AM2776.4

Sewerage Chemical Dosing Facility (CDF) Standard

For sewerage network odour and corrosion control

Document History

Revision No.	Date	Revision Description
1	*Aug 2022*	*Original Version*

Revision Working Group

Name	Position
Daniel Battisti	Sewerage Operations Engineer Network Operations
Colin Paxman	Standards & Design Auditing Manager
Sean Lewis	Program Manager Resource Recovery
Robert De Boos	Strategic Lead, Integrated Water Management
Matthew Murphy	Automation and Commissioning Team Leader
Jayson Street	Senior Technical Support Officer Maintenance
Juha Myyrlainen	Electrical Engineer Technical Officer Maintenance
Lindsay Studer	Treatment Plant Planning team member
Michael Lowe	Senior Mechanical & Electrical Engineer, Design Team
Vahid Sourghali	Minor Capital Works Manager
Jessie Huang	Sewer Network Reliability Manager
Sabrina Woon	Process and Odour Engineer Resource Recovery
Matthew Maxwell	Senior Engineer Sewerage Operations
Rob Jagger	CMP Consulting Group

Version 1 Approval

Name	Position	Signature	Date
Ben Spedding	Energy and Resource Recovery Manager		1/12/2022
Declan McCreesh	Group Manager Network Operations		30/11/22

Version 1 Authorisation

Name	Position	Signature	Date
Colin Paxman	Standards & Design Auditing Manager		03/12/22

Contents

1. Introduction

This standard has been prepared to document the design, supply and construction requirements of South East Water Chemical Dosing Facilities (CDFs) used to control odour and corrosion in its sewerage network.

This document describes the requirements of both permanent and relocatable units being installed at existing or new assets, which could dose chemical into:

a) The gravity sewerage system (at any locations upstream of SPS pressure mains)
b) SPS pressure mains.
c) Pressure Sewage Networks.

1.1 Definitions

For definitions of abbreviations and terms used in this document, refer to the MRWA Edition of the Gravity Sewerage (WSA 02) and WSAA Sewage Pumping station (WSA 04) codes.

Other definitions as follows:

Term	Definition
CDF	Chemical Dosing Facility, comprising of: Delivery Bay + CDU + Dosing Lines + Dosing Point
Delivery Bay	The delivery truck standing containment area including sump and sump drainage
CDU	Chemical Dosing Unit, comprising the bunded building / enclosure + chemical storage tank + Dosing Pumps, Switchboard and Fittings
Dosing Point	Assets at the point of discharge of chemical
Working Volume	The volume of the tank between the obvert of the dosing outlet to the invert of the overflow (ie: the maximum usable volume of chemical).

All units shall be SI (metric)

1.2 Context

This document applies to the design and construction of new or upgraded CDFs at new and existing sewerage facilities. This specification is part of a subset of documents under the overarching standard for odour and corrosion control (AM2776) which provides a framework to identify sites where odour and corrosion control might be required, identify possible solutions and assess the most appropriate outcome. Each standard references specifications for each solution type. The documents in the series are as follows:

Standard	Title
AM2776	Corrosion and Odour Control Standard
AM2776.1	Passive Ventilation Standard
AM2776.2	Forced Extraction Specification
AM2776.3	Air Phase Treatment Unit Specification
AM2776.4	Chemical Dosing Facility Specification

1.3 Relevant Regulations

In Victoria, the Environmental Protection Act 2017 and the Regulations to this Act form the legislative basis for assessing odour impacts. The legislation requires that "You shall ensure that odours offensive to the senses of human beings are not discharged, emitted or released beyond the boundaries of the premises". As State environment protection policies and Waste management policies (WMPs) do not continue under the *Environment Protection Act 2017* (the Act), except in some limited circumstances. The transition process is explained in the State Environment Protection Policy document title "Using SEPPs and WMPs in the new environment protection framework guide, Publication Number 1994, published in June 2021.

1.4 Relevant Standards

Further to this Standard, all designs, fabrication, installation, and operational requirements shall comply with the following references:

a) South East Water's approved products listing on the MRWA web site.
b) South East Water Specifications as listed at: https://southeastwater.com.au/building-and-development/developers/technical-standards/, including but not limited to:
    I. South East Water supplement to the WSAA Sewage Pump Station Code of Australia
    II. AM2488 - Drafting Specification
    III. AM2714 - Electrical Standard
    IV. AM2832 - Instrument and Control Standard
    V. AM2847 - Communication Standard
    VI. AM2848 - Approved EIC Equipment List
    VII. AM2780 - SPS RTU & SCADA Specifications
    VIII. AM2739 - Corrosion Mitigation Specification
    IX. AM2759 - Security Specification
    X. AM2522 - Operations and Maintenance Manual Specification
    XI. AM2755 - Testing Commissioning and Handover Plan
    XII. AM2757 - Covers for Underground Structures
    XIII. AM2760 - Stainless Steel Specification
    XIV. AM2761 - Vehicle Access Standard
    XV. AM2775 - Mechanical & Electrical Equipment Data Collection Details
    XVI. AM2884 - Pit Standard
c) MRWA Specifications, in particular;
    I. MRWA-S-401- Sewerage Network Airflow Management.
d) WSAA Codes, in particular:
    I. WSA 201 – Manual for the Selection and Application of Protective Coatings. The Sydney Water supplement to WSA 201, ACP0166
    II. WSA02 - Gravity Sewerage Code of Australia, MRWA edition
    III. WSA04 - Sewage Pump Station Code of Australia
    IV. WSA07 - Pressure Sewerage Code of Australia and MRWA Supplement
e) Australian Standards, in particular:
    I. AS 1319 - Safety signs for the occupational environment
    II. AS 1345 - Identifications of the contents of pipes, conduits and ducts
    III. AS 1324.2- Air filters for use in general ventilation and air conditioning - Methods of test
    IV. AS 1657- Fixed platforms, walkways, stairways and ladders – design, construction and installation.
    V. AS 3500 – Plumbing and drainage
    VI. AS 3735 - Concrete structures retaining liquids
    VII. AS 3780 – The Storage and Handling of Corrosive Substances

VIII. AS4323.1 - Stationary source emissions: Selection of sampling positions.
IX. AS 4323.3 - Stationary source emissions: Determination of odour concentration by dynamic olfactometry.
X. AS/NZS - 4766 Polyethylene storage tanks for water and chemicals
XI. AS 4775 - Emergency Eyewash and Shower Equipment
XII. National Transport Commission (NTC) – Australian dangerous Goods Code Edition 7.4 (2016)

f) European Standard EN 13121: GRP Tanks and Vessels for Use Above Ground
g) International Standards, in particular: ISO 10780 – Stationary source emissions – measurement of velocity and volume flowrate of gas streams in ducts.
h) EPA Victoria (EPAV) Publications o Publication 1666.1 "Determination of odour concentration by dynamic olfactometry", 17/10/18 o Publication 440.1 "A guide to the sampling and analysis of air emissions and air quality", 5/12/02
i) Ixom Bulk Installation Guidelines (available on request)
j) Ixom On-Site Inspection Guidelines (available on request)

2. Project Brief

All information described in Table 1 shall be provided by SEW to the Designer of the CDF with the second column completed with project specific information and the third column typical information deleted. Text in *blue italics* is instructional information to the person completing the table. SEW Resource Recovery planning will principally put this schedule together and may have, or be developing, a guide to support this work.

Table 1: CDF Project Information (Design Brief)

CDF Information	Quantity / Requirements / Units	Typical Options
Purpose of Dosing & Target Point		Corrosion and/or Odour Control downstream of asset number *XXX* or location *YYY* (refer Sec 5.2)
CDF Address	*If a location for the CDF has been established, state the location here*	
Preferred Location at this Address for positioning of CDF	*Specify where the CDF is to be located with map coordinates if possible. Provide and refer to photos where possible*	
Preferred discharge structure location and type	*Nominate the preferred location for chemical to be discharged*	Pressure Main / sewerage maintenance structure / wet well
Chemical to be dosed	Ferrous Chloride, UN1760	
Chemical Supplier	BlueScope Hastings	
Supplied Chemical Concentration	*XXX* ml/L	
Criticality	*Refer to section 5.3*	• Low (1 dosing line) • High (2 dosing lines & 2 tappings).
Range of dissolved sulphide level in un-dosed sewage	*XXX* ml/L	

Average Sewage Flow (ADWF) during dosing period (if discharging to a well or gravity system)	*XXX* l/s	
Peak Sewage Flow (PDWF) during dosing period (if discharging to a well or gravity system	*XXX* l/s	
Pressure main flow rate (if dosing to a pressure main)	*XXX* l/s	
Pressure main Maximum Operating Pressure (MOP)	*Provide the MOP of the pressure main should dosing to a pressure main be preferred*	
Rate of Chemical Dosing Minimum	*XXX* Litres / hr	
Rate of Chemical Dosing Maximum.	*XXX* Litres / hr. *Include a 1.3 x Factor of Safety*	
Periods when Chemical Dosing Required		Off Season / All Year / School Holidays
Expected Life of Dosing System	Yr 20*XX* to Yr 20*XX* *State when chemical dosing will likely be required. State planning assumptions.*	
CDU Mobility Requirement		Transportable / Fixed in Place
Preferred Maximum Delivery Truck Size	*State the preferred delivery truck information (ask Operations)*	
Existing SCADA available		Yes / No
Existing drinking water supply available		Yes / No
Existing non-drinking water supply available		Yes / No
Water supply pressure available	*XXX* mH	
Existing power supply adequate	*If an existing board is to be used to power the CDF, undertake an assessment of the board and specify available spare capacity*	Yes / No
Upgrade to site security to be included in the design	*Provide information of the security upgrades required in accordance with AM2759*	CCTV, fencing, surveillance
Aesthetic Requirements (if any)	*Describe any requirements such as screening from neighbours, colours prescribed by council*	
H_2S monitoring to inform dosing control	*Indicate if real time monitoring of H2S is to be an input into CDU dosing rate control or user input if no real-time monitoring.*	

3. Proposal Tender Schedule

Suppliers of CDF's shall complete and provide the following summary table (Table 2) as part of their proposal. A word version of this table is available on request.

Table 2: CDF Tender Schedule

Proposal Information Required	Proposal
General	
Chemical to be dosed	Ferrous Chloride
Recommended control philosophy	*Indicate deviation from this standard*
Location, Access & Site (refer sections 8. & 8.3)	
Address of Facility	
Location of CDF at the facility	*Indicate footprint of the CDF in a plan*
Delivery truck access route	*Indicate truck path on a plan*
Delivery truck egress route	*Indicate truck path on a plan*
Tank refill frequency (during peak consumption)	
Vehicle access upgrades to be completed	
Security upgrades to be completed	
Earthworks and drainage works to be completed	
Site Services (refer section 5.5)	
Water supply	
Power	
Telemetry	
Drainage	
Chemical Delivery (refer section 7.)	
Location of chemical delivery bay	
Footprint (plan area) of delivery bay	
Material of construction of delivery bay	
Delivery bay capacity (m3)	
Location of delivery bay	
Means of Discharge from Delivery Bay (valved gravity discharge / pumped)	
Discharge point for Delivery Bay	
Safety and Washdown (refer section 5.10)	
Water pipe material	
Eyewash make / model	
Location(s) of eyewash	
Shower make / model	

Location(s) of shower	
Pressure regulating fitting make / model	
Washdown facility make / model	
Location of washdown facility	
Backflow prevention make / model	
Building / Enclosure (refer section 10.)	
Location	
Materials of construction	
Dimensions (including height)	
Leak containment system (eg: bund)	
Leak containment volume (to overflow level)	
Leak monitoring arrangements	
Means of access to equipment when bund full	
Lighting	
Chemical Storage Tank (refer section 9.)	
Chemical storage tank size	
Chemical storage tank make & model	
Tank level analogue instrument	
Tank level switch(s)	
Tank level sight glass	
High Level Audible & visual alarm type	
Line of site visibility of tank level from delivery location (Y/N)	
Dosing System (refer section 11.)	
Wet panel location	
Chemical pipe material	
Pipework supports	
Dosing pump make / model	
Dosing pump max flow rate	
Location of pumps	
Dosing flowmeter	
Pressure switch(s)	
Pressure gauge(s)	
Ball valves	
Solenoid valves	
Pressure limiting fitting(s)	
Actuated ball valves	

Calibration Cylinder	
Camlock fitting(s)	
Pulsation dampener	
Dosing Point (refer section 12.)	
Location of discharge	*As per project brief unless otherwise agreed*
Back pressure at dosing point	*As per project brief unless otherwise agreed*
Discharge leakage containment, alarming and drainage arrangements	
Electrical, Instrumentation and Control Equipment (refer section 13. to 14.)	
Existing board to be used and if so, what board upgrades required	
Location of new board	
Dimensions of new board	
Other	
Critical spares to be provided	

4. Performance Requirements

a) When in automatic control, the dissolved sulphide level of dosed sewage shall be less than that specified in the Design brief.
b) All components shall have a minimum service life of 20 years.
A reduction in asset life may be acceptable to SEW where it is known to a high level of confidence that the CDF will be required for a shorter period of time.
c) Assume that the sewage system being dosed will be operating 24/7, 365 days per year.
d) All mechanical, electrical, storage, access hatches, instruments and dosing components shall be easily and safely accessible. The layout of the equipment inside the CDU building / enclosure shall be submitted to South East Water for approval prior to construction.
e) Chemical delivery and tank filling shall be efficient and safe for a single person to undertake.
f) All materials of construction shall be non-corroding for the environment and chemical to which they will be in contact.
g) All potential chemical spills and leakage shall be contained, from chemical supply delivery to chemical discharge to the sewerage system.

5. General Requirements

5.1 Chemical Selection

SEWs preferred chemical for CDUs is Ferrous Chloride Solution (UN number 3264) and this standard is based on its use. Ferrous chloride, like ferric chloride, is an iron salt. It has an iron content around 12% w/w. Iron salts are dosed in sewer systems to control corrosion and odour problems by preventing transfer of H_2S from the liquid to the gas phase. This is achieved by chemical reaction where sulphide and the ferrous ions react together form an insoluble metal sulphide precipitate in the wastewater. The precipitate forms dark coloured flocs, which remain

suspended in the sewage and can be settled at wastewater treatment plants. This treatment option is typically referred to as “ferric dosing”.

As ferrous chloride (refer Safety Data Sheet (SDS) Search (ixom.com) is acidic and classified as a Class 8 Corrosive Dangerous Good, its delivery, handling and storage is subject to government regulation throughout Australia.

Where Ferrous Chloride is unsuitable and another chemical is recommended, the CDU requirements described in this standard shall apply where they are suitable and practical. Bespoke project requirements for a CDU using a chemical other than Ferrous Chloride would need to be developed by the Designer on a project-by-project basis.

5.2 Target Point & CDF Location

A CDF must be located in an area that can be accessed by heavy vehicle delivery trucks with sufficient space to construct the required CDF assets. It is often not possible to secure such a location for the CDF immediately adjacent to the “targeted point” in the sewage network that needs chemical dosing to address an odour and/or corrosion issue. Hence the CDF may need to be located some way upstream of the target point. It is therefore critical for the Project Brief in Table 1 to record the location of the target point .

As the dosed sewage flows downstream from the CDF location to the target point it may be diluted by intersecting sewage inflows, hence the Project Brief in Table 1 must record how the specified dosed flows at the concept design CDF location have considered any dilution from intersecting sewage flows.

In this way the Project Brief information allows the specified parameters to be reappraised if it isn’t then possible to get approval to build a CDF in the desired location and it needs to be relocated to a different point in the sewage network.

5.3 CDF System Components

A CDF shall consist of the following elements:

a) Chemical tanker Delivery Bay.
b) CDU building or enclosure with spill containment for the chemical system.
c) Electrical board with controller and HMI (within CDU building or enclosure) (possibly connecting to an existing RTU if a combined facility).
d) Chemical storage tank(s) (within CDU building or enclosure).
e) Dosing pipework & fittings (within CDU building or enclosure).
f) Dosing pumps (within CDU building or enclosure).
g) Instrumentation.
h) Safety and wash down equipment.
i) Dosing Lines external to the CDU.
j) Dosing Point (assets at the point of discharge of chemical).

Specific requirements for each chemical dosing system and component are detailed in the below sections.

Process and Instrumentation Diagrams (P&ID) for the CDF are attached in Appendix A.

There are no general arrangements in this standard as CDF’s are often installed at existing facilities where the available space may limit the layout and sizing of equipment.

5.4 Dosing Criticaility and Redundancy

Note to SEW: Default position shall be "Low" unless there is particularly strong reason as to why extra redundancy is required, ie: the odour complaint and/or corrosion risk is high.

Equipment redundancy shall be provided in accordance with the criticality specified by SEW in the Project Brief, as informed by the requirements of the sewage system being dosed and Table 3. SEW may determine that a CDU has a high criticality when an odour complaint could otherwise arise in a sensitive location for the community or when corrosion would otherwise occur in a location that is operationally critical to the sewage system, an asset this is difficult to access for maintenance, and/or an asset that has been degrading rapidly.

Table 3: CDF Redundancy Requirements

CDF Criticality	Duplicate Dosing Lines and Tappings
Low (Default)	Not Required
High	Required

The P&ID in Appendix A indicates the different arrangements to be provided for each criticality.

5.5 Services

CDFs require the following services:

a) Water supply.
Recycled water is preferred for the washdown system, whenever a recycled water main is nearby or if specified by SEW in the Project Brief.

Drinking water shall be provided for the eyewash and safety shower. All Drinking water supplies coming from South East Water mains shall be provided with Reduced Pressure Zone (RPZ) valves to prevent backflow. The RPZ device should be installed for the supply feeding the safety shower and eye wash station downstream of the washdown system off-take (if applicable) to prevent pressure loss in the washdown system. Where required and depending on the incoming water pressure, booster pumps or pressure reducing valves shall be installed to provide a suitable supply to the safety shower and eye wash station.

A tanker supplied stored water tank may be considered for water supply where there is no practical alternative. In such cases, the following shall be provided:

i. A potable roto-moulded polyethylene water tank with:
   - Vermin proofing mesh on any penetrations that are or can be open to atmosphere, e.g. overflow pipe.
   - At least 5,000 L capacity.
   - A high level overflow.
   - A top access hatch for filing the tank.
   - Level indication via a sight glass.
   - A DN25 outlet with DN25 ball valve at the base.
   - Round or Slimline shape.
   - Mounting on a reinforced concrete slab.
   - Low level float switch set at 30% of tank's Working Volume.
   - Sufficient water storage to run the safety shower for 15 minutes when 30% full.

ii. Pressure pump with:

- Approval from SEW for use in Water Supply applications.
- Stainless steel impeller.
- Capable of delivering to 1.5 l/s at 25 kPa pressure to the eyewash, safety shower and washdown system (if applicable).
- Adjustable pressure switch control.
- Mounting within a protective enclosure.

b) Electrical power.
c) Instrumentation (to provide level and pump IO to SCADA).
d) Drainage.

The locations and connection arrangements for these services are to be designed as part of the design for the CDF.

5.6 Security and CCTV

Reference AM2759 SEW Facility Security Specification and the Project Brief for information on the security upgrades required as part of the CDF installation project.

Gates at the main access points to the facility shall be wide enough to accommodate the intended chemical delivery truck.

Pan-Tilt-Zoom CCTV is required of the:

a) Delivery Bay, and
b) Chemical Storage tank.

5.7 Chemical Manifest

If the chemical storage is above the Dangerous Goods manifest quantity (i.e. >10,000 L), then the following Hazardous Material (HAZMAT) information requirements shall be provided :

a) Be mounted just inside the site main entrance.
b) Be provided in a visible weatherproof box
c) Meet the requirements of the Victorian Code of practice for The storage and handling of dangerous goods which may require information on:
    I. Date of preparation.
    II. Name and contact details of Occupier / South East Water Responsible Person.
    III. Contact details for two people in case of emergency.
    IV. Details of dangerous goods storages including type, location, number and volume of tanks.
    V. Safety Data Sheet (SDS) of the chemical.
    VI. 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 identification of classes of dangerous goods storages.
        - Dosing area.
        - Location of all drains on site.
        - Nature of adjoining water storage facility.
        - Location of emergency assembly area.

5.8 Identification and Labelling

All operable (manually or automatic) equipment shall have a unique identification number in accordance with the labelling convention described in AM2714 Electrical Specification. South East Water requires the designation of unique identification numbers for all CDF assets and associated equipment.

A standard South East Water facility sign shall be mounted on the outside of the main CDU structure unless it is within a larger SEW facility.

Refer to an AS 1345 for the requirements of pipe and conduit content labelling.

5.9 Critical Spare Parts

As part of its proposal, the CDF supplier shall supply a list of critical spare parts it recommends be kept for the CDF. This list of critical spare parts shall be discussed and agreed with South East Water prior to execution of the purchase agreement.

Spare parts shall be provided as part of the project supply contract.

5.10 Safety & Washdown Equipment

The following safety equipment shall be provided:

a) A safety shower and eyewash station, which complies with AS 4775, located without obstruction within 2 to 7m of the chemical delivery connection point.
b) When the delivery bay and connection point is **not** within 7 meters of this safety shower and eyewash station, an additional safetyshower and eyewash station adjacent to the connection point shall be provided.
c) When appropriate locate an eyewash station within the CDU tank bund so that eyewash facilities are always available to workers whether they be inside or outside the CDU.
d) The safety shower and eyewash facilities shall be tested and tagged in accordance with AS 4775.
e) Long water lines to the safety shower and eye wash station that are exposed to sunlight shall be lagged to prevent the water from being heated by the sun. Lagging is to consist of mineral wool insulation with aluminium sheet covering.
f) An ABE type fire extinguisher, i.e. for use in electrical fires, shall be provided.
g) All equipment provided shall be located such that the potential for vandalism is minimised.

Washdown equipment in accordance with the following shall be provided:

a) UV resistant retractable hose reel
b) Permanently attached to a water tap and capable of reaching all parts of theCDU, including the unloading area.
c) Fitted with a 20mm female camlock fitting making it suitable for use as a flushing mechanism.

6. Products and Material

6.1 General

All materials selected shall be suitable for installation in the proposed environment assuming the highest likely humidity and temperature conditions. Where appropriate, products and materials shall conform to SEW standards (refer section 1.4).

6.2 Corrosion Resistance

Products and materials shall be resistant to corrosion such that:

a) They achieve the specified design life.
b) They are resistant to Ferrous Chloride where there is a reasonable likelihood of coming into contact with this chemical. No metallic components shall be allowed routine contact with Ferrous Chloride. On request, the CDF supplier shall provide evidence that materials in contact with Ferrous Chloride have a high level of resistance to corrosion when in contact with the chemical.
c) All bolts, nuts, and washers and any other fasteners shall be made from stainless steel grade 316, or equivalent.
d) Where required, materials shall be coated in accordance with the latest edition of Water Services Association Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201, ACP0166.
e) Material data sheets show that the material is suitable in its environment.
f) 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 the dosing chemical. All gaskets shall be made from Viton rubber materials.

6.3 Pipework and Fittings

Materials for CDF pipe work and fittings shall be PN16 and:

a) uPVC, or
b) cPVC ANSI Schedule 80, or
c) Polyethylene PE to AS4130.

Pipework for the dosing line outside of the CDU shall be:

a) UPVC/cPVC George Fischer double containment system (Double-SeeTM), or approved by South East Water equivalent, or
b) PE100 polyethylene PN16 dosing pipe with PE100 polyethylene PN16 containment pipe, or
c) PE100 polyethylene PN16 dosing pipe with DWV containment pipe.

All pipework, fittings and equipment shall be installed in accordance with the following:

a) PE pipe shall be jointed in accordance with the preferences indicated in Table 103-D within MRWA-W-103 and the MRWA edition of the Water Supply Code.
b) 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.
c) Where there is above ground double contained pipework, the outer pipe (sleeve) shall be labelled. Inner carrier pipework need not be labelled.

d) Buried non-metallic pipes shall have continuous metal tape placed in the trench above the pipe to enable detection.
e) All valves shall be:
    I. Full-bore type.
    II. Diaphragm valves if used for throttling purposes.
    III. Double union type to enable repair and maintenance.
    IV. Provided with sufficient space to enable unions to be dismantled.
    V. Identical if of the same size, duty and type.
f) Valves, piping and fittings shall be from the same supplier as much as practical.

6.4 Pipework Supports

All pipework supports shall be suitable for contact with the chemical being dosed. 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 practical.

7. Civil Works

7.1 Foundations

Refer WSA04 Sewage Pump Station Code for foundation requirements for non-transportable CDU foundations.

Relocatable CDU building / enclosure foundations shall:

a) Have a sub-base of 200 mm thick cement stabilised road base (3% minimum cement content)
b) Have any soft spots in the founding material compacted to 98% of maximum dry density prior to laying sub-base.
c) Be 50mm above the surrounding ground level, extending at this level 150mm past the CDU building / enclosure perimeter.
d) Have a base of 50mm of packing sand to ensure the load is evenly distributed on the foundation pad and a 0.25mm waterproof membrane double lapped and taped at joints. The waterproof membrane shall be increased to 2 layers for saline conditions.
e) Have a geotechnical engineer or engineering geologist confirm the allowable bearing capacity of the foundation soil is sufficient for the requirements specified by the CDU 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.

7.2 Backfill

Backfill shall be in accordance with MRWA Backfill Specification 04-03.1.

7.3 Earthworks and Excavation

Earthworks and excavation shall be in accordance with WSA04 Sewage Pump Station Code of Australia.

7.4 Site Drainage

Site drainage shall be designed to afford protection to the access road, station and surrounds in accordance with local council requirements. Surface water shall not pond anywhere on the CDF grounds (except for the Delivery Bund when the bund discharge is closed).

8. Chemical Delivery

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 for bulk chemical tanker trucks. Refer to AM2761 - Vehicle Access Standard.

8.1 Delivery Truck Size, CDU Tank Capacity and Delivery Interval

The duration between chemical deliveries (Delivery Interval) shall be as close to 6 months as practical and never less than a month and assuming a peak consumption period and deliveries of 85% of the Working Volume of the CDU tank (refer section 9.). Where this leads to a chemical storage volume in excess of 20 kL being required, consult with SEW on whether this is preferred given the safety and possible visual implications of moving beyond this storage limit.

The following process shall be adopted to determine the vehicle access requirements, the possible need for an access upgrade and the required CDF tank size:

a) Determine the largest delivery truck that can enter and exit the site given:
   I. the facility access currently available (if it is an existing site), or
   II. the proposed facility access (based on a preliminary assessment if it is a new site).
b) Determine the volume of chemical that could be delivered on this truck.
c) Assuming the expected dosing rate and the outcome of step b), calculate **A**, the expected Delivery Interval based on truck size. Submit the calculations used in the Operations and Maintenance information.
d) Determine the largest storage tank that can be installed at the site given:
   I. the facility area available (if it is an existing site), or
   II. the proposed facility layout (based on a preliminary assessment if it is a new site).
e) Determine the Working Volume of this tank (85% of the tank storage).
f) Assuming the expected dosing rate and the outcome of step e), calculate **B**, the expected Delivery Interval based on tank volume.
g) Refer table 4 to determine what truck access or storage volume would be acceptable.

Table 4: Preferred Truck and Tank Capacity Outcomes

A = Delivery Interval Based on Largest Delivery Truck	B = Delivery Interval Based on 85% of Working Volume	Required Outcome
Less than 1 month	Less than 1 month	Increase both the delivery truck access and tank storage **if possible** to provide a Delivery Interval of at least 1 month and as close as practical to 6 months. Where a Delivery Interval > 1 month (A and B) is not possible, discuss alternative locations for the CDF with SEW.
Less than 1 month	Greater than 1 month	Upgrade delivery truck access **if possible** to enable the same Delivery Interval achievable with the proposed storage
Greater than 1 month	Less than 1 month	Increase the proposed tank storage **if possible** to enable at least the same Delivery Interval achievable with the proposed delivery truck. Explore all reasonable options to increase the storage tank size (ie: relocate existing clashing assets where practical).
Greater than 1 month and less than 6 months	Greater than 1 month and less than 6 months	Increase the proposed tank storage and delivery truck access **if practical** to achieve a Delivery Interval (A and B) as close to 6 months as practical.
6 months or more	6 months or more	Proposed delivery truck, vehicular access and storage tank acceptable

8.2 Vehicle Access

Vehicle access to the CDU shall be in accordance with AM2761 – SEW Vehicle Access Standard.

Where the CDU is being constructed at an existing facility its existing vehicle access may need to be modified to accord with both Table 4 and AM2761.

Deviations from this requirement are only by agreement with SEW.

8.3 Delivery Bay Location

The delivery bay shall:

a) Be defined as the total containment area which drains to the sewerage system. It includes the delivery truck standing area and delivery bay sump.
b) Be located adjacent to the CDU building / enclosure.
c) Enable the chemical equipment on the proposed chemical delivery truck to be fully inside the delivery bay.
d) Enable the unloading hose connection point to be no more than 6m from the tanker connection point, as per the Dangerous Goods Code of Practice.

8.4 Delivery Bay General Requirements

The delivery bay shall:

a) 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.
b) Designed as a water retaining structure in accordance with AS 3735.
c) Have a capacity of 9,000 litres or 110% of the capacity of the largest delivery truck or 9,000, whichever is greater.
d) Drain with a 1 in 75 grade towards a sump drain, such that no pools of chemical will accumulate in the bund when the sump is drained.
e) Have all bund step over points (locations where workers could step over the bund) marked clearly with canary coloured coating system (refer WSA 201 for suitable coating system) for the top surface and the top 100mm of the vertical surface on both sides of the bund. The top surface shall have grit non-slip coating system where workers may step on the top surface.
f) The step(s) between the delivery bay bund low level and CDU pedestrian pathway(s) shall be a maximum of 225mm as per AS1657 step size criteria unless approved by South East Water.
g) Whenever normal passenger vehicles (Class B99) are envisaged to have a need to enter or pass through a tanker delivery bund have any associated roll-over kerbs in the tanker delivery bay bund such that they will) will not scrape the bottom of a normal passenger vehicle as per the clearance requirements of ADR43/03. If the size of the CDU site means this isn't possible then ensure that such vehicle do not enter the truck delivery bund.
h) Have a red oxide colour coating system (refer WSA 201) for internal bund surfaces.
i) Pave the area between the tanker bay bund and the CDU building with concrete so that spills in this area drain into the delivery bay bund. Any expansion joints in the concrete between the CDU and delivery bay shall be mastic filled to prevent chemical seepage in between joints
j) Drain any stormwater from the surrounding roadway and ground away from the delivery bay bund.

8.5 Delivery Bay Sump

Provide a sump pit to collect liquid from the Delivery Bay which shall:

a) Have minimum dimensions of 600 x 600 x 600 mm.
b) Ensure sufficient capture of rainwater or hose-down water without filling the sump, whilst the drain valve is closed during deliveries. Assume a rainfall of 20mm / hr during delivery and the delay period afterwards.
c) Have a sump high-level alarm to indicate the sump is full (set at 95% of sump volume).
d) Be located where it is not subjected to vehicle loading
e) Be designed and constructed in accordance with AM2884 – SEW Pit Standard.
a) Be fitted with a grated cover made from lightweight materials, in accordance with AS 3996 (Class B), weighing no more than 16 kg. The weight limit shall be labelled where appropriate. Wherever the sump pit's location is subject to falling debris from trees in the area that would fall through a grate and potentially block the drainage system; it shall instead be covered using perforated covers with 12mm diameter holes.

8.6 Delivery Bay Sump Discharge

As the delivery bay bund sump may contain residual chemical it must drain to the sewage system, not to the stormwater system.

Gravity drain the sump where the receiving sewer asset's maximum level (spill level / max HGL) is **below** the sump's gravity pipe to ensure an anti-syphon air gap.

Pump drain the sump where the receiving sewer's maximum level (spill level / max HGL) is **above** the floor of the sump.

8.6.1 Sump Gravity Drainage

Gravity sump drainage shall be to an appropriate location such as a Sewerage access structure or SPS inlet access structure. Draining directly to a wet well is not preferred and requires SEW approval.

The sump's gravity drain shall:

a) Have an actuated drain valve installed at the sump pit discharge which closes when a delivery truck is connected to the CDF delivery truck power supply. The actuated drain valve shall have a manual override.
b) Drain with a 100 mm DVW pipe.
c) Discharge to the sewerage system above the sewage system maximum HGL (to create an anti-syphon air gap), preferably upstream of any SPS wet well.
d) Have a P-trap and a non-return valve as per Detail A of sheet 2 of SEW standard AM2884: Pit Drainage.

8.6.2 Sump Pumped Drainage

Pump drainage system shall:

a) Be designed and constructed as per Detail B of sheet 2 (drainage) of AM2884 – SEW Pit Standard, with the following exceptions:
    I. the sump dimensions shall at least be 600 x 600 x 600, and
    II. the pit must be covered by a grate, and
    III. the pump shall be fitted with a titanium impeller (e.g. Tsurumi or equivalent).
b) Have a suction point elevated from the floor to prevent clogging by dirt and debris.
c) Discharge to both:
    I. The gravity sewerage system where feasible (upstream of any SPS wet well where practical), although connection to a sewage pressure main of lower pressure than the sump drainage pump may be acceptable on approval of South East Water, and
    II. A 50 mm Camlock style coupling located above ground near the sump for collection of the spilled liquid by a tanker truck.

    Isolation valves shall be installed to allow pump out to one or both of these two locations.

8.7 Tanker Delivery Power Connection Outlets

Permanently mounted electrical power outlets to facilitate unloading of the dosing chemical shall be provided. These shall:

a) Include a 415 V (20 amps) supply with Connected / Not connected feedback to the controller.
b) Include a 240 V (15 amps) supply with Connected / Not connected feedback to the controller.
c) Be interlocked with the storage tank high-high level switch (95%), to prevent operation of the tanker unloading pump. Refer section 9.5 for information on storage tank level instrumentation and section 13. for information on control philosophy.
d) Be located unobstructed within 7 m of the unloading hose connection point.
e) Be located inside the CDU building / enclosure, guarded from splashback and accessible when the building / enclosure doors are open when standing outside of the building / enclosure.

8.8 Delivery Panel Requirements

A delivery panel shall be provided to enable safe filling of the chemical storage tank. The standard electrical drawings indicate the location of and items to be included with the panel. The panel shall include a plaque with a schematic (not live schematic) of the chemical tank with key storage information as per Figure 1.

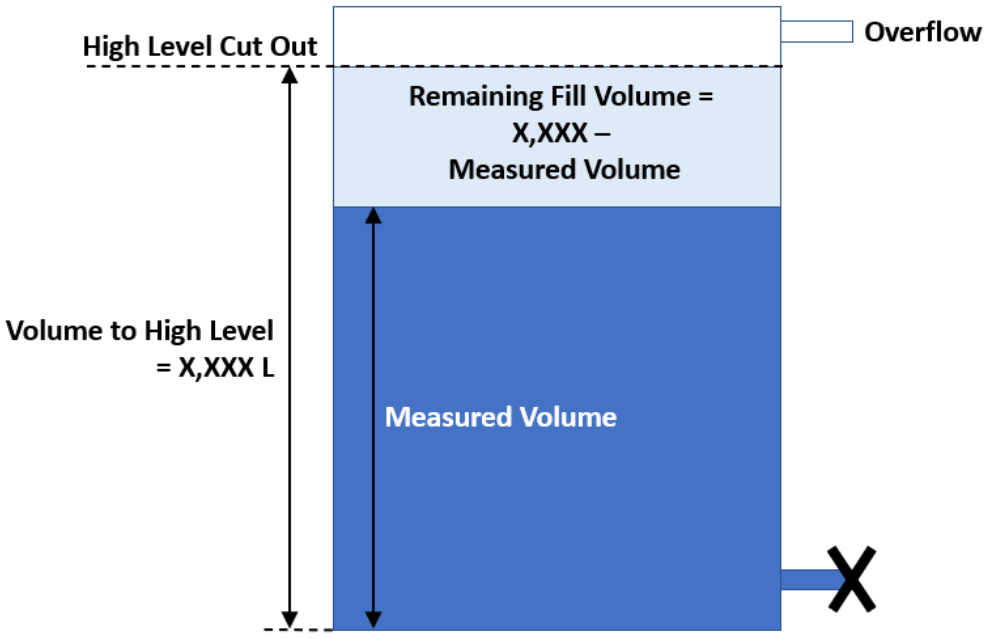


Figure 1: Chemical Tank Schematic

8.9 Chemical Storage Tank Filling Arrangements

Storage tank filling arrangements shall:

a) Be fully contained inside the CDU bund to contain any leakage.
b) Include a 50mm corrosion resistant male camlock fitting for tanker truck discharge which shall be:
    I. Located just inside tank bund within the hatch/doorway opening of the CDU building / enclosure.
    II. Angled downwards at 45$^{o.}$
    III. Fitted with removable cover.
    IV. Positioned at least 600mm and no more than 900mm above ground
    V. Firmly supported.
c) Include a 50mm fill pipe to the chemical storage tank, with a normally closed manual scour line to be able to drain the fill line to the CDU bund
d) Include storage tank connection line which:
    I. Slopes downward (1 in 100) towards the top of the tank(s).
    II. Is above the level of the overflow pipe.
e) Include a placard at the loading point containing information on the chemical, tank capacity and safe fill volume.
f) The chemical storage tank overflow pipe shall be piped to the CDU sump so that the delivery truck driver can view the overflow discharge point to see that the tank is overflowing.

9. Chemical Storage Tank

It is preferred that chemical storage tanks be integral with the remainder of the CDU in a common bund. Where the tank needs to be external to the remainder of the dosing equipment, a separate bunded area and building / enclosure shall be provided. The design of the tank area shall be in accordance with section 9. and the building / enclosure in accordance with section 10.

Chemical storage tank(s) shall be provided for safe storage of the dosing chemical. The tank(s) and related attachments shall:

a) Be located within the bunded area inside the CDU building / enclosure.
b) Contain at least 5 kL Working Volume and be commensurate with section 8.1 .
c) Be as far from the control equipment and the entry door as practical.
d) Have access hatches and level sensors which shall be easily reached for ease of operations and maintenance (ie: be between 1m and 1.3m above standing level on the ground or platform).
e) Have a minimum of 500mm clearance above the tank(s) to the ceiling of the enclosure / building.
f) Have instruments in accordance with section 9.5.
g) Have all hold-down lugs, supports and lifting lugs designed to allow water/chemical to drain away without pooling on the attachment.

9.1 Tank Material and Manufacture

The storage tank shall be:

a) Manufactured from roto-moulded polyethylene or other material suitable for the chemical specified.
b) Designed and constructed in accordance with AS/NZS 4766 and AS 3780.
c) Be marked with the material of construction, the name of the manufacturer and the date of manufacture.

9.2 Structural

Tanks shall be suitably reinforced and supported:

a) To withstand all forces, including filling forces, without deforming excessively (ie: < 10mm deflection) when it is full.
b) Assuming each tank will store a fluid with a minimum specific gravity of 1.5.
c) To withstand the weight of maintenance personnel standing on top of the tank, (noting that tanks will preferably be designed so that personnel will not need to stand on the top of the tank hence, which would obviate the need for this requirement).
d) On a suitable concrete plinth, with bitumen matting waterproofing installed between the storage tank and concrete plinth.
e) With suitable lifting lugs to enable the installation / future replacement of the tank

9.3 Tank Access

Worker access shall:

a) Be as described in 10.2.
b) Include the provision of a fixed elevated work platform if the tank is greater than or equal to 1.6m high (at the highest point). This may be a mobile platform should other elevated CDU components also require elevated access.
c) The design of the CDU building – enclosure shall be sufficient to enable the use of any such elevated or mobile work platform.
d) Include a 400mm diameter access hatch at the top of tank.

9.4 Tank Connections

All tank connections shall:

a) Be provided with manual isolation (stop) valves.
b) Have stub flange nozzles inclusive of stiffened gussets and with 316 stainless steel backing rings to ANSI 150.
c) If multiple tanks are used:
    I. all interconnecting pipework shall be sized so that filling the primary tank will collectively fill all interconnected tanks without the need to wait for tanks to balance.
    II. The tanks shall be set up so that they can operate either in parallel (rise and fall together) or as manually transferred duty – standby (not automatic changeover from one tank to another is require).

    III.

Tank(s) shall be provided with the following upper connections:

a) One DN80 **spare** flange connection
b) One DN50 diameter **vent** (breather) on the apex of the tank roof. The vent shall run from the top of the tank grading up to an external vent with a conical top sealed with vermin proof mesh.
c) One DN80 diameter **overflow**. The overflow level shall be such that it prevents immersion of instruments and equipment located at the top of the tank and directs chemical safely to the CDU sump.
d) One DN50 tank **scour** drain with a minimum diameter of as close to the tank floor level as practicable.
e) One DN50 diameter **fill pipe connection** to the top at the side nearest the tanker fill pipe, complete with a fill valve as per section 8.8.
f) One DN80 connection in the tank roof of the tank for the **level transmitter**.
g) One suitably sized branch in the roof of the tank, close to the perimeter for the **relief line return** from the chemical dosing system downstream from the dosing pump.

Tank(s) shall be provided with the following side and lower connections:

d) One suitably sized bottom **outlet for the dosing system** located so the invert is as low as possible to minimise dead storage. For smaller tanks, this can use the same outlet connection as the drain. The tank may be elevated on a plinth to enable this outlet to be fitted close to the floor. It shall be fitted with a manual isolation valve and a motorised isolation valve.
e) Two or three DN25 attachment points located in the same vertical plane at appropriate levels each for the installation of a **magnetic level indicator**.
An additional outlet may be required if the level switch low is not integral with the magnetic level indicator. The top connection will need to be in the upper part of the tank.
f) A connection for the **level switch high** (LHL).

9.5 Level Instruments

Tank(s) shall be provided with the following level instruments:

a) An ultrasonic level analogue (refer section) which has:
    I. 0% level set at the bottom of the tank (i.e. below bottom of working volume).
    II. 100% set at invert of the tank overflow (i.e. top of working volume).
    III. A sunlight readable LED IP 56 level digital display which is clearly visible from the filling point and displays the percentage full.
b) A separate capacitance type high level (positioned at 95% of Working Volume) switch (LHL).
This is configured to trip the filling power supply as described in section 8.7 and activate the visual and audible alarms described in section 9.6.
This level switch may require that an additional connection be provided to the tank.
c) A separate capacitance type Low level switch (positioned at 50mm above the outlet obvert) (LSL).
This level switch may require that an additional connection be provided to the tank.
d) All level instruments and level displays shall be powered from the 24V DC power supply which has battery back-up.

9.6 Tank Overfilling Controls

Overfilling preventative measures shall be provided as follows;

a) A level display visible from the fill point as described in section 9.5.
b) The two delivery power supplies shall trip as described in section 8.7, activated by the level High switch.
c) The chemical storage tank overflow pipe shall be piped to the tank sump in a manner such that the delivery truck driver can observe the overflow discharge point and see that the tank is overflowing.

10. CDU Building / Enclosure

CDU building / enclosures shall:

a) Be separate standalone transportable mobile buildings wherever possible.
b) Be of a durability commensurate with the asset life stipulated in the Project Brief (ie: expected dosing period).
c) Any building / enclosure elements which may potentially be in contact with Ferrous Chloride Typically shall constructed from reinforced concrete (NOV coating system lined) &/or stainless steel &/or galvanised steel &/or Glass Reinforced Polymer (GRP) &/or aluminium &/or a suitable plastic / composite.
d) Have adequate security in accordance with AM2759 - SEW Facility Security Specification. Where a perimeter site security fence has been or is to be installed and the public outside the fence has limited visibility of the CDU building / enclosure , mesh rather than solid building / enclosure walls may be suitable above the bund level.
e) Be covered at least with a carport type steel structure.
f) Ensure the roof connections are to be bolted to minimise the works involved in removing the roof if a tank replacement is required.
g) Have roof drainage that directs rainwater away from building / enclosure doorways and building / enclosure access points.
h) If mesh walls are used, the enclosure shall have sufficient eves to prevent significant rainwater entering the enclosure.
i) Be located so that the building / enclosure is as close as possible to the Chemical Delivery Bay (refer section 8.3)
j) Enable the containment of any possible leak or spill.
k) Exterior surface shall use pre-coloured materials (ie: Colourbond) in accordance with the colour scheme specified for cabinets within the SEW Standard AM2714: Electrical Standard.
l) Coatings shall be applied in accordance with WSA 201 Manual for Selection and Application of Protective Coatings and the Sydney Water Supplement to WSA 201, ACP0166. External protective coating systems shall be:
    I. ACL coating system if required for aesthetic reasons only.
    II. PUR-B or PSL coating system if required for Anti-Graffiti, or
    III. PUR-A coating system if required for a coastal environment.
m) Have all pipework run to minimise trip hazards, and as far away from electrical wiring as practicable, e.g. utilising perimeter of the building / enclosure.
n) With exception to the bund drainage pipe, have all pipes passing through the building . enclosure wall above the top of bund wall.

Standalone CDU buildings / enclosures shall be:

a) Prefabricated, mobile and transportable on a flat bed truck where possible.

b) Fully enclosed and secured such that the contents can only be accessed by an authorised officer of SEW.
c) Comply with the building and enclosure provisions in AM2759 - SEW Facility Security Specification as much as practical.

CDUs integrated into other facility buildings or enclosures shall:

a) Be segregated and partitioned off from other equipment as much as possible.
b) Have separate access to the CDU equipment if possible (rather than via another plant and equipment area).

10.1 Leakage / Spill Containment

Leakage from the storage and dosing system (excluding dosing lines external to the CDU and the Dosing Point) shall be contained and include:

a) A volume 110% of the maximum volume that could leak to it (ie: volume of tank + volume of chemical containing pipes and components)
b) Electronic high level switch to provide the real time feedback that there is a leak.
c) Clear visibility of leakage which is observable to personnel on site, without the need to remove covers / flooring.
d) A sump collection point.
e) High level overflow to the Delivery Bay sump.

10.1.1 Bespoke Bund Design

Where a bespoke CDU bund is to be used, it shall be in accordance with the following requirements:

a) The bund shall not corrode in contact with Ferrous Chloride.
b) The bund shall be designed as a water retaining structure in accordance with AS 3735 if constructed of concrete.
c) The preferred bund wall height is 400 mm.
d) The need for bund walls higher than 400mm shall be balanced against the more difficult access and emergency egress that would result. For bund wall heights greater than 400 mm, access stairs in accordance with AS1657 are required in and out of the CDU to provide safe access and egress.
e) 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.
f) Any concrete bund wall and floor shall be coated with NOV coating system.

10.1.2 CDU Bund Sump

Regardless of the bund system utilised, the bund shall drain to a sump which shall comply with the requirements :

a) Have minimum dimensions 600mm x 600mm x 600mm
b) Be designed and constructed in accordance with AM2884 – SEW Pit Standard.
c) Be fitted with a non-corroding grated cover (ie: FRP) made from lightweight materials, in accordance with AS 3996 (Class B), weighing no more than 16 kg. The weight limit shall be labelled where appropriate.

10.1.3 Discharge of CDU Bund Sump

The sump discharge shall:

a) Discharge to the Delivery Bay sump via gravity where practical or with a CDU sump pump if it is not.
   I. Sewerage or SPS inlet access structure via gravity
   II. Delivery Bay via sump pump
   III. Sewerage or SPS inlet access structure via sump pump
   IV. SPS wet well via gravity
b) If gravity discharge, the discharge shall:
   I. Be controllable via a normally closed manual ball valve, operable from outside the CDU building enclosure.
   II. Drain with a 100 mm DVW pipe.
   III. Have a P-trap and a non-return valve as per Detail A of sheet 2 of SEW standard AM2884: Pit Drainage when discharging to the sewerage system.
   IV. The penetration for this pipe through the CDU 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
c) Where gravity drainage is not feasible, the sump shall drain with a submersible pump which shall:
   I. Be designed and constructed as per Detail B of sheet 2 (drainage) of AM2884 – SEW Pit Standard, except that the pump shall be fitted with a titanium impeller (e.g. Tsurumi or equivalent).
   II. Have a suction point elevated from the floor to prevent clogging by dirt and debris.
d) Include a DN50 gravity overflow which has an obvert set at the bund top water level. This overflow shall drain with the same preference as stated above.

10.2 Layout and Clearances

The CDU building / enclosure layout shall provide:

a) Adequate and easy access to all CDU equipment for operations and maintenance. Typically that means that:
   I. Normal working areas have a straight line, unobstructed $\geq$750mm wide access preferably to a point of safe egress, or if this cannot be achieved then to a safety shower / eye wash.
   II. Unobstructed worker access to all items such that:
      i. No obstructions shall be located within 1m of the front of an item.
      ii. No obstructions shall make disassembly / assembly of an item difficult in consideration of the required tooling to be used.
      Typically this means that at least 300 clearance is required to the sides and bottom of the item.
b) Mechanical lifting equipment access shall be provided for any maintainable items that cannot be lifted by 2 people (ie: greater than 20 kg depending on the posture during lifting). In cases where mechanical lifting is required, consideration shall be given to having removable roof panels that enable large &/or heavy items to be removed from above.
c) A ceiling height where practical greater than 2.2 m from the normal standing level or 0.5 m above the highest tank, whichever is the greater.

d) Worker access to all electrical and mechanical items (ball valves excluded) without potentially coming into contact with any leakages or spills. Typically, this means that item(s) will be accessible from:
    I. Outside of the CDU building / enclosure (possibly through a hinged wall panel / door) without entering the CDU building / enclosure. In this case, the CDU building / enclosure roof footprint shall be extended over and 1.2m past the outline of the access point (to protect workers and the item from weather). Mechanical item(s) located in this way shall be located to provide visibility of the inside of the CDU from outside (when outer wall panel / door is open) as much as possible.
    II. Internally within the CDU building / enclosure but above the walkway grating located over bunding.

10.3 CDU Doors and Openings

CDU Building / Enclosure doors and openings shall:

a) When immediately adjacent to the bund, be above the bund level, with steps up and over the bund wall.
b) Be sufficiently large such that all equipment within the CDU can be replaced, without the need for modifications to the structure.
c) Have a mechanism to restrain them in the open position whilst the site is attended, and lockable shut when not attended.
d) Be replaceable without damaging or disassembling the main structure.
e) Come with adequately rated stainless steel grade 316 lifting lugs if they are removable roof panels. Where a removable roof is provided, all electrical wiring connected to equipment on the roof shall have dismantling joints or sockets to unplug and disconnect prior to removal of the roof.

10.4 Ventilation

Adequate ventilation shall be provided to prevent condensation build-up inside the building / enclosure using and extraction fans. Fully wire mesh walled enclosures do not require ventilation. Forced ventilation systems shall:

a) Include ventilation fan(s).
b) Fans shall be capable of achieving 6-12 air changes per hour.
Ventilation fans are not required to be monitored or controlled by the RTU.
c) Run continuously when the air temperature in the building / enclosure is above 30^{o}C.
d) Be corrosion resistant and be able to be operated via a 24-hour timer if required.
e) Fans shall be mounted at the top of wall of the building / enclosure.
f) Include mechanical vents which shall be provided low down, a minimum of 300 mm above floor level and above the bund level.
g) Vents shall be vermin proof.
h) If required, an air conditioning system shall also be provided for electrical controls.

10.5 Structural Design

The building / enclosure 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.

Structural drawings with a statement of structural compliance shall be submitted to South East Water for written approval prior to construction. These shall include, but not be limited to:

a) Panel and member drawings with all dimensions specified (clearly showing the type and location of the lifting lugs)
b) Concrete reinforcement drawings where concrete is to be used (plan view and sections)
c) Notes pages, which captures:
    I. Concrete and metal grade and specifications
    II. Finishes
    III. Reinforcement grade and cover reinforcement
    IV. Sub-grade preparation with notes (detailing allowable bearing capacity etc)
    V. Design life of building and lifting lugs
    VI. Design capacity of lifting lugs and lifting procedure, clearly identifying which lifting lugs to be used for transport, and loads imposed by lifting lugs
d) Building certification of design and fabrication referenced for each individual drawing.

10.6 Relocatable CDU Requirements

Relocatable (liftable and transportable by truck) CDU buildings / enclosures shall:

a) Be provided where practical.
b) Be transported without having to dismantle and reinstall the chemical storage tank(s), pipework, pumps, control system or any other equipment.
c) Come with suitable lifting lugs made from corrosion resistant steel. For lifting lugs within concrete panels, lifting lugs shall be grouted over after installation and locator markings made at the lifting point locations.
d) Have lifting lugs with a design life that exceeds 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 design drawing.
e) Include a stainless steel plate, mechanically fastened to the building which states the lifting certification date, construction materials, dry weight, maximum loaded lifting weight, and maximum load for each individual lifting lug shall be provided.

10.7 Lifting plan

As part of the design, the supplier shall provide a lifting plan for the installation and removal of the CDU.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 minimum requirements of the crane required. The lifting plan shall include details of the lifting points and their maximum loads.

For transportable CDUs with a total mass greater than 1 ton, the lifting plan shall be reviewed by a geotechnical engineer engaged by the supplier who shall 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.

10.8 Elevated Work Platform

Where there are operable items and instruments more than 1.8m above standing level, an elevated work platform shall be provided which shall:

a) Be lightweight and corrosion resistant.
b) Be suitable for undertaking electrical work.
c) Compatible with the standing surface (concrete / grating) on which it will stand.
d) Compliant with AS/NZS 1892.
e) Include closable gate(s) or rails to provide fall protection on all four sides.
f) Have a braking system for the wheels to prevent movement during use.

11. Dosing System

The dosing system shall be designed to provide a reliable, continuous dosing of metered volumes of chemical.

11.1 Dosing Pumps

Duplicate dosing pumps shall be provided, with one on-line and in service and the other mounted alongside for rapid manual changeover when required.

Dosing pump(s) shall:

a) Identical.
b) Mounted above the top of the bund at a height and location to ergonomically suit safe maintenance.
c) Both permanently wired to the control system and power supply
d) Dose throughout flow rate range described in the Project Brief.
e) Not be solenoid-driven, not have double simplex capabilities via multiplexing and not including ganging of gearboxes.
f) Incorporate digital indication of the set rate.
g) Have a metering accuracy better than 2.5% of the set rate at a variable suction head.

11.2 Pipework and Appurtenances

a) Refer section 6.3 for product and material requirements of dosing pipework and fittings.
b) Suction strainers with an aperture of 1.5 mm shall be provided.
c) All valve handles are to be lockable so they can be secured to provide isolation for maintenance works.

11.3 Dosing Cabinet / Screens

To protect workers from chemical discharge, dosing pumps and associated instruments and fittings shall be enclosed behind one of:

a) A fully enclosing cabinet.
b) A screen.

Panels shall be constructed of clear polycarbonate.

The skin thickness shall be adequate to take the load of any connected items without deflection. It shall be designed specifically to the requirements of each CDU. The doors to the cabinet shall be transparent for safe viewing of the dosing system.

The dosing cabinets shall be designed for ease of access for maintenance. There shall be a divider in the centre of the dosing cabinet to separate the two dosing pumps. The cabinet shall have adequate ventilation and drainage to the CDU bund.

Dosing pipework from the point it exits the dosing cabinet / screens shall be double contained where it is within the CDU building / enclosure.

11.4 Pulsation Dampeners

Pulsation dampeners shall:

a) Be provided in the discharge pipework from the dosing pump.
b) Be suitably sized for the displacement of the pump so that discharge pressure fluctuation does not exceed 10%.
c) Have a diaphragm separating the air chamber from the liquid chamber.
d) Have an air chamber which is pressurised and capable of being re-pressurising by an air pump via a Schrader valve.
e) Be installed with a pressure gauge which is located before the pressure relief valve.
f) Be located vertically at the discharge of the dosing pump.

11.5 Depressurising, Flushing and Draining

Dosing line offtakes shall be provided which:

a) Enable the draining of the dosing system for maintenance of all lines longer than 3m.
b) Include a normally closed ball valve with a supported lockable 20mm male polypropylene camlock fitting to connect to the washdown hose.
c) Enable the flushing of the chemical dosing lines without dismantling the lines.

11.6 Automatic Tank Isolation Valve

An automatic isolation valve shall be provided at the beginning of the dosing system near the tank outlet which:

a) Is a motorised PVC-U ball valve.
b) With a quarter turn electrical actuator which:
    I. Is located above the TWL of the bund.
    II. Has open / closed position feedback to the controller.
    III. Is powered from a 24 V DC supply that has battery back up.

IV. Closes on 24V DC power failure.
V. Is IP 65/67 per EN 60529.

c) Has manual override.

11.7 Pressure Transmitter

A pressure transmitter shall:

a) Be fitted downstream of the pulsation dampener when dosing to a pressure main.
b) Include an internal damper when pulsation damper is not being used.
c) Be installed with an interlock to stop the dosing at a high pressure in the event of a pipe blockage (operator set pressure limit).

11.8 Dosing Chemical Flowmeter

An automatic isolation valve shall be provided adjacent to the tank outlet upstream of the pump(s) to ensure the tank cannot drain in the event of a dosing system failure. The characteristics of this valve are:

a) Be a magnetic and Teflon lined type.
b) Be installed downstream of the pulsation dampener.
c) Have sufficient upstream and downstream straight pipe run to prevent turbulence affecting the flowmeter.
d) Be calibrated to units of litres per minute.
e) Measure the flow and transmit the flow signal to the control system.
f) Display the flow rate and any error messages locally.
g) Be flanged to ANSI 150.

11.9 Double Containment of Filling and Dosing Lines

Chemical lines external to the tank bund and dosing pit shall be double contained ([carrier] pipe in [containment] pipe) to provide protection of the carrier pipe as follows:

a) Chemical dosing lines with identification as per Section 5.8**Error! Reference source not found.** may be above ground or buried.
b) Chemical dosing and water lines passing within spray distance of electrical components require double containment. Alternatively, PE covers may be used to prevent leakage spray reaching electrical items.
c) Designed so that the carrier pipe can be replaced without the need for excavation.
d) Containment drainage shall be vermin proof.
e) Containment pipe shall be sealed to prevent ground water ingress and prevent egress of carrier pipe leaks to ground.
f) Concrete encasement of containment pipe is acceptable.
g) Designed dosing line carrier pipe so if it leaks it drains to either the tank bund or the dosing point pit so leaks can be fully contained and detected via a conductivity switch to facilitated safe repair / replacement.

11.10 Dosing Line Duplication

Buried dosing lines shall be duplicated whenever stipulated in the Project Brief. Where duplicate buried dosing lines are required, they shall have a minimum horizontal clearance of 2m or and/or a minimum vertical clearance of 500mm.

This is to reduce the risk of simultaneous unintended excavation damage to both dosing lines.

12. Dosing Point

Chemical shall be dosed directly into a pressure main where practical. Dosing into a sewerage access structure or SPS wet well requires SEW approval. Refer to the P&ID_2 in Appendix A for details of dosing point arrangements.

The discharge arrangements shall be included in the detailed design drawings.

12.1 Pressure Main Dosing

Sewage Pressure Mains may include Sewage Pump Station pressure mains and reticulated Pressure Sewage System pressure mains.

The following pressurised main dosing requirements shall be provided:

a) The dosing line shall discharge into the sewage pressure main at a location where flow is likely to be more turbulent (ie: after a 90 deg bend, wye junction) to facilitate mixing of the chemical and sewage.
b) The dosing connections to the pressure main shall be within in a vehicle accessible pit which shall be designed and constructed in accordance with AM2884 – SEW Pit Standard.
c) Have containment monitoring as per section 11.9.
d) Have double isolating ball valves and a non-return valve on the dosing discharge pipe within the pit.
e) Have one dosing point (tappings) per dosing line with tapping arrangements as per SEW standard drawing SEW-PSS-015 (available on request).
f) The pit shall drain back to the delivery bay sump where possible. Drain line to be fitted with an isolation valve at the point of egress from the pit. Pit drainage shall be in accordance with sheet 2 of AM2884.
   Only if this is not possible may pit's contents be educted provided that the pit is vehicle accessible.
g) To enable flow paced chemical dosing the pressure main shall have a flow meter with a flow rate value available to the CDU controller. The flow meter shall be installed as per AM2832 – SEW Instrument and Control Standard and AM2884 - SEW Pit Standard.

12.2 Gravity Sewer Dosing

The following gravity sewerage dosing requirements shall be provided:

a) Where pressure main dosing is not practical, chemical shall discharge to a network access structure or SPS inlet access structure rather than directly into a wet well.
b) Where the dosing point is a low point in the dosing line, a leak detection pit shall be provided adjacent to the discharge structure which shall:
   I. Be designed and constructed in accordance with AM2884 - SEW Pit Standard.
   II. Gravity drain to the gravity system via an isolation valve.
   III. Have a high level switch (LSH) connected to the control system within the pit drip tray to detect chemical leakage of flooding.
c) The dosing discharge access structure shall:

I. Include a suitably sized PE100 guide tube that shall be installed down the wall of the access structure for the dosing line to be fed down so that the chemical does not corrode the access structure wall.
II. The guide tube shall be fastened to the access structure as per standard MRWA-S-314 or as per the manufacturer's drop pipe requirements if it is a plastic access structure.
III. The outlet of the dosing line shall be positioned so that chemical flows directly into the sewage flow without splashing chemical on the walls of the access structure.
IV. Where possible, mechanical compression pipe fittings shall be used inside the access structure for maintenance access.

d) The dosing line shall not self drain and the vertical alignment and/or syphon break fittings on the dosing line shall be provided to prevent this.

12.3 Additional Leak Detection Pits

The dosing line shall be designed so that all leakage of the carrier pipe would be collected at either end of the dosing line if possible (ie: there are no low points in the dosing line other than at the ends).

Where a dosing line low point(s) other than at the ends is unavoidable, additional leakage pits as described in section 12.1 shall be provided at these low points.

13. Electrical

13.1 Electrical Works

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, lighting, control, instrumentation, and all necessary accessories and associated equipment, for the proper functioning of the dosing system to be installed at the site.

Requirements include, but are not limited to the following:

a) The design and construction of the electrical works shall be in accordance with SEW EIC standards.
b) Standard Sewerage Chemical Dosing Unit electrical drawings for details of wiring and switchboard electrical requirements. These are available on the SEW Technical Standards internet page, in both PDF and CAD format.
c) Where non-standard CDU designs are used, the application specific settings in the standard Plain English Functional Description (PEFD) proforma shall be changed by the process designer in combination with the Functional Design.

13.2 Electrical Boards

All CDUs shall be fitted with a dedicated electrical board which shall be as follows:

a) Designed and constructed in accordance with SEW EIC standards.
b) Located within or attached to the CDU building / enclosure and meet the location and protection requirements described in section 10.2.

c) Contains as many of the CDU electrical items as practical (eg: instrument transmitters, protection devices, terminals etc).
d) Be in a location that reduces the risk of electrical contents coming into contact with chemical or contaminants such as dust and liquids, even with board doors and escutcheon plates open / removed.
e) Contains a dedicated controller for the CDF, with direct connections to all items being monitored and/or controlled.
f) Contains dedicated telemetry for the CDF.
g) Contains a dedicated HMI for monitoring and operation of the CDF.
h) Contains a dedicated battery backed up low voltage DC supply for the CDU.
i) Has a 3-phase power supply.

Where a CDU is located with another facility (eg: Sewage Pump Station), the CDU board shall be coupled with the “main board” of this other facility, such that:

a) Power supply to the CDU board is from the other facility’s power distribution board.
    I. Where practical, if that facility’s distribution does not have adequate capacity to power the CDU, that facility’s distribution board shall be upgraded so that it can.
    II. Where it is impractical to upgrade that facility’s distribution board (ie: there is inadequate space or mains supply) and on advice and approval from SEW, the CDF may be powered directly from a separate metered supply.
b) Where the other facility has an existing permanent backup power generator, undertake the following:
    I. Assess whether the existing generator has adequate capacity to supply the main board and the CDU sub-board. Where it does, no further work is required.
    II. Where the generator does not have adequate capacity to power both boards, on advice from SEW, undertake one of the following:
        i. Upgrade the generator so that it can power both boards.
        This is typically required when the CDU has been designated as being of high criticality, or
        ii. Automatically disconnect the CDU power supply from the main board when the main board is being supplied by the generator.
        This is typically required when the CDU has been designated as being of very low criticality, or
        iii. Automatically disconnect the CDU power supply from the main board when the main board is being supplied by the generator and supply the CDU from an alternate generator.
        This is typically required when the CDU has been designated as being of high criticality and it is not practical to complete i.

13.3 Electrical Wiring & Equipment

All CDU building / enclosure electrical equipment, including wiring, shall be installed above the chemical bund overflow 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 shall be considered when designing the layout of electrical equipment within the building.

One 3-pin, 240 V power outlet shall be provided in the CDU for power supply to mobile appliances.

13.4 Cable and Equipment Protection

There shall be a non-metallic cable tray around the complete inside perimeter wall of the CDU building / enclosure. 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 selection and installation of field mounted electrical equipment within the chemical storage and dosing area of the CDU building shall have a minimum IP54 rating and comply with the requirements of AS/NZS 3000 Section 6: Damp Situations.

13.5 Lighting

Provide lighting to meet the following requirements:

a) AM2714 SEW Electrical Standard.
b) Lighting external to the CDU building / enclosure shall:
    I. Include an overall site lighting study completed after layout design is complete, including but not limited to: delivery bay, roadways, access road, gates and approach road.
    II. Be provided to at least illuminate the delivery, filling and CDU access door areas.
    III. Consist of 30W LED floodlight fittings.
    IV. Utilise shielded lamps so that lighting is not visible to the public at normal viewing angles as much as practical.
    V. Be vandal proof.
    VI. The delivery area lighting shall be controlled via an Auto – On - Off light switch located adjacent to the delivery power supply.
    VII. During AUTO mode, the operation of the lights shall be controlled via a PIR cell facing the delivery area.
c) For internal CDU lighting, an automatic door switch shall be provided, to automatically turn on the lights when the CDU doors are open, and shut off the lights when the doors close.
d) One emergency luminary with a 2 hour battery backup, shall be supplied and installed for each CDU building.

14. Monitoring & Control

Where controls and set points are operator adjustable in SCADA and the HMI, each shall alter the same register in the controller, such that the most recent adjustment (whether from SCADA or the HMI) shall take effect.

The following Alarm and Control Logic shall be provided:

14.1 Delivery Bay

a) The following Delivery Bay information and set points shall be provided:
    I. Level analogue, ranged in mm from bottom of sump to containment TWL.

II. Fill Mode manual switch, which is able to be switched to either the “Filling” or “Not Filing” positions.
III. A “Fill Mode Switch Incorrectly Positioned” alarm should be raised in SCADA and the HMI when the Fill Mode Switch is in the “Filing” position **and** the main door’s (which exposes the Fill Mode Switch) position switch is in the “Closed” position.
IV. Both Fill Power outlets shall be isolated when the Fill Mode switch is in the “Not Filling” position.
V. The “Delivery Bay Drainage Inhibit” shall be active in SCADA and the HMI when:
    i. The Fill Mode Switch is in the “Filling” position, **or**
    ii. The delivery bay level is above the “Delivery Bay Drainage Inhibit Level” set point, **or**
    iii. It has been less time than the “Delivery Bay Drainage Inhibit Drop-out Delay” set point since the Fill Mode Switch was switched to the “Not Filling” position.
VI. Manually configurable “Delivery Bay Drainage Inhibit Drop-out Delay” set point in SCADA and the HMI, typically set at 30 minutes.
VII. Manually configurable “Delivery Bay Drainage Inhibit Level” set point in SCADA and the HMI, typically set at a level of the top of the sump. This would indicate that a spill has occurred while the Drainage Inhibit is active.
VIII. “Delivery Bay High Level” analogue derived set point alarm in SCADA and the HMI.
IX. Manually configurable “Delivery Bay High Level” set point in SCADA and the HMI, typically set at a level equivalent to 10% of the delivery bay volume.
X. “Delivery Bay High Level” locally visible lamp.

b) Delivery Bay Drainage 3-pole selector switch shall be provided (If valve drained: Open / Close / Auto. If pump drained: Manual / Off / Auto).
I. It shall be clearly visible at the CDU doorway and operable from outside the CDU when the CDU doors are open.
I. When the Delivery Bay Drain selector switch is in the “Auto “ position, the following options shall be available in SCADA and the local HMI:
    i. On / Open.
    When a drainage pump is selected to “On” in SCADA or HMI, the pump shall still cut out when the level is below the “Delivery Bay Cut Out Level” (refer below).
    ii. Off / Close.
    iii. Auto, in which case it will operate as below:
II. When Delivery Bay Drain is in “Auto“ and Gravity emptied:
    i. the actuated drain valve shall **Close** when the “Delivery Bay Drainage Inhibit” alarm is active.
    ii. The actuated drain valve shall **Open** when the “Delivery Bay Drainage Inhibit” alarm is **not** active.
III. When Delivery Bay Drain is in “Auto“ and pump emptied:
    i. the pump shall **Not Run** when the “Delivery Bay Drainage Inhibit” is active.
    ii. the pump shall **be able to Run** when the “Delivery Bay Drainage Inhibit” alarm is **not** active.
    iii. the pump shall **Run** to Cut Out when the Fill Mode Switch is switched to the “Filling” position and the level is above the Cut Out.
    iv. Provide a manually configurable “Delivery Bay Pump Cut In Level” set point in SCADA and the HMI, typically set at the height equivalent to 5% of the Delivery Bay volume above Cut Out.

v. Run the drain pump when the “Delivery Bay Level“ is above the “Delivery Bay Cut In Level” provided the “Delivery Bay Drainage Inhibit” is not active.
vi. Provide a manually configurable “Delivery Bay Pump Cut Out Level” set point in SCADA and the HMI, typically set at 100mm above the sump floor.
vii. Stop the drain pump when the “Delivery Bay Level“ is below the “Delivery Bay Cut Out Level”.

c) If pump drained, provide a “Delivery Bay Drainage Pump Failure” alarm in SCADA and the HMI when either the drainage pump failure output (if one exists) &/or motor overload / overcurrent is active.
d) If valve drained:
   I. Provide an actuated Delivery Bay Drain Valve with Open **and** Closed position feedback.
   II. A “Failed to Close“ alarm shall be generated when the valve is called to “Close“ but fails to achieve this position within a prescribed time (nominally 15 secs).
   III. Both Fill Power Supplies shall be isolated on activation of the “Fail to Close” alarm.
   IV. A “Failed to Open“ alarm shall be generated when the valve is called to “Open“ but fails to achieve this position within a prescribed time (nominally 15 secs).
e) An Emergency Stop and Reset button shall be provided which:
   I. Is clearly visible at the CDU doorway and operable from outside the CDU when the CDU doors are open, and
   II. when activated will isolate the supply of power to both Fill Power Connection outlets. This isolation shall remain active until the Emergency Stop is reset on site.

14.2 Chemical Tank Volume

a) Chemical Tank Volume, Reorder and “no change” arrangements shall be provided as follows:
   I. Chemical Tank Volume (level analogue) shall be provided which is ranged in L (liters) between the tank floor (0 liters) and overflow invert.
   II. Chemical Tank Volume shall be indicated locally with an electronic display which is visible from the fill point. Refer section 9.5 for further information.
   III. “Reorder Required” analogue derived set point alarm in SCADA and the HMI when the Chemical Tank Volume is below the “Reorder Volume“ set point.
   IV. Manually configurable “Reorder Volume” set point in SCADA and the HMI, typically set at the Working Volume (volume above Volume Low Level) which provides 10 days to empty at the operator adjustable fixed rate.
   V. “No Volume Change” analogue derived alarm in SCADA and the HMI, to be active when the Volume does not change by 1% of range within a rolling 24 hour timeframe.
b) Chemical Tank High Volume alarms and Fill Power Isolation shall be provided as follows:
   I. “Tank High Volume” analogue derived set point alarm in SCADA and the HMI.
   II. Manually configurable “Tank High Volume” set point in SCADA and the HMI, typically set at 90% of Working Volume.

III. “Tank High Level” switch positioned at 95% of range, generating an alarm in SCADA and the HMI.
IV. “Tank High Level” locally visible lamp.
V. Automatic isolation of Fill Power Supplies when the “Tank High Level” alarm is active.

c) Chemical Tank Low Volume alarms and Dosing Pump Cut Out as follows:
I. “Tank Low Volume” analogue derived set point alarm in SCADA and the HMI.
II. Manually configurable “Tank Low Volume” set point in SCADA and the HMI, typically set at 10% of Working Volume.
III. “Tank Low Level” switch positioned at 5% of range, generating an alarm in SCADA and the HMI.
IV. Automatic inhibit of Dosing Pump(s) when the “Tank Low Level” alarm is active.

14.3 Tank Outlet Valve

a) A Tank Outlet valve “Open / Close / Auto“ selector switch shall be provided at the control cubicle.
I. When the selector switch is in the “Open” position and the valve position feedback indicates the valve is Open, a dosing pump may operate.
II. When the selector switch is in the “Closed” position or the valve position feedback indicates that it is closed, dosing pump(s) shall be inhibited.
II. When the selector switch is in the “Auto” position, the following options shall apply via SCADA and the local HMI:
i. Open, in which case the controller shall open the valve.
ii. Close, in which case the controller shall close the valve.
iii. Auto, in which case the controller shall Open the valve unless the “Unexpected Flow” alarm is active, in which case the valve shall Close.

b) Tank Outlet Valve Failure Alarms shall be as follows:
I. The actuated Tank Outlet Valve shall have Open and Closed position feedback.
II. A “Failed to Close“ alarm shall be generated when the valve is called to “Close“ but fails to achieve this position within the prescribed time (nominally 15 secs).
III. A “Failed to Open“ alarm shall be generated when the valve is called to “Open“ but fails to achieve this position within the prescribed time (nominally 15 secs). Dosing pumps shall be inhibited.

14.4 Leakage Detection

a) “System Leakage” alarm in SCADA and the HMI when there is an Appreciable Reduction in Chemical Tank Level and **no** Dosing Pump is running. “Appreciable Reduction” is an amount just greater than the variation in level registered by the instrument when there is no actual volume change. (ie: the variation in tank level when there is no filling, no dosing pump operating and no leakage). Appreciable Reduction shall be a Register in the CDU Controller.
b) A “Bund Level High” float switch and alarm shall be provided in each bund, fitted to be activate when a bund’s sump is full, generating an alarm in SCADA and the HMI.
c) “Dosing Line Leakage” or “Dosing Line 1 Leakage” (if there are two dosing lines) switch at the dosing line containment low point, generating an alarm in SCADA and the HMI.

d) “Dosing Line 2 Leakage” (if there are two dosing lines) switch at the dosing line containment low point, generating an alarm in SCADA and the HMI.

14.5 Dosing Pump(s)

a) Dosing Pump “Manual / Off / Auto” selector switch(s) shall be provided for each Dosing Pump at the control cubicle.
    I. When a Dosing Pump selector switch is in the “Manual” position, the pump shall run at the operator adjustable fixed rate (L / hr).
    II. When a Dosing Pump selector switch is in the “Off” position, the pump shall not be available.
    III. When the Dosing Pump selector switch is in the ”Auto” position, the following options shall be selectable for a Dosing Pump via SCADA and the local HMI:
        i. ”On”. When ”On” is selected via SCADA or local HMI, the dosing pump shall run at the operator adjustable fixed rate (L / hr). If dosing to a pressure main, dosing shall only occur when an SPS pump is operating.
        ii. ”Off”. When “Off” is selected via SCADA or local HMI, the dosing pump shall be unavailable.
        iii. “Auto”. When “Auto” is selected via SCADA or local HMI, the dosing pump shall operate according to the “Dosing Auto Mode”
    II. When the Dosing Pump selector switch is in the ”Auto” position and “Auto” is selected via SCADA or the local HMI, the following Dosing Auto Modes shall be selectable via SCADA or the local HMI:
        i. “Flow Paced Control” (refer section 14.5.4), or
        ii. “Flow Paced Control with High Inflow Reduction” (refer section 14.5.5).
b) A Dosing pump shall be inhibited when it’s Dosing Pump selector switch is in the ”Auto” position and “Auto” is selected via SCADA or the local HMI and:
    I. The other Dosing Pump’s Selector Switch is in “Manual”, **or**
    II. The “Chemical Tank Low Level“ is active, **or**
    III. The actuated Tank outlet valve ”Failed to Open”, **or**
    IV. The actuated Tank outlet valve is ”Closed”, **or**
    V. Dosing line Pressure High is active, **or**
    VI. When dosing to an SPS and the SPS High Level alarm is active.
c) “Dosing Rate Called” (by the controller) shall be calculated as per section 14.5.3.
d) Dosing Pump Failure
    I. Use a Pumps with a “Dosing Pump Failed” output which shall be included in SCADA and the HMI.
    II. “Dosing Pump Failed” pumps shall be made unavailable in both “Auto“ and “Manual“ selector switch modes.
e) Duty Pump Selection in Auto:
    I. Pumps shall operate on a Duty / Standby basis and shall not operate concurrently.
    II. Duty shall changeover if both dosing pumps are in “Auto” when:
        i. The Duty Pump becomes unavailable.
        ii. After 8 hours of run time.
    III. If one pump is in “Manual” or “On” and the other pump is in “Auto”, the pump in “Auto” shall not operate.

14.5.1 SPS Pressure Main Flow

When in Auto Mode (refer sections 14.5.4 and 14.5.5), an pressure main flow rate (L/s) is required to set the Dosing Rate. Flow shall be determined in the following way:

a) Use the “Pressure Main Flow” when the flow meter data is valid.
b) Use the “SPS Pressure Main Flow Estimate” when the SPS flow meter signal is **not** valid or there is no “no change” to SPS Pressure Main Flow in a 12 hour period.
   This estimate should be based on the SPS pump run status and the average pump flow rate of the running pumps at the SPS.
   Average pump flow rate shall be the rolling average flow rate based on the most recent 7 days of “valid” flow meter data when a pump is running.
c) Assume “SPS Pressure Main Flow Estimate” is zero (0) when there is no pump run status information or no previous SPS flow data available.

14.5.2 SPS Data Required by the CDU

The CDU controller shall be configured to extract the following data from the SPS controller to enable dosing pump control:

a) SPS High Level alarm.
   (to enable dosing pumps to be inhibited when either alarm is active).
b) SPS Pressure Main Flow (to provide the values described in section 14.5.1)
c) SPS Pressure Main Flow Meter Status (valid / invalid)
d) SPS Pump run status (for all SPS pumps)
   (to enable “SPS Pressure Main Flow Estimate” described in section 14.5.1).

14.5.3 CDU Dosing Rate

Dosing Terminology shall be as follows:

Table 5: Dosing Terminology

Term	Definition
Dosing Set Point Rate Required	The Dosing Rate being targeting
Dosing Pump Rate Required	The Dosing Rate that the PID algorithm / loop determines is necessary so that Dosing Line Flow = Dosing Set Point Rate Required
Dosing Rate Called	The Dosing Rate that is calculated as required. One of: 1) If the Dosing Flow Meter is valid, Dosing Rate Called equals Dosing Pump Rate Required, or 2) If the Dosing Flow Meter is **in**valid, Dosing Rate Called equals Dosing Set Point Rate Required
Pump Reference Speed	The Dosing Pump speed required to provide the Dosing Rate Called, based on the pumps volume per revolution.
Dosing Line Flow	The actual flow measured by the Dosing Line Flow Meter

All Dosing Rates shall have units of L/hr.

The “Dosing Pump Rate Call” shall be determined in the following process:

a) Calculate the “Dosing Set Point Rate Required” based on:
   I. The Select Switch position of the pumps (ie: Manual, Off, Auto)
   II. The SCADA-HMI control selection of the pumps (ie: On, Off, Auto.
   III. The Dosing Auto Mode if the SCADA-HMI control selection is Auto.
   IV. The Flow Paced Dosing Rate set point (if Auto Mode = Flow Paced Control)
   V. The High Inflow Reduction Factor.
b) When the Dosing Flow Meter is “Valid”, use “Dosing Line Flow” with PID control to determine the “Dosing Pump Rate Required” to achieve the “Dosing Set Point Rate Required”. “Dosing Rate Called” shall be equal to “Dosing Pump Rate Required” in this case. Refer to Table 6 for details.
c) When the Dosing Flow Meter is “Invalid”, “Dosing Rate Called” shall be equal to “Dosing Set Point Rate Required”, assuming the data sheet value for stroke volume of the dosing pump. Refer to Table 5 for details.

Table 6: Auto Dosing Pump Rate Called Calculation Options

Dosing Flow Meter Condition	Calculation Basis	PID Process Variable	PID Set Point	PID Output Control Variable	Dosing Rate Called (controller output to pumps)	Comments
Valid	PID Flow Control	Dosing Line Flow	Dosing Set Point Rate Required	Dosing Pump Rate Required	Dosing Pump Rate Required	Auto compensation for pump wear / blockage
Invalid	Data sheet stroke volume of dosing pump (L / revolution)	NA	NA	NA	Dosing Set Point Rate Required	No compensation for pump wear / blockage

When the Dosing Pump selector switch is in “Auto” and “Auto” is selected in SCADA or the HMI, the following three automatic options shall be selectable in SCADA and the HMI:

14.5.4 Mode 1: Flow Paced Control

This mode is applicable when the dosing point is a pressure main which has a flow meter. Where the dosing point is a gravity sewer or wet well, this mode shall be inhibited from being selected.

Dosing shall be initiated by the controller.

When selected to run on Flow Paced control, the “Dosing Set Point Required” shall be calculated based on an operator adjustable pre-set dose rate dependant on the flow in the sewer pressure main. This shall have a unit of mL (chemical) / litre (sewage), calculated as follows.

$$\text{“Dosing Set Point Required” (L / hr)} = \left(\text{“Flow Paced Dosing Rate” (mL (ferrous) / L (sewage))} \times \frac{\text{L}}{\text{1,000 (mL)}} \times \text{“Pressure Main Flow” (L /s)} \times \frac{\text{3,600 s}}{\text{hr}} \right)$$

14.5.5 Mode 2: Flow Based Dosing with High Inflow Reduction

$$\text{"Dosing Set Point Required" (L / hr)} = \left[\text{"Flow Paced Dosing Rate" (mL (ferrous) / L (sewage))} \times \frac{\text{L}}{\text{1,000 (mL)}} \times \text{"Pressure Main Flow" (L /s)} \times \frac{\text{3,600 s}}{\text{hr}} \times \text{Inflow Reduction Factor}\right]$$

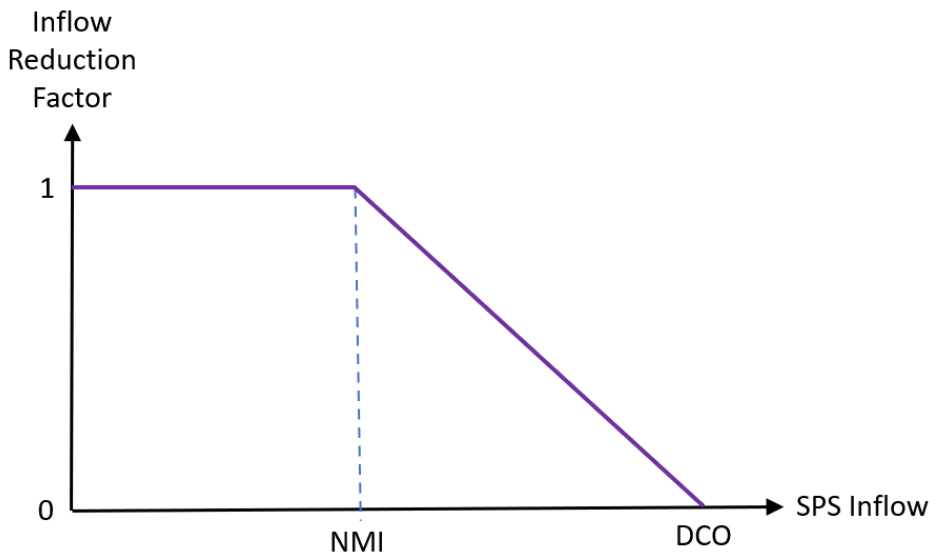
The Inflow Reduction Factor shall be calculated as follows:

The operator shall set two Inflow set points at any point in time (Normal Max SPS Inflow, and, Dosing Cut-Out SPS Inflow), from which the controller shall calculate the required Inflow Reduction Factor via linear interpolation.

i. Normal Max SPS Inflow SP = L/s (NMI)
   When Inflow is below NMI, the Inflow Reduction Factor shall equal 1.
   ie: no High Inflow Reduction Factor shall apply.
   12 Set points shall be provided for NMI for each two hour period of the day.

ii. Dosing Cut Out SPS Inflow SP = L/s (DCO)
   When Inflow is greater than the DCO, the Inflow Reduction Factor shall equal 0. ie: No Dosing.
   12 Set points shall be provided for DCO each two hour period of the day.

SPS Inflow values between NMI and DCO shall lead to interpolation of the Inflow Reduction Factor as per the below figure:



SPS inflow shall be calculated as follows:

$$\text{Inflow (L/s)} = \left[\left(\frac{\text{WWPSA (m}^2\text{)} \times \Delta\text{H (m)}}{1000\ \Delta\text{T (s)}}\right) + \frac{\text{PV (m}^3\text{)}}{1000\ \Delta\text{T (s)}}\right]$$

- WWPSA = Wet Well Plan Surface Area (m^2)
- ΔH = Change in Wet Well Level (m). Usually negative when a pump is running.
- ΔT = Calculation Interval in seconds (nominally 600 seconds)
- PV = Pumped Volume (m^3 from sewage flow meter, difference in totalised flow over ΔT)

Detention time shall be calculated and updated after each calculation interval.

14.6 Dosing Line Instruments

a) Dosing Lines shall be provided with the following Pressure monitoring arrangements:
   I. Pressure analogue which is ranged in mWG between the 0 and the dosing pumps shut head.
   II. "Dosing Line High Pressure" analogue derived set point alarm in SCADA and the HMI.
   III. Manually configurable "Dosing Line High Pressure" set point in SCADA and the HMI, typically set at 110% of Maximum Operating Pressure of the dosing system.

b) Dosing Lines shall be provided with the following Flow monitoring arrangements:
   I. Bidirectional Flow analogue ("Dosing Line Flow") which is ranged in L / hr between the negative and positive of the maximum dosing rate of the Dosing Pump.
   II. "Dosing Line Flow" (from the dosing line flow meter) shall be compared to the "Dosing Set Point Rate Required" (refer section 14.5.3).
   A "Dosing Rate Inaccurate" alarm shall be activated where these values are more than +/- "Acceptable Dosing Rate Inaccuracy Set Point".
   Either one of three conditions could cause this alarm:
      - Dosing Flow Meter inaccuracy, **&/or**
      - Dosing pump wear or inadequate performance, **&/or**
      - Dosing line blockage / closure.
   III. Manually configurable "Acceptable Dosing Rate Inaccuracy Set Point" in SCADA and the HMI, typically set at 10%.
   IV. A "Dosing Line Flow Meter Failure" shall be activated when the dosing line flow meter data is invalid.
   V. "Dosing Line Flow Reverse" digital alarm from the flow meter indicating there is backflow through the dosing system.

14.7 Standard Tags / Points

Refer Appendix B for a list of standard tags / points and their attributes.

15. Testing and Commissioning

Comply with AM2522 SEW Testing, Commissioning, Completion & Handover standard and complete and signoff the Testing and Commissioning checklist in Appendix C.

The requirements for each item in the checklist are as described by this document.

15.1 Hydrostatic Tests and Leak Detection

All containment areas and bunds shall be watertight prior to the application of any internal coating. Containment areas and bund areas shall be filled with water for at least 24 hours and it shall be deemed satisfactory if there is no appreciable change in level (ie: < 2mm change in level) during this period. Care shall be taken to minimise evaporation by shading the containment areas and bunds and undertaking the tests during cooler days.

New storage 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.

15.2 Commissioning Test Run

Test all operable equipment in all available states and modes of operation. Refer Section 13. and Appendix B for information on the functionality and tags to be tested.

Commissioning shall be deemed complete when all of the works are capable of running continuously without any fault for a period of two weeks. The commissioning shall include at least one chemical delivery and the chemical storage tank shall be > 90% full at the time of handover.

During this period, the Contractor shall maintain the unit in a proper working manner and demonstrate system performance to South East Water. The Contractor shall carry out any work necessary to ensure the unit is working correctly.

The reduction of the dissolved sulphide in the downstream sewage shall be recorded by South East Water or its representative and used to adjust the dose rate.

At the end of this period, the Supplier shall issue a certificate stating the outcome of the testing and commissioning to allow Handover.

15.3 Building certification

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

15.4 Submission of As Constructed Documentation

The Handover is not complete until all As Constructed documents, such as detailed drawings, O&M Manuals, GIS data, MAXIMO data and so on have been submitted to, checked by and approved by South East Water.

Appendix A – Piping & Instrumentation Diagrams

ENCLOSURE BOUNDARY OR CDU BUILDING

DOSING SCREENS BOUNDARY

NOTES:

1. FOR DETAILS ON THE SELECTION AND SET UP OF EQUIPMENT, REFER TO AM2776.4
2. SAFETY SHOWERS REQUIRE A MINIMUM OF 1.26L/s @ 210kPa, BOOSTER PUMP TO BE SUPPLIED IF REQUIRED.
3. DOUBLE CONTAINMENT LEAK DETECTION ONLY REQUIRED IF THIS IS A LOW POINT IN THE DOSING LINE.
4. DUPLICATE DOSING LINE SETUP WHEN ASSET CRITICALITY ASSESSMENT INDICATES REDUNDANCY IS REQUIRED.

REFERENCE DRAWINGS

SEWC-AM2776-4.P.002 MAINTENANCE HOLE DISCHARGE P&ID
SEWC-AM2776-4.P.003 SEWER PRESSURE MAIN DOSING P&ID
SEWC.8500.P.001 P& ID LEGEND

SPS DEVICES
INPUTS FROM SPS: PRESSURE MAIN FLOW, PUMP RUN STATUS, WET WELL HIGH LEVEL etc
FROM WATER SUPPLY
DRAIN FROM CDU SUMP
OVERFLOW FROM CDU
SCADA
CONTROLLER
01
CDU RPZD
DN25
EYEWASH & SAFETY SHOWER
25x15
EYEWASH
25x20
Φ20 CAMLOCK HOSING POINT
ITEMS SHALL BE OPERABLE / VISIBLE FROM OUTSIDE ENCLOSURE
415V 240V POWER OUTLETS
DN50 CAMLOCK COUPLING
DRIP TRAY
25x50
1:100 FALL
INSPECTION HATCH
DN80 SPARE
OVERFLOW
LSH
LT
LI
FERROUS CHLORIDE STORAGE TANK
LSL
ZSO
ZSC
M
CALIBRATION CYLINDER
50x25
50x20
STRAINER
20x50
DRAIN / FLUSHING ASSEMBLY REQUIRED IN LINE IF > 3m LONG BETWEEN ISOLATION VALVES
DN20 MALE CAMLOCK
DRAIN
DN50
OVERFLOW DISCHARGE VISIBLE FROM CHEMICAL DELIVERY AREA
PV
DOSING PUMP (STAND BY)
DOSING PUMP DUTY
PI
PULSATION DAMPENER
PT
FT
DOSING FLOWMETER
20x15
15x20
DN20
LEAKAGE DETECTION CONDUCTIVITY SWITCH(S) ONLY REQUIRED IF THIS IS A LOW POINT
DUPLICATE LINE SETUP (REFER NOTE 4)
Φ20 MALE CAMLOCK
TO DOSING POINT SEWC-AM12776-4.P.002 SEWC-AM12776-4.P.003
DOUBLE CONTAINMENT (REFER NOTE 3)
TANKER
FALL 1:75
CHEMICAL TANKER STANDING AREA
DRAIN FROM DOSING PIT - SEWC-AM2776-4.P.003 IF PRESSURE MAIN INJECTION DOSING
DN100
DELIVERY BAY SUMP
DELIVERY BAY (CONTAINMENT AREA)
(TYPE 1 - GRAVITY DISCHARGE ARRANGEMENT)
DN63
MF
OVERFLOW
SUMP DRAIN
LS
DN15
DN25
DN80
DN50
CDU BUILDING OR ENCLOSURE SUMP
DELIVERY BAY (CONTAINMENT AREA)
(TYPE 2 - PUMPED DISCHARGE ARRANGEMENT)
ELEVATED GRATED FLOOR ABOVE BUND TWL. LOCATE ALL ELECTRICAL ITEMS ABOVE THIS LEVEL.
LOCATE MECHANICAL EQUIPMENT ABOVE THIS LEVEL WHERE PRACTICAL
(TYPE 1) DN100
(TYPE 2) DN63 PE100
TO SEWERAGE SYSTEM - TBA

REV	DESCRIPTION	JOB No	DRAFTER	DES. REVIEW	APP'D	DATE
0	ISSUED FOR PUBLICATION		GIH	JT	CP	25.01.23

VENDOR DRAWING No:

DESIGNER	DRAFTER	SEW PROJECT MANAGER
DESIGN REVIEW	DRAFT CHECK	ASSET/ENG. MANAGER

APPROVED
C. PAXMAN
JANUARY 2023
# DENOTES SIGNATURE ON ORIGINAL

South East Water
101 Wells Street, Frankston, VIC 3199 W : www.sew.com.au
T : 61 3 9552 3000 F : 61 3 9552 3001 E : info@sew.com.au

SOUTH EAST WATER
CHEMICAL DOSING UNIT
PIPING AND INSTRUMENTATION DIAGRAM

DATUM: -
MELWAY REF: -
SCALE: -
SHEET SIZE: A1
SEW DRAWING NUMBER
SEWC-AM2776-4.P.001
0
REV
SEW JOB No: .

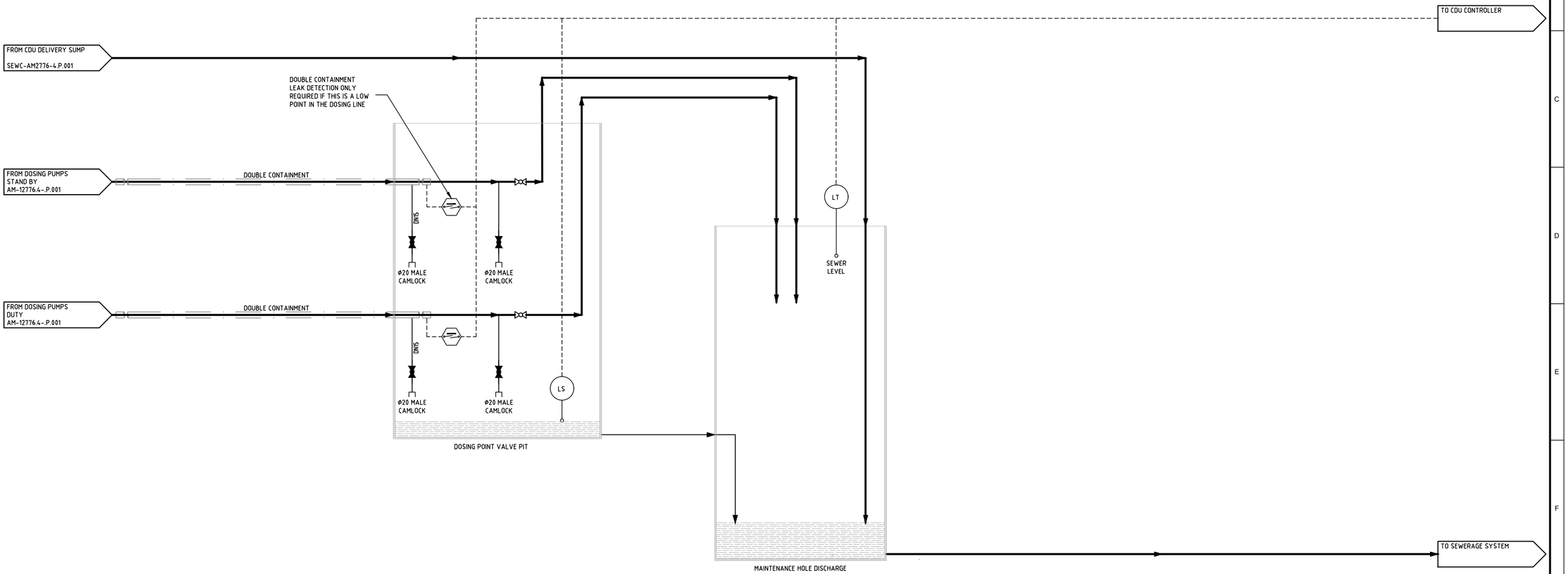
CAD FILE NAME: G:\GIH\CHECK DRAWINGS\colin p\2 dec 2022\SEWC-AM2776-4.P.001_0.dwg
PLOTTED: 25/1/2023 3:28pm BY G.HASKINS

DOSING POINT NOTES:

1. GRAVITY SEWERAGE LEVEL MONITORING OF THE DISCHARGE MH IS ONLY REQUIRED WHEN THE CHEMICAL DOSING UNIT IS NOT WITHIN CABLING DISTANCE (ie: 100m) OF AN ASSOCIATED SPS.
2. INSTALL PRESSURE MAIN FLOW METERS IN ACCORDANCE WITH AM2832 INSTRUMENTATION AND CONTROL STANDARD.
3. TAPPING POINT TO BE A MINIMUM 10m DOWNSTREAM OF CHEMICALLY RESISTANT FLOW METER
4. DESIGN AND CONSTRUCT PITS IN ACCORDANCE WITH AM2884 PIT STANDARD.

REFERENCE DRAWINGS

SEWC-AM2776-4.P.001 CHEMICAL DOSING UNIT P&ID
SEWC-AM2776-4.P.003 SEWER PRESSURE MAIN DOSING P&ID
SEWC.8500.P.001 P& ID LEGEND



REV	DESCRIPTION	JOB No	DRAFTER	DES. REVIEW	APP'D	DATE
0	ISSUED FOR PUBLICATION		GIH	JT	CP	JAN 2023

VENDOR DRAWING No:

DESIGNER	DRAFTER	SEW PROJECT MANAGER
DESIGN REVIEW	DRAFT CHECK	ASSET/ENG. MANAGER

APPROVED
C. PAXMAN
JANUARY 2023
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T : 61 3 9552 3000 F : 61 3 9552 3001 E : info@sew.com.au

SOUTH EAST WATER
CHEMICAL DOSING UNIT
PIPING AND INSTRUMENTATION DIAGRAM
MAINTENANCE HOLE DISCHARGE

DATUM: -	
MELWAY REF: -	SHEET SIZE: A1
SCALE: -	
SEW DRAWING NUMBER	
SEWC-AM2776-4.P.002	0
SEW JOB No: .	REV

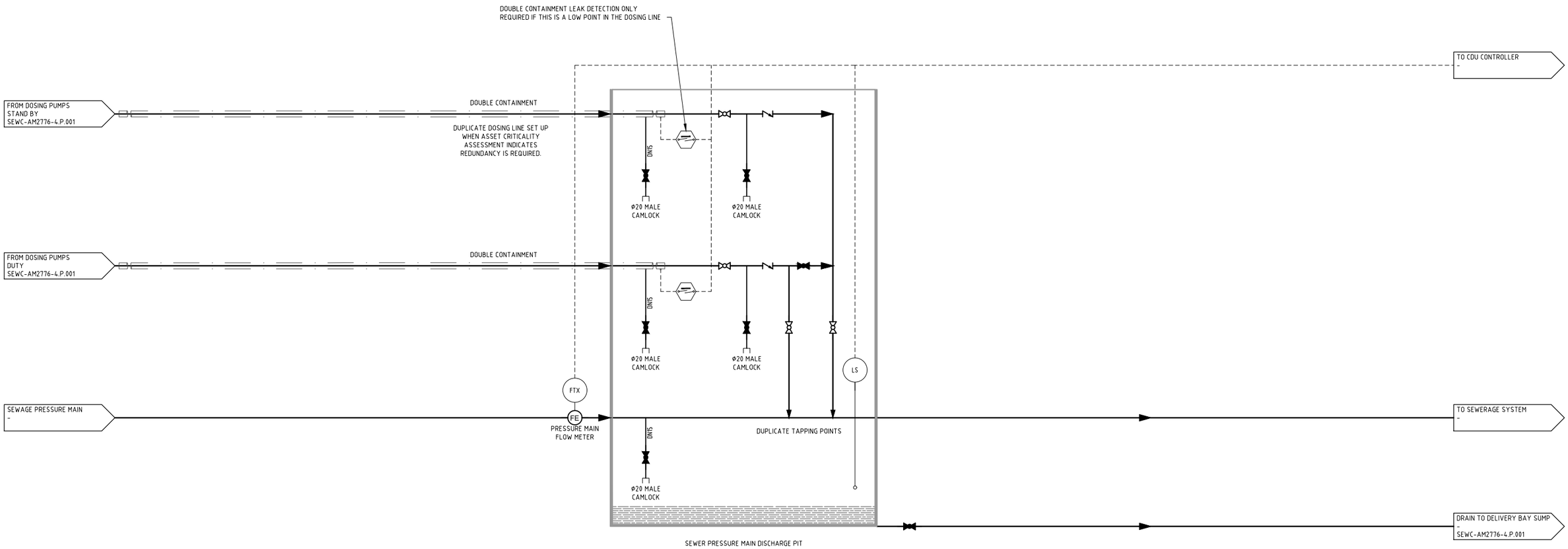
CAD FILE NAME: G:\GIH\CHECK DRAWINGS\colin p\2 dec 2022\SEWC-AM2776-4.P.002_0.dwg
PLOTTED: 25/1/2023 3:31pm BY G.HASKINS

DOSING POINT NOTES:

1. LEVEL MONITORING OF THE DISCHARGE PIT IS ONLY REQUIRED WHEN THE CHEMICAL DOSING UNIT IS NOT WITHIN CABLING DISTANCE (ie: 100m) OF AN ASSOCIATED SPS.
2. INSTALL PRESSURE MAIN FLOW METERS IN ACCORDANCE WITH AM2832 INSTRUMENTATION AND CONTROL STANDARD.
3. TAPPING POINT TO BE A MINIMUM 10m DOWNSTREAM OF CHEMICALLY RESISTANT FLOW METER
4. DESIGN AND CONSTRUCT PITS IN ACCORDANCE WITH AM2884 PIT STANDARD.

REFERENCE DRAWINGS

SEWC-AM2776-4.P.001 CHEMICAL DOSING UNIT P&ID
SEWC-AM2776-4.P.002 SEWER PRESSURE MAIN DISCHARGE P&ID
SEWC.8500.P.001 P&ID LEGEND



REV	DESCRIPTION	JOB No	DRAFTER	DES. REVIEW	APP'D	DATE
0	ISSUED FOR PUBLICATION		GIH	JT	CP	25.01.23

VENDOR DRAWING No:

DESIGNER	DRAFTER	SEW PROJECT MANAGER
DESIGN REVIEW	DRAFT CHECK	ASSET/ENG. MANAGER

APPROVED
C. PAXMAN
JANUARY 2023
# DENOTES SIGNATURE ON ORIGINAL

South East Water
101 Wells Street, Frankston, VIC 3199 W : www.sew.com.au
T : 61 3 9552 3000 F : 61 3 9552 3001 E : info@sew.com.au

SOUTH EAST WATER
CHEMICAL DOSING UNIT
PIPING AND INSTRUMENTATION DIAGRAM
SEWER PRESSURE MAIN DOSING

DATUM: -	
MELWAY REF: -	
SCALE: -	SHEET SIZE: A1
SEW DRAWING NUMBER	
SEWC-AM2776-4.P.003	0
SEW JOB No: -	REV

CAD FILE NAME: G:\GIH\CHECK DRAWINGS\vsim py3 dec 2022\SEWC-AM2776-4.P.003_0.dwg

PLOTTED: 30/1/2023 3:13pm BY: G.HASKINS

Appendix B – Standard TAGS / Points

Refer to DNP3 standard and NOCC checklist available from the SCADA team for further information.

Tag ID	Tag Name	Tag Type	Options / Units / Status / Notes
Tags applicable to CDU Electrical Board			
Includes a range of standards tags used for facilities and includes: Mains Power, Door switch, Low Voltage supply, Control Power etc. **Refer to DNP3 standard and NOCC checklist available from the SCADA team for further information.**			
Tags applicable to Delivery Bay Drain Control			
	Delivery Bay Level	Ana In. Level Transmitter	mm, ranged from floor of sump to TWL of delivery bay
	Delivery Bay Drainage Inhibit	Calculation Dig	Inhibited / Not inhibited
	Delivery Bay Drainage Inhibit Drop-out Delay SP	Set Point	Minutes. Acceptable Range from 10 to 60 mins
	Delivery Bay Drainage Inhibit Level SP	Set Point	m, ranged from floor of sump to TWL of delivery bay
	Delivery Bay Fill Mode	Dig In. Selector Switch	Filling / Not Filling
	Fill Mode Switch Incorrectly Positioned	Calculated Alarm	Active / Inactive
	Delivery Bay High Level	Calculated Alarm	Active / Inactive
	Delivery Bay High Level SP	Set Point	cm, ranged from floor of sump to TWL of delivery bay
	Delivery Bay High Level Lamp	Dig Out	Active / Inactive
Tags applicable when Delivery Bay Drain empties via gravity			
	Delivery Bay Drain Valve Control	Dig In. Selector Switch	Open / Close / Auto
	Delivery Bay Drain Valve SCADA-HMI Control	SCADA / HMI selection	Open / Close / Auto
	Delivery Bay Drain Valve Call	Dig Out	Open / Close
	Delivery Bay Drain Valve Fully Open Status	Dig In. Position Switch Feedback	Open / Not Open
	Delivery Bay Drain Valve Fully Closed Status	Dig In. Position Switch Feedback	Closed / Not Closed
	Delivery Bay Drain Valve Failure	Calculated Alarm	Failed / Not Failed
Tags applicable when Delivery Bay Drain is pump emptied			

	Delivery Bay Drain Pump Control	Selector Switch	Manual / Off / Auto
	Delivery Bay Drain Pump Available	Dig In	Available / Unavailable
	Delivery Bay Drain Pump SCADA-HMI Control	SCADA / HMI selection	On / Off / Auto
	Delivery Bay Drain Pump Call	Dig Out	Run / Not Running
	Delivery Bay Drain Pump Fault	Dig In	Fault / Not Fault
	Delivery Bay Drain Pump Cut In Level SP	Set Point	cm, ranged from floor of sump to TWL of delivery bay
	Delivery Bay Drain Pump Cut Out SP	Set Point	cm, ranged from floor of sump to TWL of **sump**
	Delivery Bay Drain Pump Failure	Dig In (motor protection / relay)	Failed / not Failed
Tags applicable to Tanker Fill Power Monitoring and Control			
	240 VAC Fill Pump Power Supply	Dig Out. Contactor	Active / Isolated
	415 VAC Fill Pump Power Supply	Dig Out. Contactor	Active / Isolated
Tags applicable to Tank Level Monitoring			
	Chemical Tank Volume	Ana In. Level Transmitter	L (depth converted to volume), ranged from tank floor to IL of overflow
	Chemical Tank Volume Display	Ana Loop	Display of amount of chemical in storage
	Reorder Volume SP	Set Point	Liters
	Reorder Required	Calculated Alarm	Active / Inactive
	Chemical Tank High Level	Dig In. Level Switch	Active / Inactive
	Chemical Tank High Lamp	Relay Out	Active / Inactive
	Chemical Tank High Volume SP	Set Point	Liters
	Chemical Tank High Volume	Calculated Alarm	Active / Inactive
	Chemical Tank Low Level	Dig In. Level Switch	Active / Inactive
	Chemical Tank Low Volume SP	Set Point	Liters
	Chemical Tank Low Volume	Calculated Alarm	Active / Inactive
	No Volume Change	Calculated Alarm	Active / Inactive
Next Tags applicable to Leakage Detection			

	System Leakage	Calculated Alarm	Active / Inactive
	CDU Bund High Level	Dig In. Level Switch	High / Not High
	Dossing Line Leakage, or Dosing Line 1 Leakage	Dig In. Conductivity Switch	Leaking / Not Leaking
	Dosing Line 2 Leakage	Dig In. Conductivity Switch	Leaking / Not Leaking
Next Tags applicable to Tank Outflow Control Valve			
	Chemical Tank Outlet	Calculation	L / hr
	Chemical Tank Outlet Valve Control	Selector Switch	Open / Close / Auto
	Chemical Tank Outlet Valve Auto Control	SCADA / HMI selection	Open / Close / Auto
	Chemical Tank Outlet Valve Call	Dig Out	Open / Close
	Chemical Tank Outlet Valve Fully Open Status	Dig In. Valve Feedback	Open / Closed
	Chemical Tank Outlet Valve Fully Closed Status	Dig In. Valve Feedback	Closed / Not Closed
	Chemical Tank Outlet Fault Status	Calculated Alarm	Fault / Not Fault
Next Tags applicable to the Chemical Dosing Building bund level monitoring / alarms			
	Chemical Dosing Building Level High	Dig In. Level switch	High / Not High
Tags transferred to Chemical Dosing Unit controller from SPS controller (if there is an SPS)			
	Chemical Dosing Mains Power Failure	Dig In. SPS Controller	Failed / Not Failed
	SPS High Level	Dig In. SPS Controller	Active / Inactive
	SPS Pressure Main Flow	Ana In. Flow Meter	L/s
	SPS Pressure Main Flow Meter Status	Dig In. SPS Controller	Valid / Invalid
	SPS Pump 1 Run Status	Dig In. SPS Controller	Running / Stopped
	SPS Pump 1 Run Status	Dig In. SPS Controller	Running / Stopped
Tags applicable to Chemical Dosing Pump Control			
	SPS Pressure Main Flow Estimate (if dosing to SPS)	Calculated Analogue	L / s. Based on SPS pump run status and average SPS flow rate, used when the SPS Flow Meter fails
	Dosing Set Point Rate Required	Calculated Analogue	L / hr. Calculation based on Mode, Set Point(s), Time of Day / SPS Flow Rate etc

	PID Dosing Rate Required	Calculated Analogue	L / hr. PID Calculation of the Dosing Rate required so that “Dosing Line Flow” = the “Dosing Set Point Rate Required”
	Dosing Rate Called	Calculated Analogue	L / hr. = PID Dosing Rate Required (if “Dosing Line Flow Meter” = “Valid”), or = Set Point Dosing Rate Required (if “Dosing Line Flow Meter” =- “Invalid”)
	Dosing Auto Mode	SCADA / HMI selection	Flow Paced Control / Flow Paced Control with High Inflow Reduction
	Dosing Pump Duty	Calculated Digital	Pump 1 / Pump 2
Tags applicable to Chemical Dosing Pump 1			
	Dosing Pump 1 Mode	Dig In. Selector Switch	Manual / Off / Auto
	Dosing Pump 1 Available	Dig Calculated	Available / Not Available
	Dosing Pump 1 SCADA-HMI Control	SCADA / HMI selection	On / Off / Auto
	Dosing Pump 1 Run Call	Dig Out	Run / Stop
	Dosing Pump 1 Speed Reference	Ana Out. Calculated	Hz. Convert Dosing Rate Called to Speed Reference based on stroke volume per revolution of the pump
	Dosing Pump 1 Speed Feedback	Ana In. From pump	Hz. Actual pump speed
	Dosing Pump 1 Fail	Dig In &/or Calculated Alarm	Failed / Not Failed
Tags applicable to Chemical Dosing Pump 2			
	Dosing Pump 2 Mode	Dig In. Selector Switch	Manual / Off / Auto
	Dosing Pump 2 Available	Dig Calculated	Available / Not Available
	Dosing Pump 2 SCADA-HMI Control	SCADA / HMI selection	On / Off / Auto
	Dosing Pump 2 Run Call	Dig Out	Run / Stop
	Dosing Pump 2 Speed Reference	Ana Out. Calculated	Hz. Convert Dosing Rate Called to Speed Reference based on stroke volume per revolution of the pump
	Dosing Pump 2 Speed Feedback	Ana In. From pump	Hz. Actual pump speed
	Dosing Pump 2 Fail	Dig In &/or Calculated Alarm	Failed / Not Failed
*Tag applicable when Pump Control Selector Switch is set to “Manual” **or** when the Pump Control Selector Switch is set to “Auto” and SCADA-HMI Control is set to “On”*			
	Fixed Rate	Set Point	L / hr

Tags applicable when Selector Switch is set to "Auto" ***and*** *SCADA-HMI Control is set to "Auto"*			
	Flow Paced Dosing Rate	Set Point	mL / L
Tags applicable when Selector Switch is set to "Auto" ***and*** *SCADA-HMI Control is set to "Auto"* ***and*** *"Dosing Auto Mode" is set to "Flow Paced Dosing with High Inflow Reduction"*			
	Inflow	Calculated	L/s
	00:00 to 02:00 Normal Max SPS Inflow SP	Set Point	L/s
	02:00 to 04:00 Normal Max SPS Inflow SP	Set Point	L/s
	04:00 to 06:00 Normal Max SPS Inflow SP	Set Point	L/s
	06:00 to 08:00 Normal Max SPS Inflow SP	Set Point	L/s
	08:00 to 10:00 Normal Max SPS Inflow SP	Set Point	L/s
	10:00 to 12:00 Normal Max SPS Inflow SP	Set Point	L/s
	12:00 to 14:00 Normal Max SPS Inflow SP	Set Point	L/s
	14:00 to 16:00 Normal Max SPS Inflow SP	Set Point	L/s
	16:00 to 18:00 Normal Max SPS Inflow SP	Set Point	L/s
	18:00 to 20:00 Normal Max SPS Inflow SP	Set Point	L/s
	20:00 to 22:00 Normal Max SPS Inflow SP	Set Point	L/s
	22:00 to 24:00 SP Normal Max SPS Inflow SP	Set Point	L/s
	00:00 to 02:00	Set Point	L/s

	Dosing Cut Out SPS Inflow SP		
	02:00 to 04:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	04:00 to 06:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	06:00 to 08:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	08:00 to 10:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	10:00 to 12:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	12:00 to 14:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	14:00 to 16:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	16:00 to 18:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	18:00 to 20:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	20:00 to 22:00 Dosing Cut Out SPS Inflow SP	Set Point	L/s
	22:00 to 24:00 SP Dosing Cut Out SPS Inflow SP	Set Point	L/s
Tags applicable to Instrumentation on the Dosing Line			
	Dosing Line Pressure	Ana In. Pressure transmitter	kPa, ranged between 0 and 110% of Maximum Operating Pressure
	Dosing Line High Pressure SP	Set Point	kPa
	Dosing Line High Pressure	Calculated Alarm	High / Not high
	Dosing Line Flow	Ana In. Flow meter	L / hr

	Dosing Line Flow Reverse	Dig In. Flow Meter	Reverse / Forward
	Dosing Flow Meter Failure	Dig In. Flow Meter	Valid / Invalid
	Dosing Rate Inaccurate	Calculated Alarm	Active / Inactive
	Dosing Rate Inaccuracy SP	Set Point	% age
Tags applicable to the Dosing Pits or Leakage Containment Pit			
	Dosing Pit Level High	Dig In. Level Switch	Active / Inactive

Appendix C – Standard High Level ITP / Commissioning Checklist

Requirement	Section	Outcome	Comment – Defect(s) Observed
General			
Redundancy	5.4		
Services	5.5		
Security	5.6		
Chemical Manifest	5.7		
Identification & Labelling	5.8		
Critical Spares	5.9		
Safety Equipment	5.10		
Washdown Equipment	5.10		
Corrosion Resistance	6.2		
Pipework & Fitting Products	6.3		
Pipework Supports	6.4		
Foundations	7.1		
Backfill	7.2		
Earthworks	7.4		
Drainage	7.4		
Delivery Bay			
Delivery Bay Size	8.1		
Vehicle Access	8.2		
Delivery Bay Location	8.3		
Delivery Bay General Requirements	8.4		
Delivery Bay Sump	8.5		
Sump Discharge	8.6		
Tanker Power Outlets	8.7		
Delivery Panel Requirements	8.8		
Tank Filling Arrangements	8.9		

Storage Tank			
Tank Material	9.1		
Tank Structural	9.2		
Tank Access	9.3		
Tank Connections	9.4		
Tank Level Instruments	9.5		
Tank Overfilling Controls	9.6		
CDU Building / Enclosure			
Leakage / Spill Containment	10.1		
Bund	10.1.1		
Bund Sump	10.1.2		
Sump Discharge	10.1.3		
Layout & Clearances	10.2		
Doors and Openings	10.3		
Ventilation	10.4		
Structural Design	10.5		
Relocatable CDU Requirements	106		
Lifting plan	10.7		
Elevated Work Platform	10.8		
Dosing System			
Dosing Pump(s)	11.1		
Pipework & appurtenances	11.2		
Dosing Cabinet	11.3		
Pulsation Dampeners	11.4		
Flushing & Drainage	11.5		
Tank Isolation Valve	11.6		
Pressure Transmitter	11.7		
Dosing Flowmeter	11.8		
Double Containment	11.9		
Dosing Line Duplication	11.10		

Dosing Point			
Pressure Main Dosing	12.1		
Gravity Sewer Dosing	11.2		
Leak Detection Pits	12.3		
Electrical Works			
Electrical	13		
Monitoring & Control			
Delivery Bay	14.1		
Tank Volume	14.2		
Tank Outflow	14.3		
Leak Detection	14.4		
Dosing Pump	14.5		
Dosing Line	14.6		
Tags / Points	14.7		
Testing & Commissioning			
Hydrostatic Tests	15.1		
Commission Test Run	15.2		
Building Certification	15.3		
As Constructed Information	15.4		