be able to access the site safely without traffic controllers. It must be safe for the truck to turn off the roadway into the property and for the driver to stop the truck and open the gate. Depending on traffic conditions in the area, slip lane(s) may be required.

The delivery bay and its access shall be large enough to accommodate a tanker to be reversed into the bund and exit the site in a forward direction. Alternatively, the access shall allow the tanker to drive through and exit the site in a forward direction. The design is to avoid the possibility of the delivery truck having to pass back through a bund in which a spill has occurred.

3.3 Delivery Bay Bund

The delivery bay shall be a concrete slab with a bund wall, to provide containment for any spill or leaks. Relevant aspects of AS 3780 shall be complied with where corrosive chemicals are used.

The bund shall be designed as a water retaining structure in accordance with AS 3735. It shall have a capacity of 9,000 litres or 110% capacity of the largest tanker vehicle compartment, whichever is greater.

The bunded area shall be designed with a 1 in 75 grade towards the sump drain, such that no pools of chemical will accumulate on either side of the bund. The bund walls must also be painted yellow to increase visibility and reduce the risk of tripping onsite. The step between the delivery bay bund low level and RCP footpath is to be a maximum of 225mm as per AS1657 step size criteria unless approved by the Principal.

Any roll-over kerbs in the roadway at either end of the tanker delivery bay bund shall be designed to allow normal passenger vehicles (Class B99) to enter and exit without scraping the bottom of the vehicle as per the clearance requirements of ADR43/03 unless other vehicle agreed or specified by the Principal.

The area between the tanker bay bund and the RCP building shall be concreted, and any spills in this area must be contained and drain into the delivery bay bund.

The delivery bay and RCP arrangement must ensure any stormwater from the surrounding roadway and ground shall be channelled away, and not flow into the delivery bay bund. Any expansion joints in the concrete path between building and delivery bay shall be mastic filled to prevent chemical seepage in between joints.

3.4 Sump and Discharge Line

A sump pit to collect liquid from the bunded area shall be provided. It shall have minimum dimensions of 600 x 600 x 600 mm to ensure sufficient capture of rainwater or hosedown water without filling the bund sump.

The sump may be either be:

1. fitted with a sump pump pumping via a layflat hose to a location selected by the operator or to a tanker via a camlock coupling or:
2. a camlock pump out point fitted with a suction pipe ending in a camlock for a sucker truck to remove the contents.
3. A diagram of the arrangement described is presented in DTC drawings.

In addition, where the site has a submersible pump installed, the bund sump needs to be substantially larger to ensure efficient operation of the submersible pump and prevent pump short cycling. High-level alarms shall be provided in the event of heavy downpours or pump failure.

The submersible pump shall be corrosion proof and shall be a fitted with a titanium impeller (e.g. Tsurumi or equivalent). The submersible pump shall be elevated from the floor of the sump to prevent clogging by dirt and debris. It shall be furnished with an accessible discharge union coupling, to enable removal for cleaning and servicing without the need for confined space entry permit.

Automatic control of the sump pump shall not be permitted in any circumstance for Sodium Hypochlorite. The pump may only be started from a push button station. Level sensors shall be installed within the sump pit for low level cut out, and high level alarm. The high level alarm signal shall be routed to IICATS.

The sump pit shall be located where it is not subjected to vehicle loading at one of the sides (outside) of the delivery bay bund. It shall be fitted with a grate/cover made from lightweight materials, in accordance with AS 3996 (Class A), weighing no more than 16 kg,. The weight limit shall be labelled where appropriate. Where the unit's location is subject to falling debris from trees in the area, perforated sump covers with 12mm diameter holes must be used as opposed to grated covers to prevent blocking of drainage system,

3.4.1 Camlock Pump Out Point

A camlock pump out point shall be installed to allow pump out from the sump pit and bund area. The location of the camlock pump out point shall be adjacent to the sump. The pump out point shall be installed on an up-stand off the pumped discharge line from the sump pump, or on its own upstand if no sump pump is required on the site. Isolation valves shall be installed to allow pump out from the sump pit pump or camlock connection.

3.5 Safety Equipment

The following safety equipment shall be provided:

- A safety shower and eyewash station, which complies with AS 4775, located within 2 to 7m of the chemical unloading connection point. This is typically mounted to the inside of the right hand door of the transportable RCP building. An additional eyewash station shall be located within the RCP dosing room near the exit, on the furthest wall away from the dosing system and tank. Safety shower and eyewash facilities shall be tested and tagged in accordance with AS 4775. Also refer to Appendix G.

- Long water lines to the safety shower and eye wash station (above ground and external to RCP building) that are exposed to sunlight shall be lagged, as water may be heated up by the sun and therefore unsuitable for use. Lagging is to consist of mineral wool insulation with aluminium sheet covering to protect from water ingress and damage.
- If adequate supply pressure for the safety shower and eyewash is not available, a booster pump must be installed. The contractor shall determine the capacity of the booster pump including pipeline, RPZ and valve losses.
- A UV resistant hose reel permanently attached to a water tap and capable of reaching all parts of the RCP, including the unloading area. The hose reel is to be fitted with a 20mm female camlock fitting making it suitable for use as a flushing mechanism.
- Sufficient lighting to enable safe work beyond daylight conditions, particularly for the chemical delivery activities.
- An ABE fire extinguisher for use in electrical fires shall be provided.

When the delivery bay is not adjacent to the RCP building (that is, in a remote location), an additional safety shower is required within 2 to 7 meters of the tanker connection point.

All equipment provided shall be located such that the potential for vandalism is minimised.

3.6 Tanker Power Connection Outlets

Two permanently mounted electrical power outlets are required for unloading of the dosing chemical. These power outlets are 415 V (20 amps) and 240 V (15 amps), and are interlocked with the storage tank level transmitter (90%) and high-level switch (95%), to prevent operation of the tanker unloading pump on high-level. That is, automatic cut out of the outlets during filling when the tank level reaches high-level (90%).

They shall be located within 7.5 m of the unloading hose connection point, and inside the RCP building and guarded from splashback at the fill point. For further detail on the switch arrangement, refer to TOG_TS02.

3.7 Fill point

The fill point shall be designed and installed so that the delivery driver can unload to either the storage tank or the dosing tank. The valve connecting to the dosing tank shall be “Locked Closed” and only filled to under direction from the Principal.

At the tanker filling point, a 50mm tanker fill pipe with a 50mm suitable male camlock fitting angled downwards at 45º, with removable cover, shall be supplied and installed. From this fill line a branch, with valve and extension piece pointing vertically down, shall be supplied and installed for hose draining purposes. Refer to typical Sodium Hydrochloride dosing unit DTC drawing set.

The camlock coupling point must be positioned at least 600mm and no more than 900mm above the ground and firmly supported above and below the wye fitting. Transfer pipes should rise vertically from the tee and slope downward (1 in 100) at the top of the tank(s) to minimise drainage losses. The tank inlet branch should be above the level of the overflow pipe. The fill point must be fully contained inside a bund to prevent release of chemicals in the event of leaks at the connection point. The fill point is to be fitted with a digital display and associated equipment in accordance with this specification.

A second tanker fill point shall be provided with valves and drain line but with a screwed plug fitted instead of a camlock. This line will connect to the dosing tank but be used only in an emergency to feed direct to the dosing tank. An individual fill point is required for each tank if there are multiple tanks in series.

A placard containing information on chemical, tank descriptor (storage or dosing), tank capacity and safe fill volume must be placed clearly on each line at the loading point as shown in DTC drawings and as per SDIMS0026 Customer Delivery Safety Signage Specification.

4 Rechlorination Plant Building

A reinforced concrete, two-room building shall be designed to accommodate the chemical storage and dosing tanks, bund, dosing equipment and control panel, along with the necessary control functions, alarms and telemetry links.

The building shall be designed to be weather proof and prohibit unauthorised entry. Its construction shall be vandal-proof and painted in accordance with the WSA Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201. The Principal shall advise whether the protective coating shall be Aesthetic (ACL coating System), Anti Graffiti (PUR-B or PSL coating System) or coastal environment (PUR-A coating system) The colour of the plant shall be as advised by the Principal.

4.1 Building Layout and Dimension

The building shall consist of two separately accessible rooms; a bunded dosing room for chemical storage and dosing equipment, that is capable of containing any chemical leaks or spills. The second room is an electrical controls room for electrical controls, telemetry, and document storage. The rooms shall be divided by a wall with a fixed transparent window (polycarbonate) of a reasonable size (typically 1m wide by 0.6 m high) to allow viewing of all key elements in the dosing room when operating from the control panel inside the electrical controls room. The window sill shall be positioned a minimum of 100mm above the chemical bund level. Separate doors shall provide external access into the two rooms. The doors shall be steel fabrication and adequately corrosion protected in accordance with WSA 201 and Sydney Water's supplement to WSA 201.

The dimension of the building shall be designed to allow adequate space to work in, and regular operation and maintenance of the tank(s) and equipment to be carried out, without removal of the roof. As a minimum, the ceiling height shall be greater than 2.2 m from the ground or 1 m from the highest tank whichever is the greatest.

Normal working areas shall have immediate access to the point of safe egress. The width for emergency access and egress shall be no less than 1 m, unless specified otherwise.

The door of the chemical dosing room shall be a double door that can accommodate removal and replacement of the storage and dosing tanks. The doors shall have a mechanism to lock them in the open position whilst the site is attended, and lockable shut when not attended. The door shall be replaceable without damaging the concrete substrate of the unit. Refer DTC drawing for more information.

Alternatively, a removable modular roof with stainless steel grade 316 lifting lugs shall be provided with a single door for access. Where a removable roof is provided, all electrical wiring connected to equipment on the roof, such as ventilation fans shall have dismantling joints or sockets to unplug and disconnect prior to removal of the roof.

A single hinged door shall be provided to the control room that opens to the outside. The door has to be provided with a lock and latch mechanism.

4.2 Mobility

Unless specified otherwise, the building shall be designed to be transportable, without having to dismantle and reinstall the chemical storage tank(s), pipework, pumps, control system and all other equipment. Suitable lifting lugs made from corrosion resistant steel shall be provided and located at

the base of the building. Lifting lugs shall be grouted over after installation and locator markings made at the lifting point locations.

The design life of the lifting lugs shall exceed the design life of the building. Structural certification from a structural engineer with National Professional Engineers Registration (NPER) with the Institution of Engineers Australia shall be provided to certify the lifting of the building. The lifting procedure shall be stated in the O&M manual and the detailed drawings.

A stainless steel plate shall be mechanically fastened to the building, stating lifting certification date, construction materials, dry weight, maximum loaded lifting weight, and maximum load for each individual lifting lug shall be provided.

Structural drawings shall be submitted to the Principal for written approval prior to construction. This shall include, but is not limited to:

- Concrete drawings with all dimensions specified (clearly showing the location of the lifting lugs)
- Concrete reinforcement drawings (plan view and sections)
- Notes pages, which captures:
    - Concrete grade
    - Finishes
    - Reinforcement grade and cover reinforcement
    - Sub-grade preparation with notes (detailing allowable baring capacity and so on)
    - Design life of building and lifting lugs
    - Design capacity of lifting lugs and lifting procedure, clearly identifying which lifting lugs to be used for transport, and loads imposed by lifting lugs
- Building certification of design and fabrication referenced for each individual drawing.

4.2.1 Permanent Plant Specific Requirements

Where storage requirements do not facilitate the use of indoor tanks and an external tank is required for dosing then a separate bunded area shall be provided. The bunded external tank area shall be designed for chemical storage capable of containing any chemical leaks or spills and shall be designed as a water retaining structure in accordance with Section 3 of this document.

The separate dosing tank bunded area shall be covered with a carport type steel structure to provide sufficient weather protection for intermittent works within the bund and to ensure rainwater does not collect in the bunded area. The roof is to have sufficient storm water drainage and downpipes. The roof connections are to be bolted to minimise the works involved in removing the roof if a tank replacement is required. The roof shall be designed to withstand all forces associated with dead, imposed and wind loading as specified in AS1170.0, AS1170.1 and AS1170.2. The design shall be site specific to evaluate wind direction, topographic and shielding factors. The walls shall be clad to a height 1m below the roof line on all four sides.

Around the perimeter of the bund fence in compliance with the DTC 5000 series is to be provided to increase site security of the outdoor asset as specified by The Principal. The gate shall be fitted with a lock compatible with a Yellow CBY key (or PS1 key for Illawarra system).

4.2.2 Lifting Plan

As part of the design the Contractor shall provide a lifting plan for the RCP unit for installation and removal. The plan shall show the location of the crane and its outriggers and include the mass of the crane and the maximum force at each outrigger point. The lifting plan shall be site specific and include the make and model of the crane used in the design. The lifting plan shall include details of the lifting points and their maximum loads.

The lifting plan shall be reviewed by a geotechnical engineer engaged by the contractor who will undertake any testing and calculations necessary to confirm suitable bearing capacity of the earth at the outrigger location. Geotechnical engineer shall confirm the temporary works required to achieve required bearing capacity at outrigger location and any works for locating the crane at the lifting point.

4.3 Bund Floor and Wall

Any chemical storage area in the RCP building shall be bunded in accordance with the requirements detailed below. The bund shall be designed as a water retaining structure in accordance with AS 3735. It shall have the capacity of at least 110% of the total capacity of the tank(s) located within the bund compartment.

The bund wall height shall be a minimum of 400 mm. The need for high bund walls needs to be balanced against the more difficult access and emergency egress and the overall size of the building. For wall height greater than 400 mm, access stairs are required in and out of the building. Where access steps/stairs are required, they shall be provided on the inside and outside of the bund wall to provide safe access and egress, in accordance with AS1657 and DTC drawings.

A high level alarm (connected to IICATS) shall be installed in the bund, to alert the operator that a spill may have occurred. The alarm set point shall be agreed with the Principal, and cause an automatic shutdown of the RCP.

The bunded area shall be designed with a 1 in 75 grade towards the sump pit such that no pools of water/chemical will accumulate on the bund floor.

The bund wall and floor shall be coated with NOV coating systems in accordance with the Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201 ACP0166.

All pipework shall be run around the perimeter of the dosing room to minimise trip hazards, and as far away from electrical wiring as practicable. With exception to the bund drainage pipe, all pipes shall pass through the building wall above the top of bund wall.

4.4 RCP Internal Sump and Discharge Line

To allow for the management of any chemical spills occurring in the internal bunded area, it shall drain to a low point recessed into the floor of the building. A DN50 PVC pipe shall be installed through a penetration at the low point of the building. The penetration for this pipe through the RCP floor shall consist of a PVC socket cast into the floor with a puddle flange glued to it (as shown in the drawing DTC-7009) such that chemicals will not come in contact with the concrete. The PVC pipe shall connect to either the delivery bund sump or a new sump (minimum dimensions 600mm x 600mm x 600mm) if the delivery bund sump is not at an appropriate location. A manual isolation valve shall be provided on this line . Refer section 3.4 of this Specification for sump and discharge details.

If a gravity arrangement is not feasible, then a manually started self-priming pump shall be permanently installed to empty the sump (refer Section 3.4).

A recessed low point inside the chemical room of the building is to be located adjacent to the door to facilitate maintenance.

External sumps shall have a lockable, easily operated lid that will permit the addition of a sump pump. The lid shall prevent the ingress of rainwater and debris.

Where there is water supply within the RCP bunded area, a 50 mm overflow pipe shall be provided above the 110% bund directing the flow away from electricals, operator accesses and where possible, to the delivery bay/intermediate sump. This can be provided through the wall of the RCP. The design shall include ready isolation of the water supply without the need to enter the bund.

4.5 Electrical Controls Room

The electrical controls room shall have an external entrance door opening outwards. The chemical delivery lines and water supply lines shall pass through a hole in the floor of the electrical controls room. The pipework shall rise above bund height and then enter the bunded dosing room. The pipework in the controls room shall be shielded with PE panels, designed to prevent impact damage to the pipes and prevent any leakage or spray from the pipes reaching the electrical and controls cubicles. Any leakage shall be diverted onto the floor of the room. The floor shall be sloped so that any leakage flows towards and out of the door and into the delivery bund.

The Contractor shall provide a table and chair in the control room.

4.6 Electrical

All electrical equipment in the chemical room, including wiring, shall be installed above the full chemical bund level. All electrical equipment shall be capable of working when the bund is full of liquid. As both water and the dosing chemicals are electrical conductors, safety of personnel within the bund must be considered when designing the layout of electrical equipment within the building.

One 3-pin, 240 V power outlets must be provided in the electrical control room for power supply. An additional twin GPO should be provided in the RTU section of the control panel.

A high impact weatherproof IP 55 socket outlet shall be provided for the sump pump. This outlet should match that of the sump pump provided. Most often this is a single phase sump pump. The outlet shall be mounted inside the building, on the wall, a minimum of 300 mm above the bund level. Power lead to the pump shall be captive when the switch is in the on position. The outlet shall be provided with a chemically resistant, engraved plastic label (10 mm high minimum lettering) screwed to the wall above the outlet, indicating, “For sump pump - do not use for filling”.

4.7 Ventilation

Adequate ventilation shall be provided to prevent condensation build-up inside the building using door vents and extraction fans.

Separate electric ventilation fans shall be provided for the chemical dosing room and the electrical controls room. The ventilation fans must be able to be run continuously, be corrosion resistant and be able to be operated via a 24-hour timer if required.

In other dosing systems, the fan is only required to operate when plant personnel are inside the RCP building. An automatic door switch on the RCP building shall be provided to automatically start the fans when the doors open, and stop the fans when the doors close. This switch will also log building access to RTU and turn on / off interior lighting.

The electrical controls room and chemical dosing room fans shall be mounted on the roof of the building. To provide adequate cross flow ventilation, mechanical vents shall be provided low down, preferrably on the eastern wall, a minimum of 300 mm above floor level in the electrical room and above the bund level in the chemical room. These vents shall be vermin proof. The fans shall be capable of achieving 6-12 air changes per hour. The ventilation fans are not required to be monitored or controlled by the RTU.

If required, an air conditioning system shall also be provided for the electrical controls room.

4.8 Lighting

Internal and external lighting of the RCP building shall be provided to allow normal work to be carried out 24 hours a day. The external lighting shall be provided to cover the area where filling is to take place and the entry door.

The lighting installation shall meet all the applicable requirements of Sydney Water's Technical Specification Part 3 – Electrical Works. Specific lighting requirements are described in the following:

- A minimum illumination level for internal lighting of 400 LUX using LEDs shall be supplied and installed in each room. An automatic door switch shall be provided, to automatically turn on the lights when the RCP doors are open, and shut off the lights when the doors close. One emergency luminary with a 2 hour battery backup, shall be supplied and installed for each room.
- Lighting shall be arranged so that the liquid level in a translucent tank can be seen.
- The external lighting shall be 30W LED floodlight fitting. Glare from the fitting shall be carefully controlled for comfort. Lighting using unshielded lamps shall not be visible to the public at normal viewing angles.
- The external lighting design shall be vandal proof. It shall utilise the building for mounting, where practicable. The lighting shall be controlled via a light switch located inside the control room in the RCP building. During automatic mode, the operation of the lights shall be controlled via a photocell. During manual mode, light can be switched on and off by operator with an 'OFF' 15 minutes delay to allow operators to safely egress the site with lights still on.
- An overall site lighting study shall be completed after layouts are complete, including but not limited to, delivery bay, roadways, access road, gates and approach road.
- Additional lighting shall be provided at roadways, gates and approach road.

4.9 Platform Ladder

A lightweight, corrosion resistant 1200mm high safety type platform ladder shall be supplied to provide access to the manholes of all tanks, level sensor, room lighting, and any elevated equipment. Platform ladder to be compliant with AS/NZS 1892 and any applicable SafeWork NSW requirements. Platform to include closable gate to provide fall protection on all four sides and to have braking system for the wheels to prevent movement during use.

4.10 Safety Equipment

Refer Section 3.5.

4.11 Chemical Manifest

If the chemical is above the Dangerous Goods manifest quantity (i.e. >10,000 L), then a Hazardous Material (HAZMAT) box shall be mounted just inside the site main entrance gate. A chemical manifest shall be provided in the box and shall meet the requirements of NSW Storage and Handling of Dangerous Goods Code of Practice 2005. Chemical manifest should comply with WHS Regulation 2017 Schedule 11. This typically contains the following details:

- Date of preparation
- Name and contact details of Occupier / Sydney Water Responsible Person
- Contact details for two people in case of emergency
- Details of dangerous goods storages including type, location, number and volume of tanks
- Safety Data Sheet (SDS) of the chemical
- A site plan of the premises which includes:
    - Location of essential site services, fuel and power isolation points
    - Location of fire extinguisher and safety shower/eye wash facilities
    - Location of the manifest
    - Main entry and exit points
    - Location and classes of dangerous goods storages and how they are identified
    - Dosing area
    - Location of all drains on site
    - Nature of adjoining water storage facility
    - Location of emergency assembly area

5 Chemical Storage and Dosing Tank(s)

Chemical storage tank(s) shall be provided for safe storage of the Sodium Hypochlorite. The tank(s) shall be located within the bunded area inside the RCP building dosing room. The preferred arrangement of the tank(s) is to have the dosing tank in the corner furthest from the window of the electrical control room and the (generally) smaller storage tank closest to the control room and the entry door.

The storage tank(s) shall be designed and constructed to provide maximum draining of the tank and its connections while still maintaining the structural integrity of the tank walls and base.

Equipment, such as access hatches and level sensors shall be easily reached from the platform ladder for ease of operation and maintenance.

The storage tank shall be designed for the maximum delivery temperature of the chemical. This temperature will be advised by SWC or its representative.

The tanks provided shall be the tallest and thinnest available with sufficient access to the level transducer on top. Clearance above the tanks shall be a minimum of 500mm.

There are 3 acknowledged references to tank capacity as follows:

1) Nominal Capacity – This is the tanks capacity as stated by the manufacturer. It is the tanks nominal capacity without fittings.

2) Effective capacity – This is the capacity of the tank to contain product. It is the tanks volume as determined from the floor of the tank to the invert of the tank overflow.

3) Working capacity – This is the tank capacity to deliver product. It is determined from the obvert of the discharge to the invert of the overflow.

The storage volume shall be calculated from the Working capacity. Level sensors that communicate through IICATS operate between 5% & 90% of the Working capacity.

5.1 Material

The storage and dosing tank(s) shall be manufactured from rotomoulded polyethylene, uPVC, FRP or other material suitable for Sodium Hypochlorite. It shall be designed and constructed in accordance with AS/NZS 4766 when it is made from PE, DVS2205 / EN12573 for uPVC or as per the Sydney Water FRP Chemical Storage Tanks Technical Specification for FRP. The chemical storage and dosing tank(s) shall be resistant to chemical attack and designed and constructed in accordance with the relevant requirement of AS 3780. A minimum of 1.5 times the specific gravity of the fluid to be stored in the tank shall be assumed for calculation of wall thickness requirement.

To avoid external corrosion, all welded brackets such as hold-down lugs, pipe supports and lifting lugs shall be designed to allow water/chemical to drain away without pooling.

The tank/s supplied shall be fitted out with the required branches, fittings, labelling and identification number. The labelling requirements shall include, but is not limited to the material of construction, the name of the manufacturer and the date of manufacture.

All stub flange nozzles shall be complete with stiffened gussets and supplied 316 stainless steel backing rings, ANSI 150. For indicative tank layout drawing including all required appurtenances refer to DTC drawings.

5.2 Structural

The tank shall be suitably reinforced and supported to withstand all forces, including filling forces, without deforming when it is full. The tank shall be fabricated such that the top of the tank is capable of supporting the weight of maintenance personnel.

For a FRP tank, it shall be anchored and mounted on a suitable concrete plinth. Suitable lifting lugs shall be fitted. Bitumen sealed mats must also be installed between the storage tank and concrete plinth.

5.3 Access Hatch

For a covered tank with a sidewall height of not greater than 2 m, a minimum of one 600mm diameter access hatch shall be provided in the top of the tank. Where the tank is small <5kL and a 600mm diameter access hatch is not feasible, a 450mm diameter access hatch shall be provided.

For any other tank, the minimum dimension of the side access hatch is 600 mm diameter. The side access hatch shall be hinged to the tank wall.

The hatch shall be made from lightweight materials, weighing no more than 16 kg, in accordance with AS 3996, Class A. Weight limits shall be labelled where appropriate.

5.4 Tank Inlet and Outlet

Tank shall be as per the DTC drawings and have a minimum of the following pipework features:

- One 50 mm diameter vent (breather) on the apex of the tank roof shall be supplied. The vent shall penetrate the external wall and finish in a 90° bend with the open end facing upward. The end of the vent pipe shall be covered with a sewer vent slotted cap.
- One 80 mm diameter overflow branch. The overflow line diameter should be at least 1.5 times the diameter of the filling line. The overflow line shall be located such that it prevents immersion of instruments and equipment located in the tank roof and directs chemical safely away from operators and to the bund sump. The overflow shall terminate in a water trap consisting of a bucket supplied by the Contractor.
- One drain branch with minimum diameter of 50 mm shall be provided as close to the tank floor level as practicable.
- One 50mm diameter fill pipe to the top side inlet from tanker unloading point, complete with a fill valve. A 50 mm suitable male camlock style fitting, with cover, shall be supplied and installed at the tanker filling point. This pipe shall rise vertically and then slope downwards towards the tank (1 in 100 fall). It shall enter the top of the chemical storage tank and be located above the level of the overflow pipe.

  One 180mm diameter branche in the roof of the tank for an Ultrasonic level transmitter fitted with female camlock connection. One shall be used the other is to be a spare, both are to be located in positions which are accessible from a moveable access platform.
- One suitably sized bottom side outlet. It shall be located 100 mm above the tank floor. It shall be fitted with a manual isolation valve and a motorised isolation valve which shall have a battery backup sufficient to drive the valve close in a power failure.
- Automatic cut out during filling when the tank reaches High Level (90%).
- Automatic cut out during dosing when the tank reaches Low Low level (5%).

- Isolation (stop) valves on each of the inlet and outlet connections.
- All branches on the tank shall finish with 150 mm or more from the tank wall or roof with ANSI flanges with stainless steel backing rings. All stub flanges to be gusseted.
- A typical storage tank data sheet is included in Appendix D.

5.5 Level Instruments

An ultrasonic level indicator to show the level/quantity of the contents inside the tank shall be provided above the overflow line. It should be mounted on a removable camlock style fitting and easily accessible from a platform ladder. The transmitter shall be connected to the control and telemetry system to allow remote monitoring as specified in Sydney Water's – IICATS (General) TOG_TS01 and Sydney Water – IICATS Water Distribution Related Instrumentation and Control Standards TOG_TS02. 0% level shall be at the obvert of the tank outlet and 100% must be at invert of the tank overflow.

In addition to the ultrasonic level indicator, a visible indicator shall also be provided. A translucent tank with level markings is acceptable. Otherwise the transparent tube indicator shall be adjacent to the tank wall. The actual liquid level inside the tank during filling shall be visible from the filling/transfer point.

A separate capacitance type High Level (95%) switch (LHL) and automatic cut out during filling shall also be provided.

A separate capacitance type Low Level Switch (LSL) shall be provided.

An alarm is to be sent to IICATS if the tank is dropping too fast, indicating a major leak. Rate of drop to be confirmed with SWC controls team.

5.6 Digital Display

A weatherproof digital display of the tank level shall also be installed at the filling transfer point to indicate the actual level during filling. An alarm system consisting of a klaxon and beacon shall also be installed at the filling transfer point, to alarm if tank high level switch has been reached. The digital display for tank level shall be suitable for operation with 24V DC power supply. It shall be equipped with sunlight readable LEDs and a minimum reading range of 10m. It shall be suitable to display percentage values.

The digital display shall have a minimum rating of IP 56, and shall be installed with suitable mounting accessories. The digital display shall be mounted on the fill line above the isolating valve as shown in the DTC drawings.

5.7 Dosing Tank requirements

For a system where dilution of the neat Sodium Hypochlorite solution provided is required prior to dosing an additional tank with associated appurtenances, level indicators, access provisions and all associated pipework, instrumentation and control devices shall be provided.

The tank shall meet all material, structural, access hatch, tank inlet and outlet and level indicator requirements as per Section 5.1 through 5.5 of this Document unless noted below. A digital display of the tank level at the unloading point is not required.

For dual tank systems an Out of Service switch shall be provided on each tank.

5.7.1 Dosing Tank Inlet and Outlet

The Dosing tank shall have all inlets and outlets as per Section 5.4 of this document with the following additions;

- One 50mm (nominal, to be confirmed on transfer pump size selection) diameter fill pipe to the top side inlet from the transfer pump. This pipe shall rise vertically and then slope downwards towards the tank (1 in 100 fall). It shall enter the top of the chemical storage tank and be located above the level of the overflow pipe.
- One 50mm diameter dilution water fill pipe to the top side inlet from the dilution water pump. Line shall be fitted with mechanically operated isolation valve, diaphragm valve and flow switch connected to the RTU. This pipe shall rise vertically and then slope downwards towards the tank (1 in 100 fall). It shall enter the top of the chemical storage tank and be located above the level of the overflow pipe.
- One 25mm diameter return line from the calibration cylinder prior to the dosing pumps and linked to the Pressure Regulation Valves on the discharge side of the dosing pumps.
- One 50mm diameter recirculation line linked to the transfer pumps with a mechanically actuated valve.

6 Batching and Dosing System

The required dosing system shall be designed to provide a reliable, continuous dosing of metered volumes of Sodium Hypochlorite. All pumps, valves, fittings and pipework necessary for the proper operation of the dosing system shall be provided. The piping shall be suitable for the Sodium Hypochlorite conveyed. The system shall be capable of operating in both automatic and local manual modes.

The system is to include the allowance for batching of the neat Sodium Hypochlorite (12.5%) delivered on site with make-up water. This dilution will enable a more accurate level of control of the amount of Sodium Hypochlorite injected into the system. The batching process is to be limited to a maximum of one (1) hour with a preferred total transfer, dilution and mixing time of 40 minutes

The system shall be supported by suitable supports for the required pumps, valves, fittings and pipework (uni-strut is not considered suitable), all pipework to be supported by pipe manufacturer proprietary product as they allow for movement without damage.

6.1 Pumps and Pipework

Refer Appendix A: DTC drawings for a list of generic P&IDs.

6.1.1 Transfer Pumps

One self-priming, Iwaki (or suitable equivalent) centrifugal, pump is required for transfer of Sodium Hypochlorite, with "seal-less" magnetic drive types. Appropriate materials of construction are:

- Fluoro-polymer lined steel
- Titanium
- Glass Fibre Reinforced Polypropylene

Where seals are used they should have a double mechanical-seal with water flush. The seal should be constructed with wetted parts from titanium and have PTFE and ceramic seal faces.

The transfer pump are to be designed to provide sufficient flow in the batching process in order to meet the time requirement set in Section 6 of this document.

The transfer pump is to be provided with suitable pipework and motor operated valves for mixing of the diluted Sodium Hypochlorite solution.

Approval from the Principal's representative shall be sought prior to procurement of pumps to be installed in the Rechlorination Plant.

6.1.2 Carrier Water Pumps

Two (2) identical duty and standby pumps of suitable brand, type and capacity range, shall be provided for make-up water and carrier water if the on-site pressures do not provide suitable pressure to meet the dilution and carry water process requirements. The pumps are to be self-priming, centrifugal, multi-stage booster pumps.

During the batching process it will be required to run both pumps in a duty / duty arrangement into a header in order to dilute the Sodium Hypochlorite solution in the dosing tank in the allowable batching time. The automatic carrier water pumps cut-out will occur when dosing tank reaches High level (90%).

These Carrier Water Pumps are also required to supply the carrier water for the dosing system in a duty/standby configuration. The pump output pressure is to be limited so as not to overcome the dosing pump pressure, however it is still to be sufficient to supply 200kPa of pressure at the injection nozzle in the reservoir or overcome the mains pressure if dosing directly into a water supply. The switchover to the standby pump shall be automatic via the control system. Automatic changeover between pump duties shall be configured on time as well as pump fault.

The automatic carrier water pump cut-out after the dosing pumps have cut-out and after an adjustable time has elapsed to flush the doing line.

Approval from the Principal's representative shall be sought prior to procurement of pumps to be installed in the Rechlorination Plant.

6.1.3 Dosing Pumps

Two (2) identical duty and standby dosing pumps (or one (1) dosing pump where the RCP is small, as approved by the Principal) of the Grundfos Digital Dosing Pump (or suitable equivalent) type of adequate capacity and pressure range, shall be provided for dosing. The switchover to the standby pump shall be automatic via the control system. Automatic changeover between pump duties shall be configured on time as well as pump fault. Automatic dosing pump cut out when the chemical dosing tank reaches Low Low level (5%). The pumps shall also be automatically disabled during batching. The dosing pumps shall be designed to allow minimum dosing during the initial operation of the Rechlorination Plant.

The dosing pumps shall be digital (10bar) with a turndown ratio of 100:1 or better.

The pumps are to incorporate digital indication of the set rate. Metering accuracy of the pumps shall be better than 2.5% of the set rate at a variable suction head.

Each pump shall be fitted with an external pressure relief valve, vented back into the calibration vent line returning into the top of the dosing tank.

An automatic gas vent shall be supplied and installed in the dosing head of each metering pump. Any gas released from the Sodium Hypochlorite solution shall be automatically vented off.

Approval from the Principal's representative shall be sought prior to procurement of dosing pumps to be installed in the Rechlorination Plant.

Operation of the dosing pumps, require several prerequisites both within the RCP unit and outside the RCP unit. Prerequisites external to the RCP include:

- Satisfactory operation of the Chlorine Residual Analyser.
- Satisfactory operation of the reservoir mixer (if dosing to a reservoir)
- Flowmeter in the water main (if dosing to a water main)

Refer to DTC drawings.

6.1.4 Pipework and Appurtenances

Carrier Water line

Carrier water shall be piped from the carrier water system to provide a minimum dilution (or carrier) water ratio of 20:1 based on the maximum dosing pump speed.

Flow from the carrier water line shall pass through an isolation valve, flow switch, rotameter, diaphragm flow control valve and non-return valve(s). The rotameters shall have a minimum length of 250 mm.

A flow switch shall be installed on the common line to provide a “carrier water system failed” alarm (failsafe) as an input to the control system, on low flow.

A suitably sized RPZ valve shall be provided in the dilution water line for backflow prevention. Only proprietary back flow prevention devices shall be used.

Dosing Line

Adjustable pressure retaining valves shall be incorporated on each discharge lines from the dosing pumps to maintain dosing accuracy over the range of operating depths in the storage tank, and to act as anti-syphoning protection.

A suction strainer with a maximum opening of 1mm shall be provided.

Pipework shall be laid, sloped appropriately, so as to facilitate venting and prevent the accumulation of oxygen.

Where in-line ball valves are used, the valve shall have a vented ball to prevent the build-up of gas. The valves shall either come pre-drilled and be compatible, or can be drilled without negative impact upon manufacturer warranties.

Transfer Line

The transfer line shall be double contained where it passes above the doorway such that any leaks will not impact on any person using the doorway.

6.1.5 Dosing Cabinets

The pumps and associated instruments shall be enclosed in a Perspex dosing cabinet (2 cabinets for the 13.5kL + 13.5kL system). The dosing cabinets shall be designed for ease of access and pump maintenance. There shall be a divider in the centre of the dosing cabinet to separate the two dosing pumps. There shall be a catch pot on the base of the dosing cabinet to ensure all spillages are contained and directed to the sump. A high level switch to detect fluid in the catch pot will be hardwired interlocked to stop the dosing pumps when activated. The cabinet requires adequate ventilation.

Dosing pipework from the point it exits the dosing cabinet shall be double contained and drain back to the dosing cabinet for pipework within the RCP building.

All valve handles are to be lockable.

There shall be a motor actuated valve on each dosing cabinet inlet line (in addition to the dosing tank outlet valve) for the 13.5kL + 13.5kL system.

6.2 Not Applicable to the Rechlorination Plant

6.3 Dosing Cabinets

Refer Section 6.1.5.

6.4 Pulsation Dampeners at Pumps

Pulsation dampeners shall be provided in the discharge pipework from the dosing pump and shall be suitably sized for the displacement of the pump so that discharge pressure fluctuation does not exceed 10%. The pulsation dampeners shall have a diaphragm separating the air chamber from the liquid chamber. The air chamber shall be pressurised, and be capable of re-pressurising by air pump via a Schrader valve. A pressure gauge shall be installed. The position of the pressure gauge shall be located before the pressure relief valve and the loading valve.

Where possible, pulsation dampener should be located vertically at the top of the common discharge from the dosing pumps, such that discharge flow is directly into the dampener before a change of direction along the dosing line.

6.5 Depressurising, Flushing and Draining

Adequate provision shall be made for draining of lines for maintenance. This typically involves at least one drain valve on each of the suction and discharge sides of the pump. These valves shall be fitted with a camlock style fitting. The valving shall be provided to allow for flushing of the chemical dosing lines without dismantling the lines.

A 20mm Male polypropylene camlock style fitting shall be provided on all flushing points to match that on the hosereel.

A 50mm Male polypropylene camlock style fitting shall be provided at the chemical filling line fitted with a lockable cap.

All camlocks are to be supported.

6.6 Automatic Isolation Valves

The automatic isolation valve at the outlets of the storage and dosing tanks shall be motorised PVC-U ball valves. The valves shall consist of two separate modules – the valve body and the actuator. The material of construction shall be suitable for the Sodium Hypochlorite. The valve shall include a compact electric actuator capable of open/close feedback and be complete with open and closed position indicators and a facility for manual control. The valve position signal shall be sent to the control system. The valve shall close on power failure and the actuator shall be IP 65/67 per EN 60529.

An additional automatic isolation valve meeting the criteria above shall be installed on a recirculation line. The recirculation line shall enable the mixing of the chemical dosing tank via the transfer pump to ensure no concentrated plumes of Sodium Hypochloride can be passed through the dosing pumps to the system.

6.7 Pressure Transmitter Indicator

A pressure Transmitter/Indicator shall be installed and connected to the control system on the discharge side of the pumps for systems dosing to a water main. The instrument shall include a digital indicator.

6.8 Dosing and Transfer Chemical Flowmeter

A flowmeter (magnetic and Teflon coated type preferred) shall be installed in each transfer and dosing line (typically prior to the pressure sustaining valve). There shall be sufficient upstream and downstream straight pipe run to prevent flow disturbances affecting the flowmeter. The dosing flowmeter shall be calibrated to units of litres per hour. The flow meter shall measure the flow and transmit the flow signal to the control system. The flow meter shall display the flow rate and any error messages.

Flowmeter shall be flanged to ANSI 150.

6.9 Carrier and Potable Water System

Carrier water shall be piped from the service water system to provide a minimum dilution ratio of 4:1 to 20:1 of carrier water to dosing chemical. If site pressure is not able to accommodate 20:1 ratio then a carrier water booster pump shall be installed in the RCP. The contractor shall determine the capacity of the booster pump including pipeline and RPZ and valve losses.

Flow from the carrier water line shall pass through an isolation valve, flow switch, rotameter, actuated valve(s) and non-return valve(s). The rotameters shall have a minimum length of 250 mm.

Actuated valves shall be solenoid valve for lines <50mm and motorised valve for lines > or equal to 50mm.

Actuated valves, isolation valves and all other items of equipment in the carrier water system must be compatible with the Sodium Hypochlorite solution being dosed.

A flow switch shall be installed on the carrier water line of each dosing set pump to provide a “carrier water system failed” alarm (failsafe) as an input to the IICATS RTU, on low flow.

A suitably sized RPZ valve shall be provided in the carrier water line for backflow prevention.

Only proprietary back flow prevention devices shall be used.

The flushing water shall operate with a dedicated timer, where a solenoid valve shall open and flush the dosing line and the solenoid valve will close at the end of timer duration. The flushing line shall have a pressure indicator installed.

6.9.1 Potable Water Booster Pump

At locations where the water pressure is insufficient to meet the service water requirements for the RCP (wash-down hose, safety shower and eyewash), a potable water booster pump shall be installed.

One duty pump of suitable type and capacity range, shall provide the required flow and pressure requirements. The booster pump is not controlled or monitored by the IICATS control system and requires integral or independent controls.

Approval from the Principals representative shall be sought prior to procurement of pumps to be installed in the RCP.

6.10 Double Containment of Filling and Dosing Lines

Chemical dosing lines outside of the chemical room must be a pipe-in-pipe arrangement. The intention is to prevent a leak in the pipe from contaminating the soil and groundwater, and to protect it from accidental damage. Care must be taken with the design and installation of the outer pipe so that leaks from the inner pipe can be readily detected and shall be sealed to stop ingress of ground water.

Concrete encasement of a conduit for the containment lines when laid in ground is acceptable.

Double containment from within the bunded area through to the dosing point shall be constructed in such a way to facilitate replacement of dosing line without excavation of that section of pipe. Continuous PE or pressure rated uPVC pipe are preferred.

Where requested, an additional dosing line shall be installed as a backup.

Leak detection shall be included in accordance with Sydney Water's Technical Specification Part 2 – Mechanical Works.

6.11 Dosing Point

6.11.1 Water Storage (Reservoir) Facilities

The dosing point shall be designed with the following considerations:

- Located so as to maximise chemical dispersion within the water storage facility and minimise the chance of short circuiting. The dosing point is located feeding into the reservoir mixer.
- Be at a level that is normally submerged within the water storage facility.
- Be of rugged construction.
- Easily cleanable.
- Easily removable

The dosing apparatus shall consist of:

- A stainless steel dosing nozzle (as per The DTC drawings).
- A stainless steel pipe support and dosing pipe connection.
- A stainless steel support and retrieval wire from the top of the reservoir to the dosing skid and clamps, to facilitate removal.
- A food grade hose.

6.11.2 Dosing to a Water Main

The dosing point shall be designed with the following considerations:

- Located in a pit.
- Have a 20mm valved drain/flushing line fitted with hose connection point.
- Have a high level switch (LSH) in the pit to detect flooding or chemical leakage.
- Have an isolating ball valve and a non-return valve.
- Have a proprietary retractable injection quill with safety chains and integral ball valve.

6.12 Leak Detection Pits

Leakage detection pits shall be installed at low points in the double contained dosing line. The double containment pipe shall have a downward facing tee and branch pipe at the pit with valve to allow draining of the double containment. The branch pipe in the detection pit shall be fitted with a LSH switch to detect a leak. The LSH signal cable shall run back to the RCP and be connected to the controls cubicle.

6.13 Chlorine Residual Analyser

A Chlorine Residual Analyser is required for operation of the RCP dosing system. This may be existing on site, be located remote to the RCP unit or be installed in the RCP unit as advised by the Principal's Representative.

If a remote chlorine analyser is required to be installed when dosing into a water main it shall be located in a suitable pit downstream of the water flowmeter. The Principal's Representative will indicate where this is required to be installed.

The analyser shall not require a buffer solution and only require the changing of gel and cap every 6 months.

6.14 Not applicable to Rechlorination Plant

6.15 Labelling and Identification

Labelling and identification of equipment and structures shall follow the requirements of Sydney Water's Maintenance Related Clauses for Capital and Operational Projects

7 Submission

The following shall be submitted to the Principal's representative for approval prior to ordering.

7.1 Design Drawings

Design drawings of the proposed RCP installation shall be provided. They shall cover all design issues including:

- Location of the RCP on site including access and egress points, delivery bunds, drains, services, dosing lines, pits and where required, truck turning bays (general arrangement);
- Process & Instrumentation Diagram (P&ID) drawing(s) with an associated list of equipment, material and size details. Supplied by the Principal with this specification;
- Position and layout of all equipment including pipework and storage tank (dimensional layout – plan and elevation). Supplied by the Principal with this specification;
- Electrical drawings (including circuits, control systems, equipment lists, manufacturer general arrangement, items, list, site general arrangement, conduit sizes and locations).
- Structural drawings, including the building

The drawing format shall be in accordance with Sydney Water's Maintenance Related Clauses for Capital and Operational Projects.

The Contractor shall submit all "Work-As-Constructed (WAC)" drawings, as follows:

Type of copy	Details of copies required
Hard Copies	1 – 2 x A3 size bound in A3 size folders
Electronic copies (CD-R/DVD/USB) in both AutoCAD DWG and Adobe PDF formats	2 – Distribution a) Asset Knowledge – Engineering Drawing Management System (EDMS) Contractor Portal, b) Reliability Maintenance Engineering

7.2 Operating and Maintenance Manual

A draft Operating and Maintenance (O&M) Manual for the RCP shall be prepared and submitted to the Principal's Representative prior to SAT. It shall be finalised and re-submitted after successful commissioning of the unit.

An exploded view of pump and consumables list is required in the O&M manual.

A template for the O&M manual is included with this specification.

The O&M manual shall be in accordance with Sydney Water's Maintenance Related Clauses for Capital and Operational Projects.

7.3 Critical Spare Parts

The Contractor shall supply critical spare parts lists for the installation. The list of critical spare parts shall be discussed and agree with the Principal's Representative prior to procurement. SWC may purchase critical spares form the Contractor or elsewhere.

8 Testing and Commissioning

Factory Acceptance Testing (FAT) of prefabricated units needs to be conducted in the presence of representative(s) from the Principal's end once all operation and maintenance manuals are complete and an updated set of all drawings are made available. Typical FAT requirements are outlined in Sydney Water's Maintenance Related Clauses for Capital and Operational Projects. This needs to be conducted prior to installation of the unit at the site.

Following installation, the RCP shall be tested and commissioned in accordance with Sydney Water's Maintenance Related Clauses for Capital and Operational Projects. The checklist in Appendix 1 and 2 of Sydney Water's Asset Commissioning Standard Administration Procedure (SAP) IMS0035, shall be used by the Commissioning Coordinator to ensure all of the Principal's requirements for asset commissioning are met. The Contractor shall develop a Commissioning Plan based on IMS0035 which shall be submitted to the Principal's representative for review. Written approval from the Principal's representative shall be sought prior to commissioning.

An example Commissioning checklist is shown in Appendix G.

The Contractor shall provide the necessary expertise and resources for successful commissioning of the unit.

In addition, the following tests shall be carried out:

8.1 Hydrostatic Test and Leak Detection

The bund area should be watertight prior to the application of the internal coating. The bund area of chemical storage area shall be filled with water for at least 24 hours and prior to the internal coating being applied. It will be satisfactory if there is no water leakage through the wall, slab, penetrations, joints, etc. The storage and dosing tank(s) should be filled to prevent any movement due to flotation.

New storage and dosing tanks and pipework shall be filled with water and inspected for leakage for at least 24 hours. Tanks shall be tested to the SG of the tank. Pipework shall be pressure tested to 1.5 times the operating pressure.

8.2 Commissioning Test Run

For the purpose of the Site Acceptance Test (SAT), a test run shall be undertaken in accordance with the Contractor's site commissioning methodology, which shall be approved by the Principal's Representative. The test run shall be a minimum of one month in duration. Typical SAT requirements are outlined in Sydney Water's Maintenance Related Clauses for Capital and Operational Projects.

The test run shall be carried out in the following stages:

- Manual operation using water.
- Automatic operation using water.
- Manual operation using chemical.
- Automatic operation using chemical.

Commissioning shall be deemed complete when the whole of the works are capable of running continuously without any fault for a period of two (2) weeks. The plant shall start and stop during this two-week period as required by the Principal's Representative. The SAT shall include at least one (1) chemical delivery.

During this period, the Contractor shall maintain the unit in a proper working manner. The unit shall be used to demonstrate system performance to Sydney Water. The chlorine residual in the water storage shall be recorded. The Contractor shall carry out any work necessary to ensure the unit is working correctly.

At the end of this period, the Contractor shall issue a certificate stating the outcome of the testing and commissioning to allow Handover, in accordance with Sydney Water's Maintenance Related Clauses for Capital and Operational Projects.

8.3 Building Certification

The Contractor shall provide all building certification documents for design and certification of the unit to the Principal.

8.4 Submission of Work As Constructed (WAC) Documents

The Handover is not complete until all WAC documents, such as detailed drawings, O&M Manuals, FMECA documentation, MAXIMO entries and so on, have been submitted to the Principal's Representative. Refer to Sydney Water's Maintenance Related Clauses for Capital and Operational Projects. This is a Hold Point.

8.5 Handover

The Asset Commissioning SAP as detailed in SWC 'Maintenance Related Clauses' shall be followed to ensure all issues are finalised before handover of the RCP to Sydney Water.

9 Document Control

Title: **Rechlorination Plant Standard Specification**

Current review date: 1/03/2019	**Review Period:** 2 years	**Registered file:** D0000389
BMIS file name: ACP000X		
Document owner:	Ken Wiggins – Urban Design & Engineering Manager	
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Approved by:	Ken Wiggins – Urban Design & Engineering Manager	

10 Change History

Version	Date revised	Approved by	Author/s	Brief description of change
1	March 2019	Ken Wiggins	Jason Smith	First Issue

APPENDICES

Appendix A: DTC Drawing List

	RECHLORINATION PLANT, COMMON DETAIL DRAWINGS
DTC7000	CHEMICAL DOSING & RECHLORINATION UNIT, COVER SHEET AND DRAWING LIST
DTC7001	CHEMICAL DOSING & RECHLORINATION UNIT, INSTRUCTIONS AND NOTES
DTC7002	CHEMICAL DOSING & RECHLORINATION UNIT, GENERAL NOTES
DTC7003	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC SITE LAYOUT - DRIVE-IN, REVERSE, DRIVE-OUT
DTC7004	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC SITE LAYOUT - DRIVE-IN, DRIVE-OUT
DTC7005	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC SITE LAYOUT SECTION (INCL. RCP/RCP FOUNDATION)
DTC7006	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC DELIVERY BUND, CONCRETE DETAILS
DTC7007	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC DELIVERY BUND - REINFORCEMENT DETAILS
DTC7008	CHEMICAL DOSING & RECHLORINATION UNIT, GENERIC DELIVERY BAY SUMP - PUMP-OUT & GRAVITY TYPE DETAILS
DTC7009	CHEMICAL DOSING & RECHLORINATION UNIT, TYPICAL CIVIL DETAILS
DTC7013	TYPICAL RECHLORINATION PLANT SODIUM HYPOCHLORITE DOSING CABINET DETAILS
DTC7014	TYPICAL RECHLORINATION PLANT SODIUM HYPOCHLORITE DOSING POINT DETAILS
DTC7015	TYPICAL RECHLORINATION PLANT SODIUM HYPOCHLORITE P&ID - DOSING POINTS
DTC7016	CHEMICAL DOSING & RECHLORINATION UNIT, MISCELLANEOUS DETAILS
DTC7017	CHEMICAL DOSING & RECHLORINATION UNIT, BUILDING SIGNAGE
DTC7018	CHEMICAL DOSING & RECHLORINATION UNIT, LINE LEGEND & INSTRUMENTATION SYMBOLS P&ID
DTC7019	CHEMICAL DOSING & RECHLORINATION UNIT, PREFIXES & PIPING CODES P&ID
DTC7020	CHEMICAL DOSING & RECHLORINATION UNIT, SYMBOLS LEGEND SHEET P&ID

	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE
DTC7145	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID – SHEET 1 OF 2
DTC7146	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID – SHEET 2 OF 2
DTC7147	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT PLAN & ELEVATIONS
DTC7148	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT SECTIONS
DTC7149	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 1 OF 2
DTC7150	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 2 OF 2
DTC7151	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 3kL STORAGE TANK DETAILS
DTC7152	3kL + 7kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 7kL DOSING TANK DETAILS
	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE
DTC7160	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID SHEET 1 OF 2
DTC7161	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID SHEET 2 OF 2
DTC7162	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT PLAN & ELEVATIONS
DTC7163	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT SECTIONS
DTC7164	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 1 OF 2
DTC7165	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 2 OF 2
DTC7166	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 7kL STORAGE TANK DETAILS
DTC7167	7kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 13.5kL DOSING TANK DETAILS
	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE
DTC7175	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID SHEET 1 OF 2
DTC7176	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, P&ID SHEET 2 OF 2
DTC7177	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT PLAN & ELEVATIONS
DTC7178	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, GENERAL ARRANGEMENT SECTIONS

DTC7179	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 1 OF 2
DTC7180	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, PIPEWORK DETAILS, SHEET 2 OF 2
DTC7181	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 13.5kL STORAGE TANK DETAILS
DTC7182	13.5kL + 13.5kL RECHLORINATION PLANT SODIUM HYPOCHLORITE, 13.5kL DOSING TANK DETAILS

Appendix B: Sydney Water Asset Data Management and Commissioning

Refer Maintenance Related Clauses

Information on Inspection & Test Plans and Defects Rectification Plan can be found Sydney Water's Asset Data Management & Commissioning SAP (IMS0035).

A sample "*New Location Listing For Assets*" template is shown in the succeeding table. More information can be found from Sydney Water's Asset Knowledge* group page on iConnect.

MEPR0063.02: Maximo (MXES) - Location Number Request Form for New/Existing Assets

Instructions:

1. Columns marked in RED are mandatory for Service Provider.
2. Sydney Water will allocate Maximo Location Numbers for finalisation of the P & ID for Assets.
3. Reference on P & ID (by Service Provider) is a temporary identifier until Location Number is allocated by Asset Data Management.
4. Examples (below highlighted in blue) are given for guidance only.
5. Do not over write or delete blue example area. Start entering your data after the last blue line (Line 18)
6. Please email completed spreadsheet and P & ID diagrams to AssetDataMgmt@sydneywater.com.au
7. For further assistance, please contact the Asset Data Management representative of Sydney Water.

FMIS Project Number	SW Project Manager or Rep (for Minor work)

Facility	Location Number (by SWC)	Maximo Location Number (by SWC)	External Reference Number (by SWC)	Ref on P & ID (Service Provider)	Location Description (by SWC)	Location Description (By Service Provider)	Location Within Facility	Asset Description	SWC Parent Location	Parent Location	P&ID / Drawing Number	Is High Voltage Asset? Yes/No	Telemetry Monitored	Comments

NOTE: * Asset Knowledge is the new business unit name for the previous Asset Data Managment.

Appendix C: Construction Hazard Assessment Implication Review (CHAIR)

CHAIR Safety in Design Tool, developed by Work Cover NSW needs to be carried out in three phases namely:

- CHAIR-1: Conceptual Design Review (To be completed by the Contractor)
- CHAIR-2: Detailed Design Construction or Demolition Review (To be completed by the Contractor)
- CHAIR-3: Detailed Design Maintenance & Repair Review (Completed by SWC). See attached CHAIR 3 report prepared by SWC for the standard RCP Unit.

More information as to guidewords and how to conduct CHAIR can be found at Work Cover NSW.

Please find below link to Appendix C

http://nt032pdmnotes.swc/BMIS/SWDocControl.nsf/AllActive/D0000389.01/$File/D0000389.01.pdf?OpenElement

CHAIR – 3 Minutes Recording Table

Attached is the CHAIR 3 report prepared by SWC for the standard RCP unit.

Appendix D: Storage Tank Data Sheets

Please find below link to Appendix D

http://nt032pdmnotes.swc/BMIS/SWDocControl.nsf/AllActive/D0000389.02/$File/D0000389.02.docx?OpenElement

Appendix E: Operations & Maintenance Manual Template

Please find below link to Appendix E

http://nt032pdmnotes.swc/BMIS/SWDocControl.nsf/AllActive/D0000389.03/$File/D0000389.03.docx?OpenElement

Appendix F: SWC Guide to Proven Products

Please find below link to Appendix F

http://nt032pdmnotes.swc/BMIS/SWDocControl.nsf/AllActive/D0000389.04/$File/D0000389.04.pdf?OpenElement

Appendix G: RCP Commissioning Checklist

Prior to commencing commissioning the following mandatory requirements to be addressed: -

- Latest revision of construction drawings are provided including:-
    - Electrical.
    - Mechanical
    - Process & Instrumentation Diagram.
    - Civil showing pipework layouts, services and operational valve locations relative to the RCP.
- A draft copy of the O&M manual is available.
- The relevant IICATs RTU I/O listing is available.
- Completed Inspection & Test Plans as well as Factory Acceptance Test Documentation.
- Sign off from IXOM (formerly ORICA) for installation conformance to chemical delivery requirements.
- SWC Bi-Lock barrels to suit the Pink CBY key are installed on the access doors to the RCP. SWC Bi-lock padlocks to suit the CBY key are installed on all pit covers and site access gates.
- Access doors to the RCP are able to be secured in the open position.
- Externally located electrical meter panels where supplied will have a spare key provided to suit the energy suppliers proprietary padlock.
- ITP showing compliance to minimum containment volume as per this specification and hydrostatic test completion.
- Power to the RCP is connected and phase rotation is correct.
- A label clearly identifying the origin of the electrical sub-circuit is provided above the main isolator for the RCP.
- Potable & Non-Potable (where applicable) water is connected.
- Potable water pressure is adequate at all times of the day to operate the safety shower (minimum 75.7 L/min @ 210 kPa).
- RPZs are clearly labelled, protected by vandal resistant cages and fitted with SWC Bi-Lock padlocks that suit the CBY key.
- Externally located taps are fitted with vandal resistant handles and are clearly labelled NON POTABLE, DO NOT DRINK.
- A roof mounted retractable Hose Reel (UTY) c/w camlock fitting and hose nozzle is provided and has sufficient length to reach the entire truck delivery bund.
- The chemical dosing line is installed according to site design either in a dedicated chemical dosing pit for a water main or directly into a reservoir. The dosing line is

appropriately supported and terminated to allow future removal and re-installation where possible, negating the need for confined space entry.

- IICATs RTU, touch screen HMI, ethernet switch where applicable and 3G modem are installed, powered and loaded with the site specific control program ready for testing
- Internal and external lighting is operational.
- Ventilation fans are operational and the controlling time clock is programmed to operate the fans between 6am and 10pm, 7 days a week.
- All electrical instrumentation is programmed and correctly ranged including:-
    - Variable Speed Drives. (VSD)
    - Digital Dosing Pumps. (PMP)
    - Level Transducers. (LTX)
    - Pressure Transducers. (PTX)
    - Flow Transducers. (FTX)
    - Set-point relays within Analogue Level Displays. (FIX)
    - Programmable Level Switches. (LSH,LSL)
    - Programmable Flow Switches. (FSL)
    - Chlorine Analyser/s (Externally located control and interlock signals such as Reservoir Mixer (MIX), Secondary Containment high level (LSH), Dose pit High Level (LSH) [all if applicable])
- Motor thermal or electronic overloads are correctly set to the F.L.C. of the motors.
- Automatic Valves are configured for open / close operation and feedback position indication.
- Chemical Storage and Dosing tanks hold sufficient water to conduct automatic and manual testing (i.e. above low-level cut-out and below high level cut-out).
- Pressure loading and relief valves are adjusted to the required operational pressures and marked accordingly. (PCV, PRV)
- Pulsation dampeners are charged with air or nitrogen to 80% of system designed operational pressure. (DMP)
- All internally and externally located equipment is labelled with allocated MAICS numbered tags as required.
- Appropriate valve isolation keys and or handles are provided for operation of exterior located valves and removal of associated pits or covers.
- Relevant site safety and Asset ID (WX####) signage is securely affixed to access doors and is clearly visible when doors are open.
- Safety Shower and eyewash signs securely affixed to the wall and door as required.
- DG Labelling is correct and affixed to the chemical storage tank. A tank capacity label is affixed to the tank.

- DG labelling is also affixed to the external wall of the building so it is clearly visible when approaching from the access roadway.
- All chemical pipework is correctly coloured and labelled for the chemical to be dosed. Direction of flow is clearly indicated.
- Potable and Non-Potable (where applicable) water pipes are correctly labelled.
- HAZCHEM signage is attached to site access gates.
- Site access gates are able to be secured in the open position.
- HAZMAT box is installed inside the site perimeter fence and contains site safety folder (applicable for chemical installations over 1KL).
- All plug-in electrical equipment is tested and tagged.
- A dry powder fire extinguisher is located on the wall of the control room and is tested and tagged.
- Fire extinguisher signage is affixed to the wall above the extinguisher.
- A suitable mobile platform ladder is located within the process room for access to instrumentation located on the roof of the chemical storage and dosing tanks. Instrumentation as well as the tank manway should be within easy reach whilst standing on the ladder. The level transducer (LTX) should be able to be removed for cleaning without unscrewing from the tank, i.e. secured via a camlock coupling.
- A table, chair, document storage and spare parts cabinet (if required) are supplied in the control room.
- Electrical control panel is lockable with a standard SWC padlock.

Rechlorination Plant Sequence Testing

- RTU Digital and Analogue Inputs
    - Manually activate each RTU input and confirm both local and remote operation.
    - RTU Digital and Analogue Outputs
    - Remotely activate each digital and analogue output to check for automatic sequence operation.
- Drop test each Dosing Pump (PMP) to confirm correct calibration to the chemical dosing Flowmeter (FTX)
- Sequentially run each Dosing Pump (PMP) in manual and check for the following operations:-
    - Switch off Dosing Pump local isolator, Dosing Pump stops and auto valve closes. Pump fault light illuminates.
    - Dosing Pump drives from minimum to maximum speed when operated in manual from the control panel.
    - Dosing Pump stops operation and the auto valve closes in accordance with the FDS when associated interlocks are activated. These interlocks include:-

- Process Room Bund High Level (LSH)
- Dosing Cabinet Catch-pot (if applicable) (LSH)
- Secondary Containment High Level (if applicable) (LSH)
- Dose Pit High Level (watermain if applicable) (LSH)
- Dosing Tank Low Level (LSL & LSC)

o Isolate the chemical dose line discharge isolation valve and check the Dosing Pump Pressure Relief Valve (PRV) opens at the set pressure. Re-open the chemical dose line discharge isolation valve and check the Pressure Relief Valve fully closes.

o Place both of the Dosing Pumps (PMP) in auto and check for the following operations:-

o Dilution Water pumps (duty / standby) in lieu of solenoid in RCPs activate when Dosing Pump runs. Dilution Water Running light illuminates. Dilution water Rotameter (FIX) is set to provide a 'minimum' dilution water flow of 20:1 to that of the Dosing Pump maximum operating speed.

- Fail the dilution water pumps and check for correct operation of the Dilution Water Low Flow switch (FSL) and associated alarm input on the RTU.

o Switch off the duty Dosing Pump local isolator, the duty Dosing Pump stops, pump fault light illuminates and the standby Dosing Pump starts running.

o Dosing Pumps operate on either a window setpoint as determined by the residual chlorine analyser or a flow paced profile as determined by the water main flowmeter.

o Dosing Pumps stop operation and the auto valve closes in accordance with the FDS when associated interlocks are activated. These interlocks include:-

- Process Room Bund High Level (LSH)
- Dosing Cabinet Catch-pot (if applicable) (LSH)
- Secondary Containment High Level (if applicable) (LSH)
- Dose Pit High Level (watermain if applicable) (LSH)
- Storage Tank Low Level (LSL & LSC)
- Failure of chlorine signal or reaching the programmed setpoint value. Chlorine analyser also has an alarm output if the associated flow switch on the flow cell registers a low flow.

- Where applicable check the automatic operation of the batching sequence including Transfer / Mixing Pump run time and make up water pumps and control valves (either actuated ball valve or solenoid dependant on the size of the system) activation with cut-out on high level.

o Check batching sequence stops operation when associated interlocks are activated.

- Activate the Truck Power Outlets and then fill the storage tank with water to activate both High Level set-points (LSA & LSH). Confirm Truck Power Outlets are de-activated and subsequent activation of the High Level warning Klaxon (KLX) and Beacon (BEA). Press the Siren Mute button on the control panel to silence the Klaxon.
- Drain the storage tank to flood the process room bund in order to check the bund containment capability and bund capacity.
- Fill the delivery bund sump with sufficient water to activate the delivery bund Sump Pump (if applicable). Run the delivery bund Sump Pump in manual and check for automatic stop operation at low level cut-out.
- Check for correct mounting and operation of the Safety Shower / Eyewash and separate Eyewash (SEQ).
- Undertake site inspection to identify all externally located valves and controls associated with the RCP. These include:-
    - Process Room Bund Drain Valve
    - Secondary Containment Drain Valve (if applicable)
    - Dose Pit Drain Valve (if applicable)
    - Delivery Bund Drain Valve (if applicable) and doseline Isolation valves located at the dosing point within the reservoir or water main.
    - External Lighting Switch
- Check valving for correct labelling and descriptions are in accordance with design requirements.
- Identify access and egress to the RCP for delivery operations, after-hours access, are free from potential trip hazards and obstacles.

Prepared by H.Hilton & B.Cook