Air Phase Treatment Unit Specification

AM2776.3

Contents

Document History

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1. Air Phase Treatment Unit Overview

Anaerobic conditions in infrastructure assets carrying sewage result in the generation and release of gaseous compounds, particularly hydrogen sulphide. South East Water operates a variety of sewer ventilation systems that prevent such gases from building-up and corroding sewer assets, and from causing unpleasant odours within the community. Sewage gases are regarded as ambient temperature, sticky wet gases because they accompany a wet environment and the fats and oils common in raw sewage are atomised by splashing with the humidity associated with hot fluids mixing with cold.

This document specifies the design, construction, commissioning and performance testing requirements for air phase treatment at sewage pump stations, including as required: vent stack plume dispersal, forced ventilation by fans with pre-filters, and treatment by bio-trickling filter (BTF) and/or activated carbon filters (ACF). The aim is to ensure adequate control of odour concentrations and asset corrosion rates, whilst minimising operational risks and costs. Broadly speaking, this document also covers the requirements for Air Treatment Units (ATUs) at Water Recycling Plants, however, there will be site specific requirements/risks including increased monitoring and control, flow balancing, as well as some altered performance requirements to be aware of. This document will be updated to include more on Water Recycling Plant requirements in future revisions.

This document does not cover any requirements for air treatment (e.g. via carbon canisters) at air valves. This is covered separately in the WSAA Pressure Sewer Code (WSA 07-2007-1.1) and MRWA WSAA Pressure Sewerage Supplement.

1.1. Context

This document applies to the design and construction of new or upgraded gas phase air treatment units at new and existing sites. This specification is part of a subset of documents under the overarching standard for odour and corrosion control (AM2776). The odour and corrosion control standard provides the overall framework for identifying sites where odour and corrosion control might be required, identifying possible solutions and assessing the most appropriate avenue. The subset provides specifications for each solution type.

The documents in the series are as follows:

Specification	Title
AM 2776	Corrosion and Odour Control Standard
AM 2776.1	Passive Ventilation Specification
AM 2776.2	Forced Extraction Specification
AM 2776.3	Air Phase Treatment Unit Specification
AM 2776.4	Chemical Dosing Specification

1.2. Relevant Regulations

In Victoria, the *Environmental Protection Act 1970* and the Regulations to this Act form the legislative basis for assessing odour impacts. The legislation requires that: *"You **must** ensure that **odours offensive to the senses of human beings** are **not discharged**, emitted or released **beyond the boundaries of the premises**"*. This is further detailed in the *State Environment Protection Policy (Air Quality Management)* (SEPP AQM- *note: currently being revised*).

1.3. Relevant Standards

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

- South East Water Specifications, including but not limited to:
    - South East Water supplement to the WSAA Sewage Pump Station Code of Australia
    - AM2714 Electrical and Data Specification
    - AM2780 SPS RTU & SCADA Specifications
    - AM2832 Instrument and Control Standards
    - AM2848 Approved EIC Equipment List
    - AM2739 Corrosion Mitigation Specification
    - AM2759 Security Specification
    - AM2522 Operations and Maintenance Manual Specification
    - AM2779_Treatement Plant PLC and SCADA Standard Specification
- MRWA Specifications, in particular MRWA-S-402: Vents
- WSAA Codes, in particular WSA04 Sewage Pump Station Code of Australia
- Australian Standards, in particular:
    - AS 1324.2- Air filters for use in general ventilation and air conditioning - Methods of test
    - AS 1657- Fixed platforms, walkways, stairways and ladders – design, construction and installation.
    - AS 4323.3 - Stationary source emissions: Determination of odour concentration by dynamic olfactometry.
    - AS4323.1 - Stationary source emissions: Selection of sampling positions.
- European Standard EN 13121: GRP Tanks and Vessels for Use Above Ground
- International Standards, in particular:
    - ISO 10780 – Stationary source emissions – measurement of velocity and volume flowrate of gas streams in ducts.
- EPA Victoria (EPAV) Publications
    - Publication 1666.1 “Determination of odour concentration by dynamic olfactometry”, 17/10/18
    - Publication 440.1 “A guide to the sampling and analysis of air emissions and air quality”, 5/12/02

1.4. Process Selection

The selection of the preferred air treatment technology will depend upon a number of factors including, but not limited to:

- South East Water’s understanding of current situation as compared to future situation, i.e. anticipated rate of construction in catchment, timing of future upstream SPS, transient loads from tourists, etc will influence sewage volumes/age, mix of residential versus trade waste from time to time, etc.
- Airflow rates
- Odour concentrations
- Odour characterisation
- Load variability
- Site layout including available space, location of existing assets & vehicular access options

- Aesthetic constraints, e.g. by councils, neighbours, etc.

This selection should be guided by the information available as a result of air stream characterisation (if available) and should take into account the inherent strengths and weaknesses of the different technology types e.g. highly variable loads cannot be effectively processed by a BTF alone.

South East Water's preference is for BTFs or ACFs, either as individual units or in combination. The decision shall take into account whole of life costs and environmental impacts amongst other criteria, when comparing competing technology proposals. Standard Piping and Instrumentation Diagrams (P&IDs) for these two air treatment systems are provided in Appendix A.

Standard monitoring and control arrangements (including standard SCADA tags and tag attributes) for these facilities shall be as defined by AM2779_Treatment Plant PLC and SCADA Standard Specification.

2. Performance Requirements

- All components shall have a minimum service life of 20 years.
- All mechanical, electrical and media components shall be easily and safely accessible.
- All media shall be located within 5 m of a safe vehicle access point.

2.1. Mechanical Ventilation

a) **Ventilation flow rate** shall exceed 10 headspace changes per hour, unless it can be demonstrated to South East Water's satisfaction that lower extraction rates will sufficiently reduce the corrosive atmosphere to acceptable levels. The headspace for a pump station is defined as the volume between the cover level and the cut-out levels in the wet-well, excluding upstream sewers. Structures that either don't contain sewage (e.g. building superstructure) or rarely contain sewage (e.g. detention storage tank) don't need to be included in the headspace calculation if they are, or can be, partitioned to seal them from the areas that contain sewage. Partitioning can reduce the size of the OCU and therefore its capital and recurrent cost.

b) **Pressure**. A negative pressure of at least 5 Pa shall be maintained under all covers at all times so that fresh air leaks in through covers, etc. rather than odorous gases leaking out.

c) **Noise**. The odour control unit shall meet EPA's noise standards and guidelines. A noise design shall be signed off or prepared by an experienced and qualified noise engineer. A noise test report meeting EPA's standards and guidelines shall be provided to confirm this. This includes but is not limited to noise from fans, motors, duct work, etc.

d) **Discharge Velocity**. A minimum stack discharge velocity of 15 m/s (at the point of discharge) shall be achieved unless otherwise specified.

2.2. Air Treatment Unit

a) **Performance Requirements**. The discharge concentrations at the design flowrate in the vent stack shall achieve the following performance requirements, irrespective of how many stages of treatment are applied:
    - <0.1 ppm Hydrogen Sulphide

- <0.02 ppm Mercaptans (thiols)
- <500 Odour Units (OU) for network assets

b) **Reductions to these limits** may be considered by South East Water where buffer, land use and plume assessments indicate there is a low risk of customer complaints should the odour discharge levels be higher.

2.3. Activated Carbon Units

a) **Minimum activated carbon bed life** shall be 24 months based on the agreed maximum loading rate. The design life is defined as the length of time between activated carbon media replacements based on breakthrough of gas contaminants above the performance requirements.
b) **Carbon Type.** The ACF shall be designed for KOH as the impregnated carbon and shall be filled with KOH for commissioning and proof of performance testing. Alternative options can be considered, but must be justified and approved by South East Water.
c) **Residence Time**. An activated carbon unit shall be designed such that the minimum empty bed residence time is at least 3 seconds at the maximum design air flow.
d) **Face Velocity**. An activated carbon unit shall be designed such that the face velocity is less than 0.25 m/s.

2.4. Biotrickling Filters (BTFs)

BTFs shall be designed:

a) To achieve a target of 95% and a minimum of 90% **hydrogen sulphide** removal efficiency, unless otherwise agreed with South East Water.
b) To achieve a target of 95% and a minimum of 90% **odour removal** efficiency, unless agreed with South East Water.
c) Such that the minimum **empty bed residence time** is at least 12 seconds at the design flows and provides the required removal efficiencies for both hydrogen sulphide and odour at this residence time.

The design basis, or design calculations, which demonstrate compliance with the above shall be provided to South East Water.
All site drawings shall be suitably updated with the modifications undertaken at site.

3. Physical Requirements

Unless specified otherwise, all ATUs shall adhere to the following:

3.1. General

a) **Risk Assessment.** In areas where there is a history of flammable gases levels exceeding 90% of the Lower Explosive Limit (LEL) (as informed by South East Water), a site specific risk assessment shall also be provided, which identifies and controls risks posed by sewerage system gases.
b) **P&IDs**. All PIDs shall conform to the nominated standard P&ID s indicated in Appendix A and B, unless otherwise agreed by South East Water.

c) **Materials**. All components of the system shall be constructed from materials suitable to the environment in which they will operate. Refer to South East Water specification AM2739: Corrosion Mitigation.
d) **Fasteners**. All metal fasteners (screws, nuts, washers and bolts) shall be stainless steel 316 as a minimum to prevent corrosion.
e) **Colour**. All outdoor elements visible to members of the public should be finished to Australian Standard colour G62 Rivergum. Where the manufacturer has not constructed equipment with the exact required colour and requires blending colour tints to match the required colour, a sample piece at least 100mm x 100mm square on the same substrate as the final equipment shall be provided for approval prior to construction. Sheet metal / plate surfaces / pipework / cabinets shall be powder coated 300 micron thick.
f) **Drainage** shall be provided from all vessels (e.g. pre-filter, mist separator, fan, ACF/BTF, vent stack) and low points in the ductwork that may accumulate liquid condensate. The drainage offtake shall be at the lowest point and shall include a SS316 ball valve at the drain offtake. The condensate shall discharge to a sewerage asset (wet-well or sewer), ordinarily by gravity. Gravity lines shall be graded at 1 in 60 or steeper. All materials used for these drains shall be corrosion resistant.
g) **Water Seals** in the form of traps are required on all drainage lines to prevent air leaks through the drain, e.g. short circuiting between ventilation system components or fugitive emissions. Each trap shall have sufficient water head to stop the system's air pressure from pushing the water out. Traps may be U, S, Q or J-shaped.
h) **Water Seal Access**. As condensate can evaporate or fats in the condensate can solidify, traps require top access points to allow water seals to be manually inspected, replenished and/or unblocked. Water seals must not impact access to any component of the ATF.
i) **Sample points**/ports compliant to the relevant standards (including but not limited to AS 4323.1, AS4323.3 and ISO10780) shall be provided in suitable locations to demonstrate compliance with all the performance requirements. At minimum this requires the following types of sample ports:
    - 100mm port installed for measuring hydrogen sulphide concentration using an Odalogger unit (refer MRWA-S-402, Fig 402-A2). An eye bolt made of stainless steel 316 to be fitted to each port lid to allow for the Odalogger to be tied off to.
    - Two 25mm (minimum) ports at 90 degrees to each other and with suitable straight pipe runs before and after for airflow measurement as per ISO10780 and AS4323.1.
j) If the ATU is being retrofitted and the requirements of these standards cannot be met, then this shall be highlighted to South East Water as soon as practicable and an agreed alternative implemented.
k) **Control, SCADA and HMI**. All alarm set points shall be provided to South East Water for approval prior to commissioning. All Control and SCADA shall be as per AM2779_Treatement Plant PLC and SCADA Standard Specification. All must be controlled by the site PLC/RTU and HMI. The HMI shall provide analogue & digital operating statuses, set points, alarms.
l) **Instrument Test Points**. All pressure instruments require test points for calibration and maintenance. All fittings shall be threaded SS316 Swagelok. All test points shall be 1/4".
m) **Instrument Weather Protection**. All instrumentation is to be adequately protected from weather and UV. Refer to SEW's Electrical Specification and Instrument Specification for the type of enclosures and method for weather and UV protection.
n) **Access**. The infrastructure of all access/sampling/maintenance points shall provide for safe operations and maintenance usage noting that operations' vehicles don't carry ladders e.g.

all bolts on top covers shall be accessible without exposing workers to falling from heights risks.

o) **Ladders**. All ladders and stairs shall have adequate grip that meet current safety requirements, platforms with grating have clips in line with relevant Australian standards.

p) **Security**. All air treatment facilities shall either be located within a building or within a fenced compound as per South East Water document AM2759 Security Specification.

q) **Valves.** All valves on the induct and extraction duct shall be close-wise closing, including handles and gearbox wheels with opening and closing directions marked on the valve.

r) **Spares cabinet.** If an odour system is outside or the existing building is not large enough, suitably sized aluminium cabinet coloured G62 Rivergum shall be provided to store all replacement and consumables: pre- filter elements, minimum of one 20L nutrient bag or more if required to fill a nutrient tank from empty to full, a stainless mixing bucket and stick, mechanical scales. The cabinet must be secured with SEW Abloy M3 barrel/cylinders. Cabinet to be labelled as Odour System Spares.

s) **Mixing bucket.** Where the system is designed to mix nutrients locally, a stainless bucket with a capacity of at least 8 litres and an appropriate stainless mixing stick shall be provided. They are to be stored onsite in the spares cabinet.

t) **Pre-filter.** A pre-filter a shall be installed on inlet side of extraction fan rather than the outlet side to prevent injury due to positive pressure inadvertently opening hatchways when replacing filter elements.

u) **Pre-heaters.** Preference is for pre-heaters to be excluded as a method to remove humidity.

3.2. Foundation

All ATUs shall be placed on a minimum 150mm thick steel reinforced concrete slab which is at a common level at all locations within the ATU area if practical (ie: no steps or raised edges). In addition to the plant and equipment being mounted on a concrete slab, the concrete slab shall extend to provide an apron of at least 1m around the outside of the plant and equipment where space permits. The slab surface shall be graded at 1 in 100 grade to drain surface water away from the ATU area.

3.3. Ventilation

a) **Vent Stack**. A vent stack compliant with MRWA-S-402 Table 402-A shall be provided. . It shall have an efflux cone to ensure maximum air velocity at discharge (in line with the performance requirements in this specification) and dilution into atmosphere. It should be noted that certain locations may require a different stack height based upon neighbourhood and community aesthetic concerns - such situations will be noted specifically by South East Water planning. The vent stack should have a sample port installed that is accessible and shall be fitted with a 25mm MNPT thread to enable breakthrough indicators to be installed to detect H_2S. A breakthrough indicator shall be installed in this sample port.

b) **Vent Cowling**. Unless otherwise stated the vent stack shall comply with the MRWA standard drawing - MRWA-S-402 - excluding the Figure 402-F educt cowl. Instead of this cowling, vent stacks shall have a corrosion resistance mesh across the top opening to prevent perching birds from falling into the stack and blocking it.

c) **Fan VSD**. The fan shall be installed with a VSD to ensure flexibility for changing conditions in the future (e.g. as the catchment develops). Fans shall function at the design air flowrate when the inlet valve to the duct is fully open. No throttling should be required.
d) **Fan Location**. If the unit has a carbon bed installed the fan shall be before the inlet and therefore be pushing air into the carbon bed. This is to allow the use of colourmetric breakthrough indicators on the carbon bed, which require a positive pressure to operate. All fans must have prefilters installed before them.
e) **Fan Material**. Fans shall be made of a minimum of 316 stainless steel enclosure and blades to prevent corrosion and damage caused by corrosive sewer gases. Fans must be direct drive / oil sealed. Smaller sites may also have plastic fans if suitable (<200mm Refer to approved products list for these).
f) **Fan Durability**. Fans shall be industrial heavy duty grade fans designed and manufactured for ducted industrial applications.
g) **Fan Motor**. The fan motor shall be intrinsically safe if in contact with the odour stream or mounted externally to avoid contact with odours. Fitted with a plastic cooling fan cover.
h) **Fan / Motor Enclosure. If the** fan/motor is mounted outside, it must be fitted in an acoustic enclosure. If the fan/motor is installed in a building, an enclosure will be required if the noise level of the fan is over 87dB. The building may be required to be modified to reduce noise outside to meet the EPA guidelines. The enclosure must meet EPA noise requirements and be stainless steel or aluminium, painted G62 Rivergum, fitted with an Abloy M3 Cylinders, vented to allow the motor and fan to be cooled.
i) **Fan Control**. The fan is to be operable and controlled via HMI and by the local controls on the switch board
j) **Fan Spare.** A spare fan shall be provided unless South East Water can confirm an identical one in their spare parts inventory. Factory vibration reports shall be provided for both the installed and spare fans to confirm the fan and motor bearing vibrations are within acceptable limits for its entire operating range.
k) **Ductwork**. Individual air inlet pipe shall connect the sewerage asset to each air treatment unit. Ductwork shall be gas tight to prevent odours escaping if the unit is off for an extended time and should include an adjustable damper and backdraft flap. Ducts must not obstruct safe operation and maintenance of the station. Ducts, and rigid & flexible joints should be designed for outdoor environment including UV degradation.
l) **Air Inlet (also known as an induct)** provides make-up (i.e. additional) air when there is insufficient air carried with the incoming sewage to achieve the flow rate defined in Section 2.1, as is often the case. When connected to a pump station the induct shall be positioned to minimise still air dead spots in the well, whilst maintaining adequate height above the sewage high alarm level of the pump station. If this is not possible, then this shall be highlighted to South East Water as soon as practicable, and an alternative agreement reached. The induct must have a manual damper so the make-up air can be manually tuned to suit sewage catchment development, and must close when the fan is idle, e.g. a flap damper with an adjustable counter-weight.
m) **Safety Signage**. A sign at the Fan and a sign at the fan control switch shall be installed and read as follows: "If Fan is planned to be off for 24 Hrs shut isolation valve to carbon tank". This is required to prevent odour entering the carbon bed and causing fire. Signs to meet requirements in AM2714 Electrical Specification.

3.4. Carbon Filter Units

3.4.1. Pre-Filter

a) **Allowable Types**. Vane type separators or mesh pre-filters shall be installed to remove aerosols and particulates from the odour airstream.
b) **Performance**. Pre-filters shall achieve a reduction in particulate, oil, fat and aerosol of 96% to a PM_1 standard as defined within ISO 16890.
c) **Monitoring**. A differential pressure instrument shall be installed across the pre-filter. This shall be connected back to SCADA and shall have high and low alarm points configured.
d) **Sizing**. The pre-filter and ducting shall be sized and designed so as to only require cleaning every 3 months. The filter size shall be 3 times greater than the induct cross sectional area.
e) **Access**. Pre-filter access panel shall have a lockable latch release mechanism installed so that it may be locked to prevent unauthorised access.
f) **Material**. Pre-filters shall be made of stainless steel 316 mesh / vanes and shall not be constructed of paper or fabric.
g) **Filter Spare**. A spare set of filters needs to be supplied with the original installation and stored at site within the air treatment facility (either within the building or a suitable aluminium cabinet).
h) **Drainage**. A drain outlet shall be supplied at the base of the pre filter to allow for draining of condensate.

3.4.2. Heater

a) **Performance**. Heaters shall reduce humidity to below 85% of saturation at the air temperature at the outlet of the heater.
b) **Components**. The heater unit shall have an electric heating element, thermostat or temperature probe and an isolation switch. Alternative technologies to reduce the humidity to the required levels will be considered on application to South East Water.
c) **Temperature Probe**. An industrial rated durable temperature probe shall be installed immediately downstream of the heater.
d) **Temperature Control**. A Man / Off / Auto selector switch shall be provided for the heater. When selected to Auto, the PLC/RTU shall automatically switch the heater on an off depending on the measured temperature and the start / stop settings set up in a Human Machine Interface (HMI) at the control panel. Fail safe implemented that when fan is off the heater is turned off.
e) **Alarm** points for the heater shall be setup in PLC/RTU as per the SCADA tag list and SCADA standard. The supplier shall specify the preferred heater outlet temperature and the low and high heater set point temperature set points.
f) **Measurement Ports**. Suitable 25mm ports shall be installed before and after the heater to allow for humidity and air velocity measurements (as per the relevant standards).
g) **Drain**. A drain outlet shall be supplied at the base of the heater to allow for draining of condensate.
h) **Spare Element**. At least one spare heating element shall be provided with all heaters.

3.4.3. Carbon Bed

a) **A differential pressure instrument** shall be installed across the carbon bed. This shall be wired back to PLC / RTU and have suitable high and low pressure differential alarm points configured.
b) **Access**. The media vessel shall have quick release access hatches (at approximately waist height if practical) of adequate size to allow for media replacement. The design arrangement shall mitigate manual handling risks as far as practicable (i.e stairs are preferred for top hatches rather than ladders).
c) **Media Replenishment**. For small units (<250kg of carbon), 12.5kg media bags can be used for media replacement, whilst larger units ($\geq$ 250 kg) shall have the appropriate infrastructure to be able to be filled by 500kg bulk bags (if practical).
d) **Media Monitoring**. A series of media sample points shall be fitted at multiple heights on the carbon tank. These shall be aligned with 25%, 50%, 75% and 90% carbon bed saturation. These sample ports shall be fitted with a 25mm MNPT thread to enable breakthrough indicators to be installed to detect H_2S. Breakthrough indicators are to be installed at each of these ports under positive pressure.
e) **Isolation and Safety Signage**. A carbon bed isolation valve shall be installed to allow the carbon bed to be isolated when the fan is switched off. This shall be a gas tight valve to prevent sewer gases entering the bed. A minimum of two visual warning signs (weather proof signs if located outside) shall be installed to alert service crews that the inlet valve must be closed when the fan is off.
f) **Corrosion Protection**. When a fiberglass tank is installed, a rubber mat shall be placed beneath it to prevent pooling of corrosive liquid and potential corrosion of the concrete underneath the fibreglass tank.
g) **A Media Specification** shall accompany each batch of carbon media supplied to South East Water. This shall be provided at the contractor's cost. The activated carbon supplied shall also be required to absorb the hydrocarbons that may be present at times.

3.5. Biotrickling Filter Units (BTF Units)

3.5.1. BTF Tanks

a) **Tank Manufacture**. BTF tanks shall be manufactured from GRP to BS EN 13121-3, a European standard which gives requirements for the design, fabrication, inspection, testing and verification of glass reinforced plastic (GRP) tanks and vessels.
b) **Asset Life**. BTF media shall be of a material such that its lifetime will be 10 years or longer. The design shall consider and plan for a safe and efficient media change after 10 years.
c) **Drain**. BTF units shall have an overflow and sump drains. pH sampling points shall be provided on the BTF drain.
d) **Safety Signage**. Weatherproof visual warning signs about acidic conditions and the need to wear chemical resistant gloves and safety goggles when working on BTF drainage needs to be supplied and installed.
e) **A differential pressure instrument** shall be installed across the BTF bed to measure the pressure drop. These instruments shall be placed so as to avoid water

accumulation in the sample lines. The instruments shall be connected to the PLC / RTU and have suitable alarms as per the standard.

f) **Access**. Nutrient/water sprays shall be removable from the BTF unit for maintenance without the need to access the tank internally.

g) **Liquor Recirculation**. From a practical point of view, South East Water has a preference for no recirculation of liquor over the BTF bed (i.e. a pH gradient will exist from neutral to acidic pH) unless the performance requirements for a particular site dictate that this will be inadequate, in which case alternatives will be considered by South East Water. Power needs to be located near recirculation pipework, so they recirculation pump can be powered during re-seeding.

h) **Valves and Instrumentation** shall be provided as per the P&IDs in Appendix A.

i) **Safety Shower and Eyewash Station**. A safety shower and eyewash station shall be installed where a BTF is installed. Design and installation shall meet AS 4775 Emergency eyewash and shower equipment.

j) **Hose Reel.** A hose reel shall be provided where a BTF is installed. Where the hose reel cannot be installed indoors, it shall be mounted in a G62 coloured stainless or aluminium cabinet. Hose reels shall be from South East Water's approved list.

k) **Recirculation line.** Fit female ¾" camlock fittings with caps to allow for a temp recirculation pump to be fitted for setup when required.

3.5.2. Nutrient System

a) **Tank Size**. BTF units shall have a nutrient dosing tank that can hold a minimum of 6 months nutrient supply. That tank shall have easy access to water to fill, this can be in the form of a hose reel located nearby or via a direct plumbed connection to the water supply system.

b) **Design & Manufacture**. A weatherproof IP55 nutrient storage cabinet shall be supplied for bulk storage of nutrient bags on site. This needs to be either stainless steel 316 or aluminium and be powder coated in the current South East Water approved colour (refer general section). Ventilation points are required on the cabinet to prevent moisture contamination of the nutrient.

c) **Level Sensors and Alarms**. Nutrient storage tanks require a level sensor that shall be connected to SCADA with low, low-low and high level alarms.

d) **Label.** Where the nutrient tank is designed to be filled with a pre-mixed solution, a label close to the fill point shall be fitted to the tank with a table showing the volume in % at 0%, 20%, 40%, 60%, 80% and 100% vs volume in Litres.

e) **Level Sightglass.** A level sightglass to be installed to see liquid tank with top and bottom isolation valves to allow replacement of sightglass without taking the nutrient tank offline.

f) **Calibration Cylinder.** To allow calibration of the Dosatron or dosing system, a permanently installed calibration cylinder with suitable graduations must be installed to allow the flow rate to be checked by timing and drawing down over 2 minutes. Suction hose design and relative elevation to nutrient tank level shall be considered. The calibration cylinder and sightglass can be the same item.

g) **Mixing Sump Pump.** Where the system is designed for nutrients to be mixed on site, a permanently installed sump pump with an IP56 plug mounted within the nutrient tank for mixing of the nutrient. A power outlet with a 24hr switch must be installed to control the permanent sump pump.

h) **Permanent Potable Water Supply.** The nutrient tank must have a potable water supply permanently connected to the tank with a manual shutoff valve. This pipework and water supply must be sized to refill the tank from low level within an hour.

i) **Scales.** A set of mechanical scales must be provided to allow operators to measure out nutrient correctly.

3.6. Electrical & Instrument Requirements

3.6.1. Electrical

a) All controls shall be installed in the main switch board.

b) If the main switchboard is full then a full new tier must be installed. Add on boxes are not allowed.

c) Local marshalling panels may be installed in the field. These are to be stainless steel or aluminium painted G62 Rivergum

d) All control must be carried out in the main site RTU / PLC.

3.6.2. Instrumentation

a) All instrument lines must have Auto Drain: F92G-2GN-AT1 Filer Excelon Pro G1/4 + Bracket – Auto D Installed.

4. Commissioning Checklist

Item	Checked
Civil Components	
Rubber mats present beneath fibreglass tanks	☐
All screws, bolts and washers are stainless 316 (nylon washer are acceptable)	☐
All ladders and stairs have adequate grip that meet current safety requirements, platforms with grating have clips in line with South East Water standards	☐
All external assets are finished in line with South East Water approved standards (murals are an exception)	☐
All pipework is airtight to ensure the only air leaving the unit is through the vent stack	☐
Vent stack has anti-bird controls to prevent unit blockages	☐
All instruments are protected adequately from weather.	☐
All signage is correct and in place (safety signage and odour prevention signage (e.g. on air inlet isolation valve)) on valves and control cabinet	☐
Adequate sample points as per P&ID's are present and are at safe height with correct diameter and fittings (i.e. 25mm MNPT female connection for breakthrough indicators and 100mm minimum fittings for OdaLog installation)	☐
Sampling points in correct place on carbon bed	☐
Break through indicators installed and correct colour	☐
Drainage and U traps:	☐

• Full of water and operational. • Can be easily topped up with additional water • Are not lost when the station's extraction system is running, and • No air flow short circuiting via drain traps	
Well inlet valve isolation dampener seals and has warning signage affixed to ensure isolation when fan off	☐
Spare filter present onsite	☐
Carbon bed air inlet valve present and warning signs prominent	☐
Nutrient storage cabinet present and ventilated (BTF)	☐
Water top up for nutrient tank accessible (BTF)	☐
All site drawings have been updated	☐
Operational Status	
Fan producing correct airflow rate measured with the appropriate standard	☐
Fan VSD is set to correct speed (if applicable)	☐
Noise levels at site compliant with regulations and levels don't exceed design specifications	☐
Inlet valves are fully open when station running normally at design flows	☐
All instruments fully operational and correctly calibrated	☐
System shut down when LEL present (if required)	☐
Ability to control fan and heater through HMI	☐
All alarms feedback to SCADA, including from prefilter, heater, carbon bed and fan. Check all alarms working to prevent carbon damage.	☐
All performance requirements able to be tested	☐
Heater working and humidity at outlet checked to be below 85%	☐
Pressure instruments calibrated and verified working correctly. Pressure instrument calibrations supplied.	☐
BTF unit working correctly including verifying acidity of BTF discharge liquor pH correct at between 2 and 3 (BTF only)	☐

5. Performance Testing Requirements

5.1. Aim of Testing

The contractor shall demonstrate compliance with the performance requirements for the air treatment unit specified herein. This section provides the minimum requirements for satisfying the above aim. It does not preclude any additional testing, which the contractor may deem necessary.

5.2. Sampling Standards

All testing shall be compliant with the relevant standards including, but not limited to:

Parameter	**Standard**
Airflow and velocity testing	ISO 10780 and AS4323.1:1995
Odour (olfactometry) testing	AS 4323.3:2001
	EPA Victoria Publications 1666.1 and 440.1

The Contractor shall engage a National Association of Testing Authorities (NATA) accredited emissions testing consultants to undertake all sample collection and testing.

5.3. Test Locations

The following lists the proposed sample locations:

- Educt(s) from each wet-well/inlet chamber – i.e. in duct sample port to confirm velocity and airflow rates from each area
- Under access covers – i.e. temporary monitoring to confirm negative pressures
- Either side of heater – sample ports on either side of heater to confirm humidity reduction
- Inlet to ATU – i.e. in duct sample port for odour and H_2S
- Discharge from vent stack – i.e. in duct sample port to allow airflow, velocity testing, H_2S, odour and mercaptan testing
- Additionally for systems with a BTF – in duct sample port following the BTF (and prior to the ACF) to allow intermediate removal efficiencies of H_2S and odour to be determined.

All sample ports shall be designed to be compliant with the relevant standards for airflow and air stream characterisation as per the table above and MRWA-S-402, Fig 402-A2.

5.4. Sampling Equipment

The continuous hydrogen sulphide monitoring shall be undertaken with OdaLog logger (or equivalent) portable units that can be accessed without portable steps or ladders (these aren't carried by South East Water Operators). This installation should be such that it measures a representative air concentration, but that it is not impinged upon by liquids (sewage) (e.g. at high levels in the wet-well). The units shall be calibrated prior to installation to ensure accuracy. The in-situ accuracy of these units shall be confirmed by colourimetric tube hydrogen sulphide testing concurrent with the odour/sulphur characterisation detailed below. The tubes used shall have a suitable measurement range.

Odour samples are to be collected according to best practice and as per AS4323.3, EPAV Pub 1666.1 and EPAV Pub 440.1.
A suitable mercaptan measurement method should be employed, this may be via colourimetric tubes, or alternatives, provided the accuracy and range is sufficient to demonstrate compliance with the performance requirements.

5.5. Timing of Testing

The timing of the performance testing is to be agreed with South East Water prior to commencement of the project. Typically performance testing is undertaken once the ATU has reached its optimum performance and the sewerage system has been live for some time. This depends on the type of unit and can range from a week to 2 months following the unit going into service (for BTFs which require acclimatisation).

5.6. Reporting

All of the performance testing undertaken shall be compiled and analysed into a testing report to demonstrate compliance with the performance requirements of this specification. This shall be submitted to South East Water upon completion of testing.

5.7. Non-compliance with Performance Requirements

If any of the performance requirements are not met during performance testing, then the contractor shall inform South East Water and undertake the following at minimum:

- Determine the cause of the non-compliance/s
- Determine the options to rectify the non-compliance
- Provide a report to South East Water on the causes/options and actions to be undertaken
- Implement the actions agreed with South East Water at the contractor's expense
- Repeat the above process until the non-compliance(s) is rectified

5.8. Testing Schedule

Testing shall be completed in accordance with the following schedule:

Parameter	Criteria	Testing Requirements	Locations	Sampling Period
Velocity and airflow testing	Extraction airflow rates as per performance requirements achieved (e.g. > 10 ACPH) from wet-wells/inlet chambers	• Velocity and airflow testing to be compliant with ISO10780 and AS4323.1 • System to be running as per design intent at time of testing.	Velocity and airflow from each wet-well and any inlet chambers	• Velocity and airflow testing to be undertaken during the period when the characterisation (below) is being undertaken. • A minimum of 2 tests to be undertaken for each location and the uncertainty in the results quantified.

Parameter	Criteria	Testing Requirements	Locations	Sampling Period
Vent stack discharge velocity	Vent stack exit velocity requirement achieved as per performance requirements (i.e. > 15m/s discharge velocity)	• Velocity testing (if used) to be compliant with ISO10780 and AS4323.1. • To avoid the need for velocity testing at the point of discharge, it shall be demonstrated by calculation that the measured upstream velocity in the duct will upon release through the discharge cone achieve greater than 15m/s.	Suitable vent stack sampling port	Velocity testing to be undertaken during the period when the characterisation (below) is being undertaken.
Negative pressure under covers	Negative pressures maintained under all covers at all times as per performance requirements (i.e. < - 5Pa (negative pressure))	• Vacuum pressure testing with suitable portable pressure gauge • System to be running as per design intent at time of testing.	Under covers for all units to be extracted from	Negative pressure testing to be undertaken during the period when the characterisation (below) is being undertaken.
Relative Humidity	Relative humidity less than 85% after dehumidifier	Humidity testing with suitable portable humidity gauge	Suitable sampling port following heater and prior to activated carbon filter	• 3 measurements at peak dry weather flow times • Uncertainty in results to be quantified
Hydrogen Sulphide concentration prior to treatment	Quantify hydrogen sulphide concentration in extracted air prior to treatment	• Continuous online hydrogen sulphide monitoring. • System to be running as per design intent at the time of testing. • Transient hydrogen sulphide profile to be used to determine the daily patterns and peaks.	Suitable sampling port prior to ATU	• 2 weeks of continuous sampling to be undertaken to determine the transient emissions profile. • Hydrogen sulphide logging to be in place 1 week prior to the odour characterisation to enable peak identification.
Hydrogen Sulphide concentration being discharged at design flows	Quantify hydrogen sulphide concentration in treated air prior to release to atmosphere to achieve performance requirements (<0.1ppm H_2S)	• Continuous online hydrogen sulphide monitoring • System configuration to be normal • Transient hydrogen sulphide profile to be used to determine the daily patterns and peaks.	Suitable sampling port in duct following ATU	• 2 weeks of continuous sampling to be undertaken to determine the transient emissions profile. • Hydrogen sulphide logging to be in place 1 week prior to the odour characterisation to

Parameter	Criteria	Testing Requirements	Locations	Sampling Period
				enable peak identification.
Odour concentration being discharged at design flows	Quantify odour concentration in treated air prior to release to atmosphere to achieve performance requirements (<500 OU)	• Odour sampling to be undertaken by a NATA certified lab and compliant with AS4323.3, EPAV Pub 1666.1 and EPAV Pub 440.1. • Samples to be collected in duplicate at minimum • Uncertainty in results to be quantified • Sampling for odour to be undertaken at peak times as determined from the previous week of online H_2S monitoring.	Suitable sampling port in duct following ATU	3 grab samples at peak emissions to be completed over 1 week period
Mercaptan concentration being discharged at design flows	Quantify reduced sulphur compounds (RSC) concentration in treated air prior to release to atmosphere to achieve performance requirements (< 0.02ppm mercaptans)	• GasTech tube samples to be collected in duplicate at minimum • Uncertainty in results to be quantified • Sampling for RSC to be undertaken at peak times as determined from the previous week of online hydrogen sulphide monitoring.	Suitable sampling port in duct following ATU	3 grab samples at peak emissions to be completed over 1 week period
Odour concentration entering BTF	For BTFs only – quantify odour concentration in extracted air prior to treatment	• Odour sampling to be undertaken by a NATA certified lab and compliant with AS4323.3, EPAV Pub 1666.1 and EPAV Pub 440.1. • Samples to be collected in duplicate at minimum • Uncertainty in results to be quantified • Sampling for odour to be undertaken at peak times as determined from the previous week of online hydrogen sulphide monitoring.	Suitable sampling port in duct prior to BTF	3 grab samples at peak emissions to be completed over 1 week period
Hydrogen Sulphide concentration being released from BTF	For BTFs only - quantify hydrogen sulphide concentration in treated air prior to entering activated carbon unit to	• Continuous online hydrogen sulphide monitoring • System to be running as per design intent at the time of testing	Suitable sampling port in duct following BTF and prior to ACF	• 2 weeks of continuous sampling to be undertaken to determine the transient emissions profile.

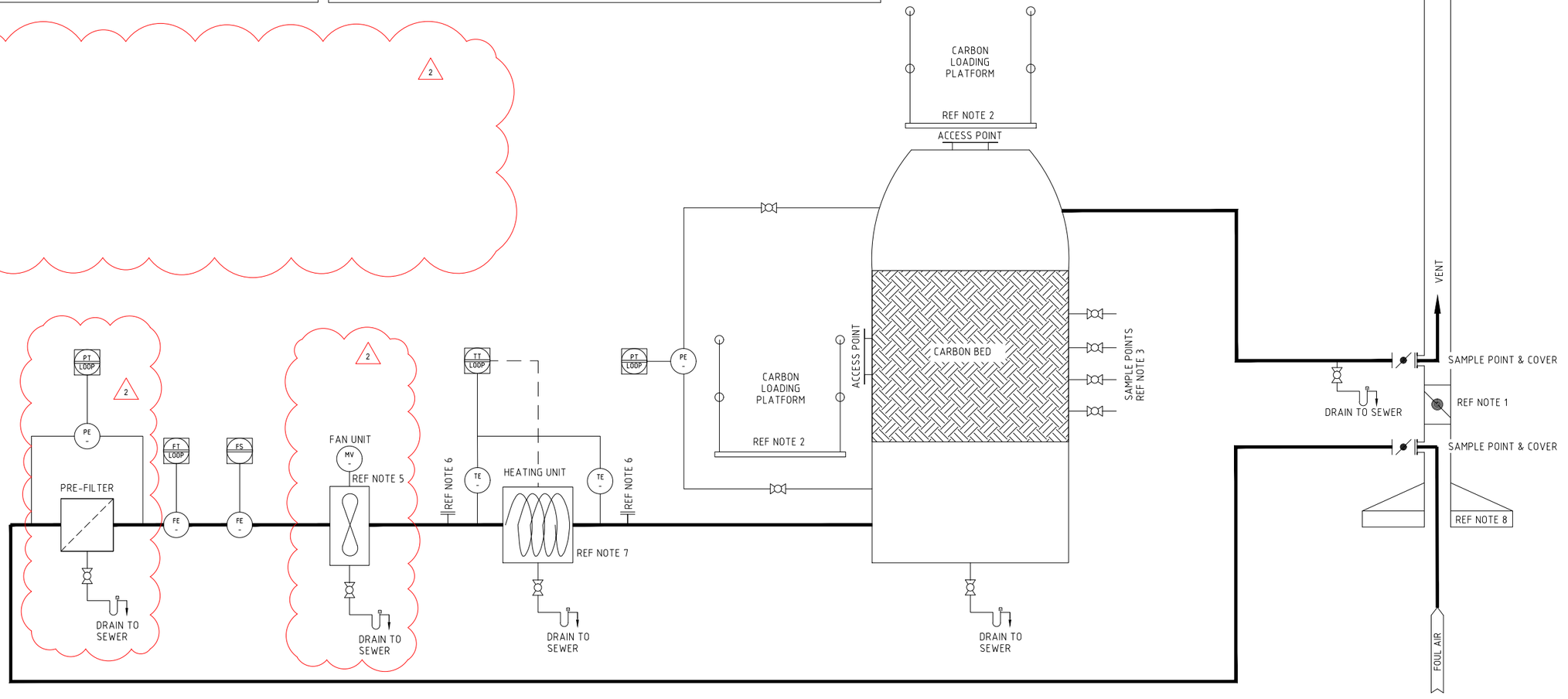
Parameter	Criteria	Testing Requirements	Locations	Sampling Period
	determine % removal in BTF	• Transient hydrogen sulphide profile to be used to determine the daily patterns and peaks.		• Hydrogen sulphide logging to be in place 1 week prior to the odour characterisation to enable peak identification.
Odour concentration being released from BTF	For BTFs only - quantify odour concentration in treated air prior to entering activated carbon unit to determine % removal in BTF	• Odour sampling to be undertaken by a NATA certified lab and compliant with AS4323.3, EPAV Pub 1666.1 and EPAV Pub 440.1. • Samples to be collected in duplicate at minimum • Uncertainty in results to be quantified • Sampling for odour to be undertaken at peak times as determined from the previous week of online hydrogen sulphide monitoring.	Suitable sampling port in duct following BTF and prior to ACF	3 grab samples at peak emissions to be completed over 1 week period

6. Appendix A: Standard Process and Instrumentation Diagrams

RELEVANT PROCESS SYMBOLOGY

- BALL VALVE (STAINLESS STEEL 316)
- BALL VALVE - NORMALLY CLOSED (STAINLESS STEEL 316)
- BUTTERFLY VALVE
- ABC - INSTRUMENT, LOCALLY MOUNTED
- FNC LOOP - COMPUTER INTERFACE WITH SHARED FUNCTIONS FOR DISPLAY & CONTROL LOCAL PANEL MOUNTED
- MV - MOTOR - VARIABLE SPEED

NOTES:
1. ALL BUTTERFLY VALVES TO BE GAS TIGHT
2. PLATFORMS TO PROVIDE ACCESS TO ACCESS POINTS FOR MEDIA REPLACEMENT. FOR LARGER SITES, ACCESS SHALL BE SUITABLE FOR MEDIA REPLACEMENT USING 500 kg BULK BAGS. PLATFORM REQUIREMENTS DEPENDANT ON VESSEL HEIGHT.
3. SAMPLE POINTS TO BE LOCATED AT HEIGHTS: 25%, 50%, 75% AND 90%. CARBON BED SATURATION COLOURMETRIC BREAKTHROUGH INDICATORS TO BE INSTALLED IN EACH PORT.
4. VENT STACK SHALL BE 14m HIGH UNLESS OTHERWISE INDICATED.
5. FANS SHALL BE CONSTRUCTED OF SS316 EXCEPT FOR SMALLER FACILITIES (ie: PIPEWORK < 200mm DIAMETER) WHERE PLASTIC FANS MAY BE USED.
6. PROVIDE BLANK FLANGED OFFTAKE PORTS EITHER SIDE OF THE HEATING UNIT FOR HUMIDITY MONITORING.
7. ALTERNATE HUMIDITY REDUCTION TECHNOLOGIES MAY BE CONSIDERED WHERE THERE IS ADEQUATE EVIDENCE OF THE TECHNOLOGY BEING EFFECTIVE. HEATER UNIT ONLY REQUIRED WHEN THE ACTIVATED CARBON UNIT IS BY ITSELF, ie: IT IS NOT DOWNSTREAM OF A BIO-TRICKLING FILTER.
8. REFER MRWA-S-402 FOR ADDITIONAL INFORMATION ON VENT CONSTRUCTION.



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WARNING

BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHALL BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

ISSUED FOR INFORMATION

REV	DESCRIPTION	JOB No	DRAFTER	DES. REVIEW	APP'D	DATE
2	DELETED POTABLE WATER , FAN & PRE FILTER SWAPPED		GIH	R.J	C.P	10.2021
1	FIRST PUBLICATION		R.J	M.T.	L.S.	01.2019
0	ISSUED FOR COMMENT	.	R.J.	M.T	C.P	11.2016

VENDOR DRAWING No: .

DESIGNER M.TESTON 11.2016	DRAFTER R.JAGGER 11.2016	SEW PROJECT MANAGER C.PAXMAN .	
DESIGN REVIEW C.PAXMAN 11.2016	DRAFT CHECK R.JAGGER 11.2016	ASSET/ENG. MANAGER .	
APPROVED .			

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SOUTH EAST WATER
AIR TREATMENT ACTIVATED CARBON FACILITY
OUDOUR CONTROL UNIT
PID

DATUM: -
MELWAY REF: -
SCALE: NTS
SHEET SIZE: A1
SEW DRAWING NUMBER
SEW - STD - OCU1
SEW JOB No: .
2
REV

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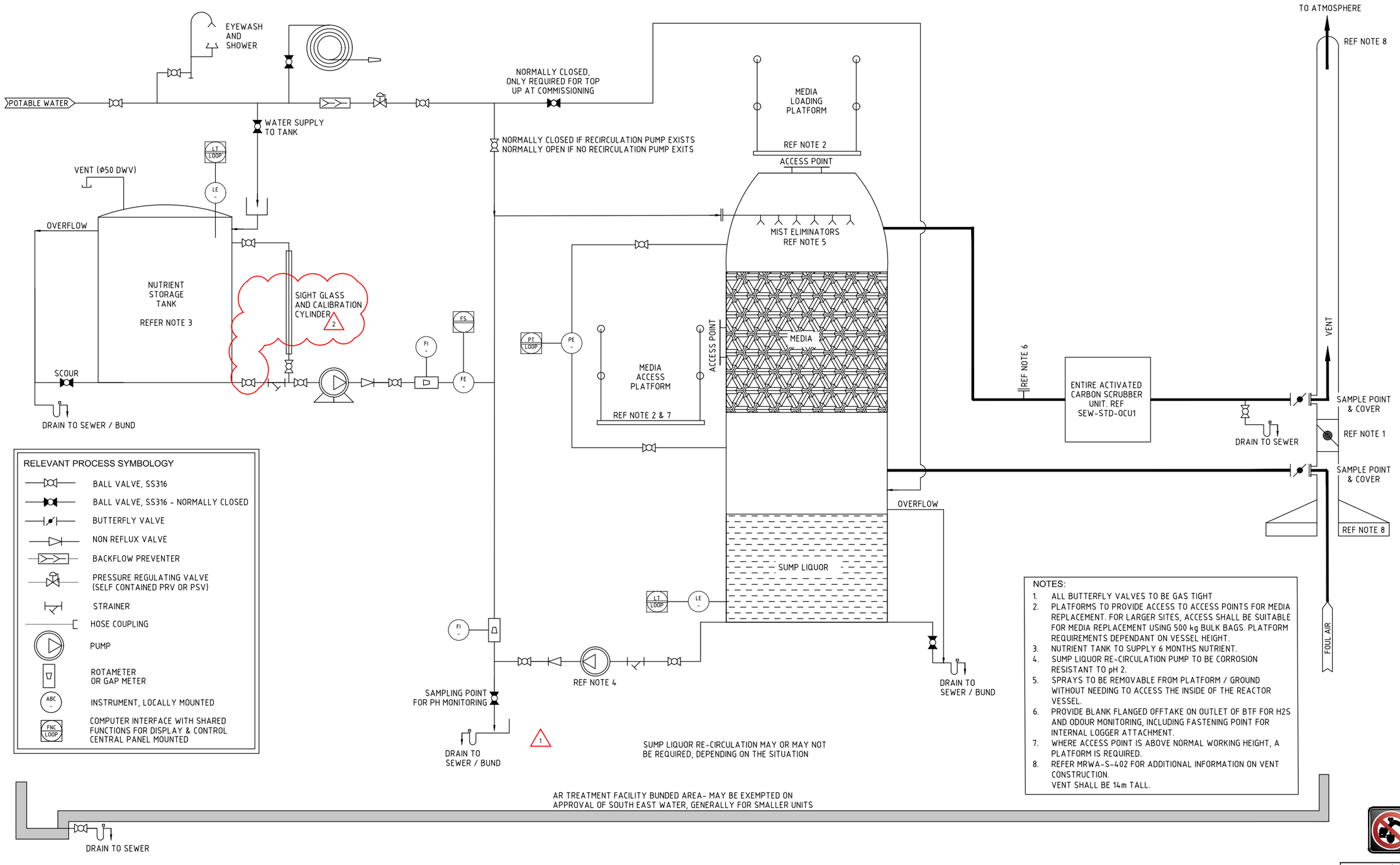
Plotted @ 08/11/2021 9:29am by ghaskins



RELEVANT PROCESS SYMBOLOGY

- BALL VALVE, SS316
- BALL VALVE, SS316 - NORMALLY CLOSED
- BUTTERFLY VALVE
- NON REFLUX VALVE
- BACKFLOW PREVENTER
- PRESSURE REGULATING VALVE (SELF CONTAINED PRV OR PSV)
- STRAINER
- HOSE COUPLING
- PUMP
- ROTAMETER OR GAP METER
- ABC – INSTRUMENT, LOCALLY MOUNTED
- FNC LOOP – COMPUTER INTERFACE WITH SHARED FUNCTIONS FOR DISPLAY & CONTROL CENTRAL PANEL MOUNTED

NOTES:

1. ALL BUTTERFLY VALVES TO BE GAS TIGHT
2. PLATFORMS TO PROVIDE ACCESS TO ACCESS POINTS FOR MEDIA REPLACEMENT. FOR LARGER SITES, ACCESS SHALL BE SUITABLE FOR MEDIA REPLACEMENT USING 500 kg BULK BAGS. PLATFORM REQUIREMENTS DEPENDANT ON VESSEL HEIGHT.
3. NUTRIENT TANK TO SUPPLY 6 MONTHS NUTRIENT.
4. SUMP LIQUOR RE-CIRCULATION PUMP TO BE CORROSION RESISTANT TO pH 2.
5. SPRAYS TO BE REMOVABLE FROM PLATFORM / GROUND WITHOUT NEEDING TO ACCESS THE INSIDE OF THE REACTOR VESSEL.
6. PROVIDE BLANK FLANGED OFFTAKE ON OUTLET OF BTF FOR H2S AND ODOUR MONITORING, INCLUDING FASTENING POINT FOR INTERNAL LOGGER ATTACHMENT.
7. WHERE ACCESS POINT IS ABOVE NORMAL WORKING HEIGHT, A PLATFORM IS REQUIRED.
8. REFER MRWA-S-402 FOR ADDITIONAL INFORMATION ON VENT CONSTRUCTION.
   VENT SHALL BE 14m TALL.

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WARNING

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ISSUED FOR INFORMATION

REV	DESCRIPTION	JOB No	DRAFTER	DES. REVIEW	APP'D	DATE
2	SIGHTGLASS NOTE CHANGED & VALVE ADDED		GIH	R.J	C.P	10.2021
1	FIRST PUBLICATION		R.J	M.T.	L.S.	01.2019
0	ISSUED FOR COMMENT	.	R.J.	M.T	C.P	11.2016

VENDOR DRAWING No: .

DESIGNER M.TESTON 11.2016	DRAFTER R.JAGGER 11.2016	SEW PROJECT MANAGER C.PAXMAN .
DESIGN REVIEW C.PAXMAN 11.2016	DRAFT CHECK R.JAGGER 11.2016	ASSET/ENG. MANAGER . .
APPROVED . .		

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SOUTH EAST WATER
AIR TREATMENT ACTIVATED CARBON FACILITY
AIR TREATMENT BIO-TRICKLING FILTER
PID

DATUM: -	
MELWAY REF: -	
SCALE: NTS	SHEET SIZE: A1
SEW DRAWING NUMBER	
SEW - STD - OCU2	2
SEW JOB No: .	REV

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Plotted @ 08/11/2021 9:36am by ghaskins