Wellington Water

Monday 5 February 2024

OIA IRO-549
Name: [redacted]
Email: [redacted]@gmail.com

Kia ora [redacted]

Official information request Seaview Wastewater Treatment Plant.

Thank you for your official information request dated Wednesday 22 November 2023, which was transferred to us from Hutt City Council on Thursday 14 December 2023.

The Local Government Official Information and Meetings Act 1987 (the Act) requires that we advise you of our decision on your request no later than 20 working days after the day we received it. Unfortunately, we cannot meet the timeframe and must therefore extend the time to make our decision to Monday 19 February 2024.

This extension – which is being made in accordance with Section 14(1)(b) of the Act – is necessary because consultations necessary to make a decision on your request are such that a proper response cannot reasonably be made within the original time limit.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

Ngā mihi,

[redacted]

[redacted]
Governance Coordinator

Wednesday 7 February 2024

OIA IRO-549
Name: [redacted]
Email: [redacted]@gmail.com

Kia ora [redacted]

Official information request Seaview Wastewater Treatment Plant.

Thank you for your official information request dated Wednesday 22 November 2023, which was transferred to us from Hutt City Council on Thursday 14 December 2023.

You requested all information and documents (correspondence, emails, reports, advice) that refers to whether the bio filter replacement on the Seaview Wastewater Treatment Plant will be an effective long-term solution to the odour problems caused by the Seaview Wastewater Treatment Plant.

We have considered your request in accordance with the Local Government Official Information and Meetings Act 1987 (the Act) and determined that we are able to grant your request in part.

We will provide you with the requested documentation in due course.

Pursuant to Section 7(2)(a) of the Act, some information within that documentation may be withheld to protect the privacy of individuals.

Our IT team pulled 2,102 items and following advice from officers to narrow the scope from July 2020 (following the treatment plant receiving significant non-compliance from July 2020 to June 2021 compliance period for Odour Consent) to the date you made your request, this presented 1,832 items. Given the significant volume of correspondence, we are declining this part of your request in accordance with Section 17(f) of the Act.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

Ngā mihi,

[redacted]

[redacted]
Group Manager, Network Management Group

Activity brief

Council:	Hutt Valley JV
Suburb(s):	Seaview WWTP Catchment
Activity code:	TBC
Activity name:	Seaview WWTP Odour Treatment Renewal
Date:	23 May 2023

Document information

People involved

Activity	Title	Name	Electronic signature	Date
Prepared by	Senior Engineer	[redacted]	[redacted]	04/05/23
Checked by	Principal Wastewater Engineer	[redacted]	[redacted]	10/05/23
Input and reviewed by Network Management Group	WWTP Contract Manager	[redacted]	[redacted]	12/05/23
Input and reviewed by Network Management Group	Senior Wastewater Operations and Assets Advisor	[redacted]	[redacted]	10/05/23
Input and reviewed by Service Planning	Senior Asset Engineer	[redacted]	[redacted]	10/05/23
Approved by	Chief Advisor	[redacted]	[redacted]	19/5/23

Revision history

Date	Version number	Description of change
21/04/2023	0.1	Draft for internal review
23/05/2023	1.0	Final

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1 Purpose of activity brief

The purpose of this activity brief is to define the outcomes for the Seaview Wastewater Treatment Plant (WWTP) Odour Treatment renewal and upgrade project.

The objective of this activity is to renew and upgrade the odour treatment equipment, as the existing configuration is no longer delivering compliance with the odour consent conditions for the site. The renewal and upgrade of odour extraction and treatment equipment must be able to achieve odour compliance over the expected 20-year life of the new equipment and provide a safe working environment for operators.

2 Activity definition

2.1 Activity approval

This activity brief is a result of repeated odour complaints in the vicinity of the Seaview WWTP, and condition assessments showing that work is required on the odour extraction and treatment system to achieve consent compliance and in some instances, to provide a safe working environment.

In March 2023, the Hutt Valley Services Committee, a joint committee of HCC and UHCC, requested that WWL report back to the community monthly and to the committee at future meetings on the progress of investigations for odour management at the site, indicating that resolving the odour issues is a critical project from a governance perspective.

The project has been included in Planned Renewals in the Capital Delivery Programme for Year 3 and Year 4.

2.2 Investment area

The investment portfolio element for this project is Wastewater Treatment Plants renewal. Currently approved investment planning for this activity is as described below:

- The Adopted LTP-21 includes:
  - Allowances for *Seaview odour treatment upgrades*, as:
    - $100K in Year 4 (FY25)
    - $5.9M in Years 9 thru 11 (FY30 thru FY32).
  - *Aside:* an allowance for air discharge consent renewal in Years 14 & 15 (FY35 & FY36)
- The Capital Delivery Programme (CDP, ref. LTP-21 years) includes:
  - Approved Years 2 & 3:
    VS0014 *HCC JV WWTP PLANNED Renewals*, 4.4M
  - Draft Years 3 & 4 (pending all of Councils' approval, *imminent*):
    Seaview WWTP Odour Control Modification/Upgrade, $400K.

It is notable that current financial planning has revised the priority of activity under this specific scheme of work, and so brings forward the fall of cost for this and other planned upgrades at the Seaview WWTP and has also increased the expected scale of work based on new understanding. This is reflected in the "Second Cut" submission of the Unconstrained 30-Year Plan for the NTU (March '23), which included around $15M in the first three years (i.e. FY25-on) for this scheme.

2.3 Customer outcomes and service goals

The primary and secondary customer outcomes and service goals linked to this activity are shown in the table below.

Table 1: Customer outcomes and service goals

Primary customer outcome		Outcome 2: Respectful of the environment
Primary goal		2.4 We ensure the impact of water services is for the good of the natural and build environment
Secondary customer outcome		Outcome 1: Safe and healthy water
Secondary goal		1.2 We operate and manage assets that are safe for our suppliers, people and customers

2.4 Service objectives and performance measures

The primary and secondary service goal objectives and performance measures are shown in the table below.

Table 2: Service objectives and performance measures

Primary service objective	Water services are managed to comply with consents
Primary performance measure	Full compliance with the odour-related consent conditions for the Seaview WWTP – WGN950162 (01).
Secondary service objective	Water services are delivered in a way that is safe for our suppliers, people and customers
Secondary performance measure	The odour treatment system at the Seaview WWTP shall be fit for purpose and provide a safe working environment to meet new standards around H_2S.

2.5 Service goal risk score

This activity has a primary service goal risk score of 25 out of 25.

The service goal risk score is worked out by probability x consequences.

The table below shows the probability and consequences rating currently.

Table 3: Probability and consequences rating - current

Score Component	Current Risk Score Rating (1-5)	Residual Risk Score Rating (1-5)	Comments
Probability	5	1	Greater Wellington Regional Council is investigating odour complaints relating to the site, and have issued an Abatement Notice (June 2021), followed by an Infringement Notice as a result of non-compliance with the Abatement Notice (April 2023). Investigations have shown that odour equipment requires remediation. WWL is obliged to ensure safe working conditions in terms of air quality for employees.
Consequences	5	5	Failure of the odour system will lead to non-compliance and ultimately prosecution, as well as potentially un-safe working conditions.
Inherent Risk Score	25	5	This brief will address the currently identified odour issues with a solution that should reliably achieve odour consent compliance for the next 20 years.

3 Activity description

3.1 Why is this activity needed?

A well-functioning odour extraction and treatment system is critical in achieving compliance with the odour consent for the Seaview WWTP. The WWTP site is located within a light industrial area in Lower Hutt, and operates with the same odour treatment system that was installed at commissioning in 2001. Odour complaints received have escalated in the period 2021-2023, leading to an odour investigation in April 2023.

The investigation identified components of the odour treatment system that require remediation, replacement, or upgrade to ensure the WWTP can meet its odour consent. Operational decisions have been made recently (to increase odour extraction rates with existing equipment) that mean there is no standby or spare capacity in the odour system.

An odour survey undertaken as part of the odour investigation identified other industrial odour sources outside of the WWTP site that may be contributing to odour complaints in the general area. There is no fixed odour / gas monitoring or weather monitoring equipment to support reporting of odour complaints.

Veolia have also undertaken an asset condition assessment of odour components and identified remediation or replacement is required.

Given the escalating nature of the odour complaints, resolving the site's odour compliance is of specific concern to the Hutt Valley Joint Venture Committee.

In some areas of the WWTP, improved odour extraction and treatment is required to provide a safe working environment, while also supporting odour consent compliance.

3.2 What are the problems?

Table 4 lists the odour treatment issues identified at the Seaview WWTP to date.

Table 4: Known Odour Issues

Area	Issue	Comment
Inlet Works Building	When milliscreen covers are off for maintenance or cleaning, milliscreen building air quality does not meet new H_2S standards.	Consider appropriate level of building ventilation with localised treatment before discharge to air.
Grit Bin	No cover on sludge handling grit bin, may be a source of fugitive emissions.	Veolia to provide permanent cover on grit bin or plastic bag arrangement under site management requirements.
Screenings Bin	Uncovered, source of odour.	Veolia to resolve covering & extraction.
Existing Odour Ducting	Condition of joints of concern. Reports indicate some ducting may potentially be blocked (due to degree of deterioration?)	Veolia to repair identified leaks.
Existing Odour Ducting	Ducting condition to be reviewed to determine remaining life.	Consider refurbishment or replacement of ducting.
PST Headspace Extraction	Handrail deterioration above PST indicates that cover seals may be in poor condition.	Veolia to refurbish PST cover seals to reduce fugitive emissions and optimise extraction of odour air from PST headspace. Project team to advise if issues in this area are not resolved once repairs completed
Odour Fans	Leaking seals observed. Fans operating at full capacity.	Consider installation of suitably sized fans to provide adequate levels of odour extraction from existing and any new odour sources if original duty are flow rates are no longer considered adequate.
Biofilter	H_2S measured above biofilter surface. Short circuiting air flow observed around biofilter walls.	Veolia to undertake replacement of biofilter media as maintenance. Project team to consider condition and suitability of plenum, and potential

	Surface of biofilter covered in plant growth. Media deteriorated. Damage to plenum. Potential accumulation of solids in plenum.	accumulation of fatty solid material in plenum acting as odour source. Consider short-circuiting and whether baffles are present inside biofilter. Consider suitability of current biofilter size & odour treatment redundancy, and provision of online instrumentation for improved monitoring & control (moisture & pH). Consider provision of alternative odour treatment technology, given temperature variation experienced within the biofilter when dryer is on/off.
Storm Tank (when emptying)	Settled solids in storm tank are a source of odour when emptying lower levels.	Consider installation of stirring equipment to maintain odourous sludge in suspension when emptying, or flushing and return to return liquors, or similar solution. Define if it will make an appreciable difference to odour at the site.
Odour System Instrumentation	Biofilter back pressure monitoring installed. Biofilter moisture, air flow and temperature monitoring not installed or operational.	Consider installation of modern odour treatment system process monitoring equipment to ensure improved odour extraction & treatment monitoring, reduce operator input.
Dryer building	Dryer building vents to atmosphere (roof mounted fans). Fugitive emissions in dryer building from strong odour sources such as sludge bins and dryer itself.	Consider installation of localised treatment (i.e. carbon filter) on air extracted from dryer building. Solution should consider finite life of existing dryer building.
Odour monitoring (permanent)	No permanent odour monitoring equipment on boundary.	Consider installation of gas monitoring equipment and weather monitoring station on site boundary to support odour management (particularly of complaints).
Solids Treatment & Storage Tanks/Silos	Some leaks observed, around tank joints/seals.	Resolve fugitive emissions from solids handling equipment, identify whether equipment needs refurbishment of seals or replacement if degradation indicates it's required. May be undertaken as normal maintenance by Veolia.
'Water Trap' Backup Odour Air Release System	Strong odour observed in polymer makeup room - hypothetically from odour air being released to floor drainage	Consider whether secondary odour air system is appropriate (with respect to installed standby odour fan capacity)

	system (as designed) due to high biofilter pressure currently.	and remove odour air connection to water drains as appropriate.
Operator Health & Safety	Odour extraction rates from existing equipment and buildings must meet new Health & Safety workplace exposure standards (i.e. new H_2S limits).	Ensure forced (not passive) odour extraction rates from areas that operators regularly access are adequate to provide a safe working environment. E.g. centrifuge room.

3.3 Past investigations & reports

The following investigations and reports have been prepared for the odour treatment system at Seaview WWTP:

- STNZ 2021 – This report identified a number of system and equipment changes that could be made to optimise odour performance of the existing equipment. Veolia subsequently carried out the 'easy wins'. Air flow monitoring was undertaken to determine air extraction rates from equipment. Refer to Appendix B for further information.

- STNZ 2023 – This report was undertaken to follow up on the 2021 report and identify if the physical works had resulted in an appreciable improvement in the surrounding area. A number of areas where fugitive emissions were occurring were identified; a major recommendation was the replacement of biofilter media. Refer to Appendix B for further information.

- Air Quality 2023 – An odour survey over eight days was undertaken in the vicinity of the WWTP to identify and report on odour. This report also measured H_2S and identified places around the WWTP site where fugitive emissions were observed, and provided commentary on how to resolve the issues. Again, the report indicates the highest priority is biofilter media replacement – but also presents a list in order of priority to resolve the odour complaints. Refer to Appendix C for further information.

- Veolia May 2023 - Asset condition assessment report is due in May 2023. Verbal advice of their asset condition assessment are in line with the findings of the STNZ & Air Quality reports.

3.4 Location

The Seaview WWTP is located at Waterman Street, Seaview.

Photos of the odour control system assets are found in the investigation reports supporting this activity brief.

3.4.1 Location map

Figure 1 shows the location of the odour boundary at Seaview WWTP.

Figure 1: Seaview WWTP

3.5 Activity objective

The objective of this activity is to:

- Refurbish, replace components, or upgrade the odour treatment equipment at Seaview WWTP with an efficient system that is capable of reliably and consistently achieving the current resource consent odour conditions.
- Provide a solution that also delivers a safe working environment for operators, to meet Worksafe's proposed new Workplace Exposure Standards for Hydrogen Sulphide: WES-TWA[1] of 1ppm and WES-STEL 5ppm in the year 2023.

3.6 Performance requirements and design criteria

3.6.1 Performance requirements

Assets refurbished or replaced as part of this activity brief must be capable of ***reliably*** meeting the relevant resource consent requirements, for their asset life.

3.6.2 Equipment requirements

The minimum asset life for various equipment types is defined in Table 5.

Table 5: Expected Asset Life

Asset Type	Expected Asset Life
Civil	50 years
Mechanical	20 years
Electrical	15 years
Instrumentation & Controls	7 years
Biofilter Media	4 years

Given the need to reliably meet resource consent conditions (avoiding asset failure as a cause of non-compliance), redundancy shall be considered as part of designing the solutions for this project. As relevant to each component of the odour system, the consultant shall review and propose a level of redundancy. The consultant shall define whether redundancy is achieved via critical spares or the number of installed units. WWL stakeholders shall then review and approve the level of equipment redundancy to be achieved.

3.6.3 Consent compliance requirements

The pertinent odour compliance criteria and sampling methodology that the odour system must achieve are summarised below:

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[1] WES-TWA: Workplace Exposure Standards – Time Weighted Average
WES-STEL: Workplace Exposure Standard – Short Term Exposure Limit
For more information, refer to document: Workplace Exposure Standards and Biological Exposure Indices, Worksafe, April 2022, Edition 13, OR latest published version.

"On completion of commissioning, there shall be no discharges to air that are noxious, dangerous, offensive or objectionable at or beyond the boundary of the property. These discharges include odour and dust."

Resource consent WGN950162 (01) stipulates the odour compliance the site must achieve. Refer to the resource consent (Appendix A), for complete understanding of the compliance criteria that the plant must achieve.

3.6.4 Other performance requirements

The selected equipment shall reflect Wellington Water's responsibility to its client to minimise operating costs while optimising treatment plant performance. Operating costs include electricity, consumables (media, chemicals, carbon filters), and operator attendance.

The proposed equipment shall be supported by the supplier for the defined asset life.

New equipment must be integrated into the plant's control system.

The components shall be resistant to corrosion for the environment into which they are installed, and/or modifications made to engineer an environment that is able to achieve the design life of the system components.

Capital and operating carbon are also important design considerations for WWL and shall be duly considered during the design development.

The physical works must be programmed in a way that the WWTP can maintain at least the design level of odour extraction and treatment during construction, or as agreed with Greater Wellington Regional Council.

3.6.5 Codes, Specifications and Relevant Documents

The project shall be undertaken in accordance with all relevant WWL codes, specifications and other standard documents. The performance requirements and design criteria should include, but are not limited to the following documents listed below:

- Current resource consents for the WWTP
- Wellington Water H&S Standards and Procedures (or Veolia equivalent)
- Wellington Water Regional Standard for Water Services
- Wellington Water Regional Specification for Water Services
- Wellington Water As-built Specification for Water Services
- Wellington Water Draughting Manual for Water Services
- Wellington Water Electrical Specifications Parts 1 through 4
- Any by-laws or requirements specified by the relevant Council
- NZ Standards and Legislation relating to the scope of work, in particular:
    - NZS 3106: 2009 Design of concrete structures for the storage of liquids
    - Hazardous Substances Regulations 2017 (HSNO)
    - The Building Act 2004

4 Scope of work

The overall scope of work is the optioneering, concept design, detailed design, tendering, construction, commissioning, asset testing, and hand over of an odour system capable of complying with the resource consent at Seaview WWTP.

4.1 Project Delivery

Delivery of this project is in accordance with the Programme Management Delivery Model. The key steps for successful delivery of this project include (at minimum):

General

- Co-operation with the site operations team (Veolia) and integration of new facilities into an operating plant with minimal disruption, while maintaining consent compliance as far as practicable during construction/commissioning works.
- Project Management and associated tasks including monthly progress reports.
- All documentation to be uploaded to the Woogle Project Site and filed correctly.
- Develop a detailed stakeholder engagement and communications plan to keep both internal and external stakeholders engaged and informed of the project's progress.
- Cooperation with the nominated Resource Consent advisor (to be advised).
- Deliver the project in accordance with the Programme Management Delivery Model, as relevant. This should include but not be limited to management of design, procurement, construction, commissioning, performance testing and operational support throughout.
- Contribution to monthly Seaview WWTP Programme meeting (for all consultants and contractors working on the site).

Phase 1 DEFINE

Investigation completed, identifying the need for the project defined in this Activity Brief.

HOLD POINT: NET to initiate Project and pass to Project Delivery.

Phase 2 PLAN

The Project Management Plan must reflect the urgency to resolve the current odour issues, and include a suitable allowance for communication with the Regulatory Authority regarding the resolution of the odour infringements.

HOLD POINT: Approval of Project Management Plan, including review by NMG/NET to ensure it is consistent with latest regulatory position.

Phase 3 CONCEPT DESIGN

In addition to the scope of work required by the Delivery Framework, this phase shall include:

- Proceed (via Phase 4 & 5) with short-term mitigation measure of expedited design and purchasing of immediate odour control solutions for zones where odorous air is extracted but un-treated (dryer & milliscreen building). A proposed solution is a carbon filter to be 'bolted on' to the existing extraction system. Alternative solutions can be considered by the project team.

- Review and identification of solutions to achieve compliance with new Workplace Exposure Standards (2023).
- Assessment of usefulness and efficacy of odour masking systems currently in use.
- Consider suitability & reliability of biofilter technology to treat odour and meet resource consent; where air streams treated in the biofilter consist of the 'base' and 'variable' sources. The variable air flow is the dryer air, and the base, or constant, air flow is all other air streams treated in the biofilter currently.
- Assessment of the odour control system backpressure release to water traps and underfloor drainage systems.
- Conduct options workshop with agreed assessment criteria. Options workshop shall utilise layout plans, and PFDs to demonstrate treatment solutions.
- Prepare a Concept design report compiling the Optioneering phase outcomes and recommendations.
- Liaise with regulatory authority as required by NMG Regional WWTP Contract Management team.
- Develop Level 3 CAPEX cost estimate as per the cost estimation manual, and develop OPEX cost estimate.

HOLD POINT: Provide Basis of Design Report for Wellington Water internal stakeholders to review and provide approval to proceed beyond Gateway 3.

Phase 4 DETAILED DESIGN

In addition to the scope of work required by the Delivery Framework, this phase shall include:

- Carry out design to a level appropriate for the preferred procurement approach for the preferred options and undertake design reviews with internal Wellington Water stakeholders. Detailed design should include all aspects of process, civil, structural, mechanical, electrical, instrumentation and controls design.
- Undertake Safety in Design (SiD) Review and ensure consideration of construction phasing and maintenance requirements are factored into the design along with other considerations noted in Section 3 of this Activity Brief.
- Provide updated CAPEX cost assessment as per the cost estimation manual, and updated OPEX assessment.
- Define necessary inputs to manage any temporary consent application requirements (WWL managed).
- Complete all requirements as part of Gateway 4 including design report.
- Prepare tender documents including specifications, schedules, data sheets, communications plan, and consent compliance plan.

HOLD POINT: Confirm funding allocated for construction and obtain approval from Wellington Water that the design meets the current required performance measures and to proceed beyond Gateway 4.

Phase 5 PROCURE

In addition to the scope of work required by the Delivery Framework, this phase shall include:

- As required by the project programming, managing the tendering process via Wellington Water procurement processes; noting that equipment supply and installation tenders may be separate (due to expediting equipment order) or combined, and phases 5-7 may be repeated for different parts of the project at different times according to funding availability or as the project knowledge progresses.

HOLD POINT: Confirm preferred tenderer and seek approval from Wellington Water to proceed beyond Gateway 5.

Phase 6 CONSTRUCT & COMMISSION

Construction, contract management, construction monitoring, commissioning, and asset proving of the solids handling upgrade in accordance with the gateway process and with consideration of the following items:

- Operator involvement during preparation of the Construction Management Plan, Commissioning Plan, commissioning and suitable operator training.
- Operations and Maintenance Manual submission to WWL/Veolia. Ensure appropriate training for operations staff around any process changes and modify/generate SOP (in specified format) for operating the system.
- Consideration with the timeline of any other construction projects on the site to avoid conflict during construction and additional risks.
- Liaison with Veolia to ensure health and safety requirements plus environmental management plans are being met, and to minimise the risks/impacts of construction on the ongoing operation of the WWTP.
- As-built documentation. Ensure P&IDs, FDS's, and site As-Builts are updated as part of the commissioning requirements.
- Ensure new equipment has been commissioned acceptably and is operating reliably to start performance proving period.
- Successfully complete performance proving period to ensure the odour control system meets operational and performance requirements set by Wellington internal stakeholders and that of the contracted operator, Veolia.

HOLD POINT: Demonstrate commissioning is complete, and performance proving period has met the required performance measures. Seek approval from Wellington Water internal Stakeholders plus Veolia (as operator) to move beyond Gateway 6.

Phase 7 COMPLETE

Complete all requirements of Gateway 6 to proceed into Defects Liability Period and close out project.

4.2 Key activities out of scope

The following activities are out of the scope of this Activity Brief:

- The odour treatment for the new sludge drying facility will be designed by the sludge drying project; however, the current sludge drying facility must be upgraded where practicable to support odour consent compliance until the new dryer project is commissioned.
- Change to the primary odour treatment technology being a bark bed biofilter, unless the project demonstrates an alternative will achieve improved compliance reliability.
- Consent condition changes with Greater Wellington Regional Council.

- ‘Maintenance’ repairs, as indicated in the Investigation Reports supporting this brief, as they will be undertaken by Veolia. For example, this includes replacement of seals and replacement of biofilter media. At the outset of the project, a meeting shall be held between the project team, Veolia and a Regional Contract representative to clearly identify which maintenance/repair works have or will be been undertaken by Veolia, and the degree of success achieved with those works. Any issues remaining in these areas must be defined by the project team.

Note – This Consultant is responsible for capturing any additional out-of-scope elements that are identified during the project and ensuring they are brought to the attention of the appropriate parties within Wellington Water.

4.3 Key dates

The Project Management Plan shall outline key dates for the project, and be agreed with Stakeholders in line with odour compliance requirements.

4.4 Deliverables

As part of the scope, a list of deliverables is required to be developed by the project team and submitted to Wellington Water for approval. As a guide, a list of deliverables is provided below for consideration for inclusion by the Project Team (but should not be limited to this):

4.4.1 Update existing documents:

- Site Operating Guide
- Site Hazard Register
- Process Flow Diagram
- Site P&IDs
- Site Functional Description – modify existing and create new sections as appropriate
- Site Plan
- Site Buried Services Plan and/or Hazardous Area Plan
- Environmental Aspects and Impacts Register
- Emergency Response Plan

4.4.2 Provide documentation for new plant:

- Operations & Maintenance Manuals (including Standard Operating Procedures) and indexed by plant / tag numbers / asset IDs etc. Hard copies to also be provided (loose leaf in binders).
- Functional Description
- Safety in Design Documentation
- HAZOP Documentation
- Hazardous Area Assessment and Dossier
- Basis of Design Report
- Final Design Report
- Equipment Information Sheets
- Lifting Plans
- Asset data schedule (for Veolia’s Asset Management System)

- Any relevant GIS files or information
- MSDS
- Electrical Code of Compliance Certificate
- Commissioning Plan
- Commissioning Results
- Asset Release to Service Forms
- Instrument Calibration Sheets
- SCADA Mimic Screens
- Capitalisation Information
- Consenting Info
- Preventative Maintenance and Renewal Schedule/s
- Critical Spares List
- Compliance Reports
- Training Schedule
- Warranties
- Operations Acceptance of Construction Works Form

4.4.3 As Built Drawings include:

- P&IDs
- General arrangement drawings
- Civil drawings
- Structural drawings including reinforcing details.
- Mechanical drawings
- Electrical Single Line Diagrams
- Electrical Cable Block Diagrams
- Control Schematics
- Cable loop diagrams

4.4.4 Other items:

- QR Coding and Integration into Veolia's Asset Management System.
- Adequate training delivered for Operators including training materials and recorded training session for future operators to refer to.

5 Significant risks

The known significant health and safety hazards and issues, as preliminarily identified in this section, are subject to the following conditions:

- The SID H&S risk assessment is a living document.
- The H&S risk assessment shall be updated throughout a project, by the project team.
- The current SID H&S risk assessment will be stored in the project's Woogle site.

5.1 Health and safety

The consultant shall be responsible for preparing a design health and safety risk assessment, and maintaining it for the life of the project.

The known significant health and safety hazards and issues, as identified in the assessment are:

- Contact with odorous air.
- Operating wastewater treatment plant – contact with biological hazards in the form of solids, liquids and aerosols.
- Confined spaces containing wastewater, with the potential for inundation or H_2S and CH_4 off-gassing.
- Interactions with existing live services, in particular electrical services.
- Working close to or over water and liquid vessels.
- Working at height, such as on the tops of tanks or near first-floor openings.
- Working adjacent to noisy, automatic, and/or remotely operated equipment, including those with deafening, crushing, cutting, or entanglement risks.
- Falling objects or machinery during the construction phase of the project.

Note:

- A SID H&S risk assessment is required to be developed by the project team and updated throughout.
- The Risk Assessment is a live document and must be reviewed and updated at key stages of the project (refer to Wellington Water Safety in Design process) and copies of the updated register provided to Wellington Water's project manager.
- The known significant health and safety hazards and issues, currently identified at the WWTP will be provided by Veolia as part of the project initiation phase.

5.2 Environmental risks

The initial environmental risks identified are:

- Impacts from failure to maintain odour treatment performance during construction.
- Loss of synthetic construction materials, such as packing wrapping or PVC offcuts, to the environment.

A detailed risk register will be created and maintained by the project team.

5.3 Project risks

A detailed risk register will be created and maintained by the project team. The initial project risks identified are:

- Increased risk of odour treatment non-compliance during construction.
- Maintaining compliance while new equipment is being replaced.
- Seismic performance of existing structures.
- Corrosive conditions / atmospheres.
- Uncertainty around project funding being adequate for project.
- Changes in growth profile.
- Climate change affecting WWTP site.
- Development encroachment affecting odour sensitivity.

6 Considerations

6.1 Design considerations

General design considerations include:

- The Seaview WWTP is an operational site at which work must not result in further consent non-compliance. Construction and commissioning of the work should be implemented with minimum operational disturbance to the existing site and without impacting the compliance. The ability to continue to manage odour at the site during installation works must be carefully considered by the supplier/contractor.
- Undertake the work with respect to any relevant regulatory requirements.
- Reduction of manual handling and operator input.
- Consideration of other associated assets.
- Consideration of the whole of life costs in the options assessment of the long-term solutions and reducing carbon footprint where possible.
- Designs and works must comply with the requirements of any environmental protection and/or Resource Management requirements in place at the site.
- Wellington Water H&S Standards. All contractors are required to be approved Wellington Water Contractors.
- Facilitate Safety in Design (SiD) and Project Risk workshops in all relevant stages with relevant personnel from Wellington Water as per Wellington Water SiD process. Incorporate outcomes in the final design.
- Arrange and facilitate a HAZOP workshop with all relevant stakeholders, and incorporate the workshop outcomes in the final design.
- Ensure the development of a commissioning plan that includes liaison and coordination with operational personnel regarding timing/procedures/testing required, to ensure safe and reliable operation of the plant during commissioning and performance testing.
- Confined spaces – avoid where possible.
- The site's current electrical supply capacity.
- Seamless integration with the plant's existing operation, monitoring, and control.
- Minimising fragmentation of the site's existing clear area to enable future WWTP upgrades.
- Safety in Design (construction).
- Safety in Design (operation).
- Hazardous Substances and New Organisms (HSNO) Act 1996 for any chemical cleaning System.
- Standardised equipment across Wellington region, where appropriate, to optimise maintenance knowledge and ultimately spares.

6.2 Specific design considerations

Specific design considerations include:

- Provide sufficient instrumentation to monitor the equipment being replaced, in a fit-for-purpose manner.

- Consider other minor repair / renewal works that need to be carried out to ensure the basic operation of any systems associated with the discrete project being undertaken.
- Ensure a safe environment inside any plant buildings.
- Ensure equipment can be maintained easily in the future.
- Minimise future corrosion risks.

6.2.1 Level of Service

Level of Service considerations are outlined in Table 6.

Table 6: Levels of Service

Process Unit	Comments
Reliability / Redundancy	The installed equipment shall meet the duty/assist/standby configuration as agreed with WWL and Veolia, during the Concept phase.
Energy efficiency	Energy efficiency is a critical consideration of any design.
Labour requirements & automation	Automatic start-up and remote operation without operator attention (i.e. overnight, outside of normal working hours) shall be designed. Normal operator site attendance and engagement shall be agreed.
Seismic resiliency	To meet importance level 3 – TBC.

6.3 Communication considerations

The project team shall engage with WWL operations team, Veolia (the site's operators), with support from GWRC, to create a Communications Plan that ensures all stakeholders are engaged when necessary, particularly with relation to effects on consent compliance.

6.4 Other considerations

6.4.1 Growth

Growth is expected to be observed at the WWTP, but there is no current expansion planned for the Maximum Flow value at the WWTP, or changes to the existing treatment processes at the site.

7 Cost estimate

7.1 Total cost estimate

Due to the recent emergence and evolving nature of this project, no formal cost estimate has been carried out yet. The Concept Phase must initially prepare a cost estimate based on the template on the WWL Cost Estimation Manual.

8 Stakeholders

8.1 Internal stakeholders

The internal stakeholders for this activity are shown in the table below.

Table 7: Internal stakeholders

Name	Contact Details	Role	When to Contact
[redacted]	[redacted]@wellingtonwater.co.nz	Senior Engineer, NET Activity Brief Author	• Technical queries • During design development • Clarification on brief related matters • Risk & SiD Workshops • Review of technical reports • HAZOP Attendance
[redacted]	[redacted]@wellingtonwater.co.nz	Principal Engineer Wastewater, NET	• Technical queries • During design development • Risk & SiD Workshops • Review of technical reports • Review of hold points
[redacted]	[redacted]@wellingtonwater.co.nz	Chief Advisor – Wastewater	• Programme and project risk updates • Changes to scope • Approval of hold points
[redacted]	[redacted]@wellingtonwater.co.nz	Wastewater Contracts – Manager	• Endorse project gateways from Regional Contract perspective • Workshops with external stakeholders • Level of service, operations & maintenance requirements • Wellington Water's interface with Veolia operations contract • Issuing contract instructions to Veolia, related to this project
[redacted]	[redacted]@wellingtonwater.co.nz	Process Engineer – NMG	• Risk & SiD Workshops • Review of technical reports • Workshops with external stakeholders

			• Level of service, operations & maintenance requirements • HAZOP Attendance
[redacted]	Richard.Millican@wellingtonwater.co.nz	Senior Asset Engineer, Asset Service & Performance	If there is a change to the primary or secondary: • customer outcome • service goal • service objective • performance measure.
Customer Hub	customer@wellingtonwater.co.nz	Customer Hub	• For updates on things that could affect neighbours/customers
[redacted]	[redacted]@wellingtonwater.co.nz	Communications and Community Engagement for Seaview WWTP	• Consultation and approval of the communications plan • To be informed of progress and potential impacts on stakeholders and customers
[redacted]	[redacted]@wellingtonwater.co.nz	HCC Client council rep	• Project significant issues requiring contact with HC-JV

8.2 External stakeholders

The external stakeholders for this activity are shown in the table below. A communications plan should be developed to describe how and when these stakeholders (or others) will be engaged with. Note that the inclusion of Veolia as external stakeholders is intended to highlight the importance of the design team engaging with the operations team at the specified project intervals.

Table 8: External stakeholders

Name	Contact details	Stakeholder	When to contact
[redacted] or delegated authority	[redacted]@veolia.com	Veolia Contract Manager	• Phasing of work • Plant outages • Risk & SiD workshops • Design reviews • Works programming
[redacted]	[redacted]@veolia.com	Veolia Operations Representative for Seaview WWTP	• Risk, SiD and HAZOP workshops • During design development • Operations & maintenance requirements • H&S site induction

Name	Contact details	Stakeholder	When to contact
			• H&S reporting during construction • All construction & commissioning phase site approvals

9 Document location and links

9.1 Where project documents are stored

All future documentation associated with the capital project, including this brief, will be stored in the Project Server CAPEX folder (to be set up).

9.2 Approved products, standards and specifications

The Wellington Water approved products, standards and specifications are listed on the Wellington Water website.

See: Wellington Water Technical information.

Appendix A: Resource Consent

[Consent No. WGN950162 (01).pdf (wellingtonwater.co.nz)]

Appendix B: Source Testing NZ

Hutt Valley WWTP Odour Control System Assessment July 2021.pdf (wellingtonwater.co.nz)

Veolia Water Services Seaview WWTP H2S Monitoring Programme September to November 2021.pdf (wellingtonwater.co.nz)

Hutt Valley WWTP Odour Control System Assessment February 2023.pdf (wellingtonwater.co.nz)

Appendix C: Air Quality Consulting NZ

R001 Wellington Water - Odour Investigation Report (DRAFT).pdf

Veolia Water Services (ANZ) Pty Ltd Wellington

HUTT VALLEY WASTEWATER TREATMENT PLANT, BIOFILTER ASSESSMENT, MARCH 2023

Issue

May 2023

Veolia Water Services (ANZ) Pty Ltd
Wellington

HUTT VALLEY WASTEWATER TREATMENT PLANT, BIOFILTER ASSESSMENT, MARCH 2023

Issue

May 2023

Source Testing New Zealand Ltd
PO Box 32 017
Maungaraki
Lower Hutt 5010
Tel: 0275 533 210
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Document history and status

Revision	Date issued	Issued by	Reviewed by	Date reviewed	Revision type
Draft	8 May 2023	[redacted]	[redacted]	8 May 2023	Minor amendments
Issue	8 May 2023	[redacted]			

Approved by

Name	Title	Signature
[redacted], CAQP	Senior Air Quality Scientist	[redacted]

Distribution of copies

Revision	Copy no	Quantity	Issued to
Issue	1	Electronic	Veolia Water Services (ANZ) Pty Ltd 8 Waterman St Gracefields Lower Hutt 5010

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File name:	C:\STTP\STNZ\Clients\Veolia\Seaview WTP\Biofilter Assessments\Biofilter Assessment March 2023\Deliverables\Hutt Valley WTP Biofilter Assessment March 2023.docx
Author:	[redacted]
Name of organisation:	Veolia Water Services (ANZ) Pty Ltd
Name of project:	Hutt Valley Wastewater Treatment Plant, Biofilter Assessment, March 2023
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Contents

Executive Summary

The results of the HVWS Hutt Valley WTP odour control biofilter assessment conducted on 16 March 2023 showed the total flow of foul air to the biofilter was 44,668 m3/hr, which equated to a retention time of 82 seconds which was slightly above the design foul air flow rate of 43,000 m3/h with a 90 second retention time. The lower retention time will reduce the treatment efficiency.

On 16 March 2023, the exterior block work was examined to identify any potential leaks and it was found that at both ends of the biofilter plenum there was significant degradation of the block work and numerous leaks.

The biofilter was covered in a thick layer of vegetation up to 1 m in height with extensive root penetration into the media. The vegetation cover on the biofilter will act as a cap on the biofilter, increasing back pressure and forcing the flow to the perimeter, potentially resulting in short circuiting of the media. The vegetation and associated root system act to further compact the media.

The biofilter media consisted of medium (20 mm) to large (50 mm) bark nuggets, soil, and seashells to buffer the media against acidification. The media was reasonably consistent between the cells and was highly degraded with a high proportion of fine/mud like material. The bark nuggets and the seashells were also highly degraded to the point the material could be broken with one's fingertips. The media in general was damp to touch and clumped together. However, there were also areas which were significantly drier than the bulk of the media.

The media at 750 mm was also highly degraded with a high proportion of fines and significant root growth in several location. The media at this depth was also highly compact, to the extent it was difficult to dig the test pits. There were also significant dry zone and even mould in one location. The presence of mould in the media indicates low to no flow is penetrating the media.

The results of the Hutt Valley WTP biofilter media assessment showed the moisture content to range from 58.4 to 69.5 %, with an average of 65.2 %, with most samples greater than 65 %.

While the pH data has been invalidated due to the delay in the analysis, Cell 1 Site 2 had a pH of 4 at 250 mm and a pH of 2 at 750 mm. Cell 5 Site 1 also had a pH of 3 at both depths. Given the rest of the pH data indicated neutral conditions, the pH at these locations was likely extremely low.

The results of the bacteria sampling showed the aerobic plate counts to range from 760 to 430,000 cfu/g with an average of 50,000 cfu/g. In April 2019, the aerobic plate counts ranged from 32,000 to 1,600,000 cfu/g with an average of 188,000 cfu/g which indicates a significant reduction in bacterial activity adversely affecting the efficiency of the biofilter.

In summary, the media in all six cells is highly degraded with significant fine material. The media has become highly compacted, which has been exacerbated by the vegetation. There are also indications of short circuiting around the edge of the cells, and areas of low or no flow as evident by the mould and dry zones. The media is in a very poor state, with all six cells requiring all new media.

STNZ recommends the following to ensure the biofilter is working at optimal condition:

1. *It is recommended that the block work be remediated to fix any leaks.*
2. *It is recommended that the surface of the biofilter be managed to ensure minimal vegetation growth.*
3. *It is recommended that routine monitoring of the biofilter media be conducted to trend the bacteria counts*.
4. *It is recommended that the media all six cells be completely replaced with the media developed for the Careys Gully biofilter*.

1. Introduction

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia Water Services (ANZ) Pty Ltd (Veolia) to undertake an assessment of the odour control biofilter at the Hutt Valley Wastewater Treatment Plant (WTP), Seaview, Wellington. The objective of the assessment was to investigate the operational condition of the biofilter and identify any actions which could aid to improve the efficiency of the biofilter. Possible actions include;

- Turning, restructuring and dampening of the bed material:
- The addition of supplementary bed material:
- Partial bed material replacement; or
- Total bed material replacement.

The Hutt Valley WTP odour control system extracts foul air from odorous processes and discharges them to a bark/soil biofilter for treatment. On 16 March 2023, an assessment of the plant biofilter was conducted by [redacted] Senior Air Quality Scientist with STNZ. [redacted] has 25 years air quality monitoring and consulting experience and is designated as a key technical person under STNZ's IANZ accreditation. [redacted] is also a Certified Air Quality Professional (CAQP) under the Clean Air Society of Australia and New Zealand (CASANZ) certification programme.

Please note, there were significant delays with the analytical laboratory conducting and reporting the data with the report not issued until 8 May 2023. Furthermore, the pH analysis was not performed until 16 days after the samples were collected. Due to buffer agent in the media, the pH slowly increases to become neutral. Hence, the pH data has not been reported.

The following report presents a summary of the biofilter, sampling methodologies and results of the biofilter media assessment. Recommendation for maintaining the biofilter in the optimal working conditiosn are then presented.

2. Odour Control System Biofilter

The Hutt Valley WTP Odour Control System extracts foul air from contained odorous processes around the plant and discharges the foul air to a six-bed bark/soil biofilter for treatment. The biofilter is designed to treat a foul air flow rate of 43,000 m^3/hr with a 90 second retention time (refer to the Operations Manual). The total surface area of the biofilter is 850 m^2 with a bed depth of 1.2 m. Foul air is discharged to a 2 m x 2 m plenum by ID fans located in the Milliscreening Plant, the Sludge Dryer and the inlet to the biofilter. Nine pipes per cell evenly distribute air to the base of the biofilter for treatment. A water spray within the plenum removes particulates from the sludge dryer and other process areas. The spray is drained to the return liquor pump station.

3. Odour Control Biofilter Assessment

3.1 Flow Assessment

In order to ensure that the biofilter was operating at the designed flow rate, the volumetric flow rate was measured using a TSI 9545 Hot Wire Anemometer. The plants sludge drier discharges directly to the biofilter and was operating on the day of the assessment. The volumetric flow of the two biofilter ID fans were measured using a hot wire anemometer while the flow rate from the sludge drier was measured using a Pitot Tube with digital manometer and a K type thermocouple. The sludge dry flow rate was measured on 24 February 2023 as part of the Hutt Valley WTP Odour Control Assessment, February 2023 while the biofilter fans were measured on 16 March 2023.

3.1.1 Flow Assessment Results

Table 1 presents the results of the Hutt Valley WTP biofilter flow assessment conducted on 24 April 2019. The results showed the total flow to the biofilter was 44,668 m^3/hr, which equated to a retention time of 82 seconds. This indicates the biofilter is operating above the at the designed air flow rate of 43,000 m^3/h and is significantly higher than the odour control ventilation system was designed to handle.

In August 2018 and April 2019, the total flow to the biofilter was 10,865, m^3/hr and 36,431 m^3/hr respectively. In February 2023, the flow rate had increased further and was now operating in excess of the design flow rate.

- **Table 1 Biofilter Flow Assessment Results, February/ March 2023**

	Biofilter Fan FN1001	Biofilter Fan FN1002	Sludge Dryer Fan[1]	Biofilter Total
V (m/s)	15.5	12.9	10.0	
T (ºC)	18.5	18.1	45.4	
D (mm)	635	635	660	
Vol (m^3/hr)	17,691	14,724	12,253	44,668
Vol (m^3/s)	4.9	3.6	3.4	11.9

1. Based on data collected on 1 August 2019

3.2 Biofilter Media Assessment

The assessment of the Hutt Valley WTP biofilter media commenced with a visual assessment of the surface of the biofilter to identify any excess vegetation, dry patches or evidence of short circuiting. A series of two test pits per cell were then excavated with a description of the media and a sample collected at depths of 250- and 750-mm. Appendix A presents the location of each of the test pits. A description of the media was then recorded at a depth of 250 and 750 mm along with the collection of media samples for moisture content, pH and bacteria analysis and were delivered to Eurofins ELS Ltd, Wellington on the day of collection.

Moisture content analysis was conducted in accordance with PHA 21st Edition Method 2540 B, AOAC 18th Edition 950.46 B(a) and LAS official test 3.1.3; pH analysis was conducted in accordance with Soil Suspension/pH Meter ANECC GUI 624.131.37 and total micro-organism viable counts (Aerobic Plate Count) was performed in accordance with USFDA-BAM 8ed 1995, Ch. 3.

3.2.1 Biofilter Media Descriptions

The Hutt Valley WTP biofilter consists of a six-bed bark/soil biofilter. On 16 March 2023, the exterior block work was examined to identify any potential leaks and it was found that at both ends of the biofilter plenum there was significant degradation of the block work and numerous leaks (Figure 1). It is recommended that the block work be remediated.

Figure 1: Biofilter Blockwork, 16 March 2023

The biofilter was also covered in a thick layer of vegetation up to 1 m in height (Figure 2). The extensive vegetation growth had resulted in roots penetrating the media to a depth of 300 to 500 mm as can be seen in Figure 3. The vegetation cover on the biofilter will act as a cap on the biofilter, increasing back pressure and forcing the flow to the perimeter, potentially resulting in short circuiting of the media. The vegetation and associated root system act to further compact the media.

- **Figure 2: Biofilter Surface, 16 March 2023**

- **Figure 3: Biofilter Root Base, 16 March 2023**

While it was difficult to see the full surface of the biofilter, there was evidence of dry spots and short circuiting on Cell 2 (Figure 4), particularly around the perimeter of the cell. The dry patches can be indicative of limited or uneven flow distribution caused by the compaction of the media.

- **Figure 4: Biofilter Dry Spots and Short Circuiting, 16 March 2023**

The biofilter media consisted of medium (20 mm) to large (50 mm) bark nuggets, soil and seashells to buffer the media against acidification (Figure 5). The media was reasonably consistent between the cells and was highly degraded with a high proportion of fine/mud like material. The bark nuggets and the seashells were also highly degraded to the point the material could be broken with one's fingertips. The media in general was damp to touch and clumped together. However, there were also areas which were significantly drier than the bulk of the media.

The media at 750 mm (Figure 6) was also highly degraded with a high proportion of fines and significant root growth in several locations. The media at this depth was also highly compact, to the extent it was difficult to dig the test pits. There were also significant dry zones and even mould in one location (Figure 7). The presence of mould in the media indicates low to no flow is penetrating the media.

In summary, the media in all six cells is highly degraded with significant fine material. The media has become highly compacted, which has been exacerbated by the vegetation. There are also indications of short circuiting around the edge of the cells, and areas of low or no flow as evident by the mould and dry zones. The media is in a very poor state, with all six cells requiring all new media.

- **Figure 5: Biofilter Media 250 mm depth, 16 March 2023**

- **Figure 6: Biofilter Media 750 mm depth, 16 March 2023**

- **Figure 7: Biofilter Media 750 mm depth – Dry and Mouldy Media, 16 March 2023**

3.2.2 Biofilter Media Results

Table 1 presents the results of the pH, moisture content and total bacteria count analysis of the Hutt Valley WTP biofilter media samples collected on 16 March 2023. The laboratory report is presented in Appendix B.

Please note, there were significant delays with the analytical laboratory conducting and reporting the data with the report not issued until 8 May 2023. Furthermore, the pH analysis was not performed until 16 days after the samples were collected. Due to buffer agent in the media, the pH slowly increases to become neutral. Hence, the pH data has not been reported.

- **Table 2 Biofilter Media Analytical Results, 16 March 2023**

Sample Description	Moisture Content (% by weight)	pH	Aerobic Plate Count @ 35 °C (cfu/g)	Moisture Content (% by weight)	pH	Aerobic Plate Count @ 35 °C (cfu/g)
	250 mm			750 mm		
Cell 1 Site 1	3,600	ND	65.1	36,000	ND	66.3
Cell 1 Site 2	16,000	ND	65.4	760	ND	62.2
Cell 2 Site 1	5,400	ND	63.6	15,000	ND	66.3
Cell 2 Site 2	2,200	ND	63.6	3,900	ND	60.5
Cell 3 Site 1	34,000	ND	64.6	41,000	ND	67.8
Cell 3 Site 2	33,000	ND	67.0	430,000	ND	69.3
Cell 4 Site 1	14,000	ND	66.8	24,000	ND	66.7
Cell 4 Site 2	35,000	ND	62.7	150,000	ND	69.5
Cell 5 Site 1	1,200	ND	67.9	1,500	ND	66.2
Cell 5 Site 2	2,400	ND	66.2	3,900	ND	59.1
Cell 6 Site 1	56,000	ND	58.4	44,000	ND	69.1
Cell 6 Site 2	20,000	ND	65.7	230,000	ND	64.7

It is generally considered for the optimal efficiency, a biofilter should have a moisture content between 40 and 65 % by weight and a pH in the range 5 to 8. Recommended levels of colony forming units for biofilters vary widely in the literature, from 10^4 to 10^9 cfu/g and is related to the loading on the biofilter. Biofilters with higher loading would be expected to have higher bacteria counts as there are more nutrients available. In contrast, biofilters with lower loads provide less nutrients to the bacteria, limiting growth.

The results of the Hutt Valley WTP biofilter media assessment conducted on 16 March 2023 showed the moisture content to range from 58.4 to 69.5 %, with an average of 65.2 %, with the majority of samples greater than 65 %.

While the pH data has been invalidated due to the delay in the analysis, Cell 1 Site 2 had a pH of 4 at 250 mm and a pH of 2 at 750 mm. Cell 5 Site 1 also had a pH of 3 at both depths. Given the rest of the pH data indicated neutral conditions, the pH at these locations was likely extremely low.

The results of the bacteria sampling showed the aerobic plate counts to range from 760 to 430,000 cfu/g with an average of 50,000 cfu/g. Only three samples indicated suitable bacterial colonies with the remaining results low to very low. Furthermore, the only samples with viable colonies were collected from a depth of 750 mm, suggesting the nutrients from the foul air was not reaching the upper levels of the media.

In April 2019, the aerobic plate counts ranged from 32,000 to 1,600,000 cfu/g with an average of 188,000 cfu/g which indicates a significant reduction in bacterial activity adversely affecting the efficiency of the biofilter.

3.3 Summary and Recommendations

The results of the HVWS Hutt Valley WTP odour control biofilter assessment conducted on 16 March 2023 showed the total flow of foul air to the biofilter was 44,668 m3/hr, which equated to a retention time of 82 seconds which was slightly above the design foul air flow rate of 43,000 m3/h with a 90 second retention time. The lower retention time will reduce the treatment efficiency.

On 16 March 2023, the exterior block work was examined to identify any potential leaks and it was found that at both ends of the biofilter plenum there was significant degradation of the block work and numerous leaks.

It is recommended that the block work be remediated.

The biofilter was covered in a thick layer of vegetation up to 1 m in height with extensive root penetration into the media. The vegetation cover on the biofilter will act as a cap on the biofilter, increasing back pressure and forcing the flow to the perimeter, potentially resulting in short circuiting of the media. The vegetation and associated root system act to further compact the media.

It is recommended that the surface of the biofilter be managed to ensure minimal vegetation growth.

The biofilter media consisted of medium (20 mm) to large (50 mm) bark nuggets, soil, and seashells to buffer the media against acidification. The media was reasonably consistent between the cells and was highly degraded with a high proportion of fine/mud like material. The bark nuggets and the seashells were also highly degraded to the point the material could be broken with one's fingertips. The media in general was damp to touch and clumped together. However, there were also areas which were significantly drier than the bulk of the media.

The media at 750 mm was also highly degraded with a high proportion of fines and significant root growth in several location. The media at this depth was also highly compact, to the extent it was difficult to dig the test pits. There were also significant dry zone and even mould in one location. The presence of mould in the media indicates low to no flow is penetrating the media.

The results of the Hutt Valley WTP biofilter media assessment showed the moisture content to range from 58.4 to 69.5 %, with an average of 65.2 %, with most samples greater than 65 %.

While the pH data has been invalidated due to the delay in the analysis, Cell 1 Site 2 had a pH of 4 at 250 mm and a pH of 2 at 750 mm. Cell 5 Site 1 also had a pH of 3 at both depths. Given the rest of the pH data indicated neutral conditions, the pH at these locations was likely extremely low.

The results of the bacteria sampling showed the aerobic plate counts to range from 760 to 430,000 cfu/g with an average of 50,000 cfu/g. In April 2019, the aerobic plate counts ranged from 32,000 to 1,600,000 cfu/g with an average of 188,000 cfu/g which indicates a significant reduction in bacterial activity adversely affecting the efficiency of the biofilter.

It is recommended that routine monitoring of the biofilter media be conducted to trend the bacteria counts.

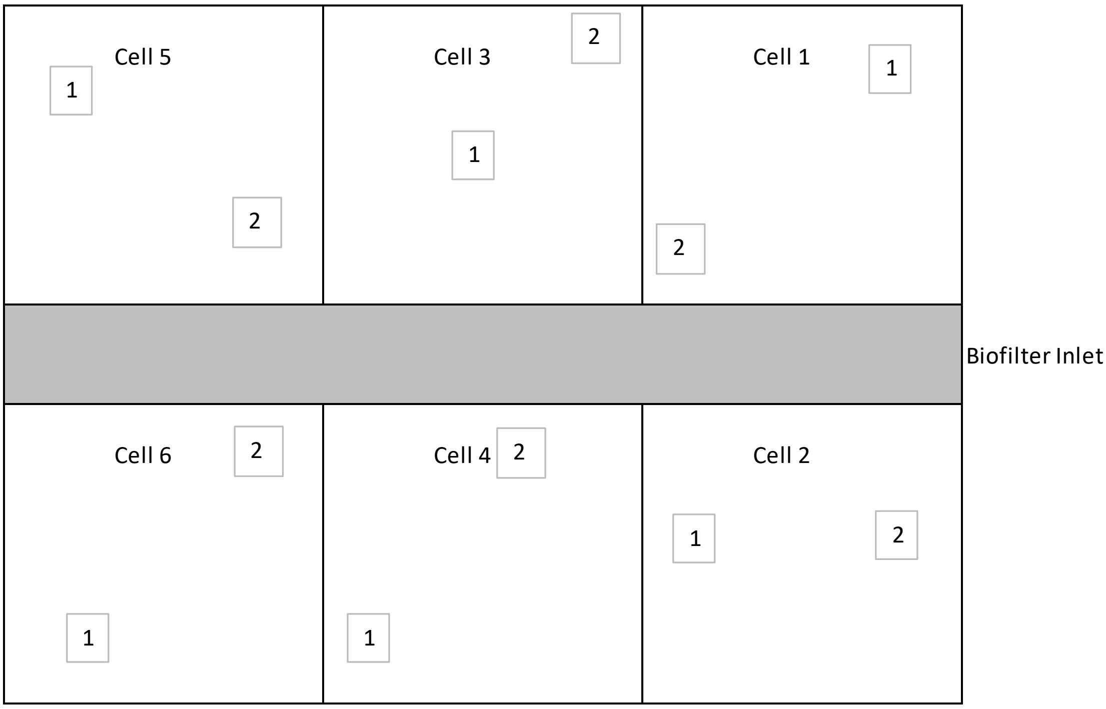
In summary, the media in all six cells is highly degraded with significant fine material. The media has become highly compacted, which has been exacerbated by the vegetation. There are also indications of short circuiting around the edge of the cells, and areas of low or no flow as evident by the mould and dry zones. The media is in a very poor state, with all six cells requiring all new media.

It is recommended that the media all six cells be completely replaced with the media developed for the Careys Gully biofilter.

Appendix A Sampling Locations

This Appendix contains 2 pages including cover

Hutt Valley WTP Biofilter Sampling Locations, 16 March 2023.



Appendix B Laboratory Reports

This Appendix contains 10 pages including cover

eurofins

Food & Water Testing

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ANALYTICAL REPORT

REPORT CODE	AR-23-NW-021536-01	REPORT DATE	08/05/2023

Attention Source Testing New Zealand
[redacted]
PO Box 32-017
Maungaraki
Lower Hutt 5010
Wellington
NEW ZEALAND

Phone [redacted]
Email [redacted]@sourcetesting.co.nz

Contact for your orders:	[redacted]	**Order code:**	EUNZWE-00113196
Contract:	GBS - Service Now		
Comments:	.		

SAMPLE CODE	812-2023-00034596		
Client Reference:	ST1111/01		
Sample described as:	Cell 1-Site 1 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	3600	cfu/g	10
③NU223	**Moisture**			
	Moisture	65.1	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034597		
Client Reference:	ST1111/02		
Sample described as:	Cell 1-Site 1 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 14:55	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	36000	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.3	%	0.1
③NU012	**pH**			
	pH	6		1

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Food & Water Testing

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SAMPLE CODE	812-2023-00034598		
Client Reference:	ST1111/03		
Sample described as:	Cell 1-Site 2 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	16000	cfu/g	10
③NU223	**Moisture**			
	Moisture	65.4	%	0.1
③NU012	**pH**			
	pH	4		1

SAMPLE CODE	812-2023-00034599		
Client Reference:	ST1111/04		
Sample described as:	Cell 1-Site 2 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:01	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	760	cfu/g	10
③NU223	**Moisture**			
	Moisture	62.2	%	0.1
③NU012	**pH**			
	pH	2		1

SAMPLE CODE	812-2023-00034600		
Client Reference:	ST1111/05		
Sample described as:	Cell 2-Site 1 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 14:55	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	5400	cfu/g	10
③NU223	**Moisture**			
	Moisture	63.6	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034601		
Client Reference:	ST1111/06		
Sample described as:	Cell 2-Site 1 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 18:18	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

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		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	15000	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.3	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE **812-2023-00034602**

Client Reference: ST1111/07
Sample described as: Cell 2-Site 2 250 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 15:01 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	2200	cfu/g	10
③NU223	**Moisture**			
	Moisture	63.6	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE **812-2023-00034603**

Client Reference: ST1111/08
Sample described as: Cell 2-Site 2 750 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 14:55 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	3900	cfu/g	10
③NU223	**Moisture**			
	Moisture	60.5	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE **812-2023-00034604**

Client Reference: ST1111/09
Sample described as: Cell 3-Site 1 250 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 14:55 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	34000	cfu/g	10
③NU223	**Moisture**			
	Moisture	64.6	%	0.1

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		RESULTS		LOQ
③NU012	**pH**			
	pH	6		1

SAMPLE CODE	812-2023-00034605		
Client Reference:	ST1111/10		
Sample described as:	Cell 3-Site 1 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	41000	cfu/g	10
③NU223	**Moisture**			
	Moisture	67.8	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034606		
Client Reference:	ST1111/11		
Sample described as:	Cell 3-Site 2 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	33000	cfu/g	10
③NU223	**Moisture**			
	Moisture	67.0	%	0.1
③NU012	**pH**			
	pH	6		1

SAMPLE CODE	812-2023-00034607		
Client Reference:	ST1111/12		
Sample described as:	Cell 3-Site 2 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 14:55	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	4.30×10^5	cfu/g	10
③NU223	**Moisture**			
	Moisture	69.3	%	0.1
③NU012	**pH**			
	pH	7		1

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SAMPLE CODE	812-2023-00034608		
Client Reference:	ST1111/13		
Sample described as:	Cell 4-Site 1 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	14000	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.8	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034609		
Client Reference:	ST1111/14		
Sample described as:	Cell 4-Site 1 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	24000	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.7	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034610		
Client Reference:	ST1111/15		
Sample described as:	Cell 4-Site 2 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:01	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	35000	cfu/g	10
③NU223	**Moisture**			
	Moisture	62.7	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034611		
Client Reference:	ST1111/16		
Sample described as:	Cell 4-Site 2 750mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

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		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	$1.50x10^5$	cfu/g	10
③NU223	**Moisture**			
	Moisture	69.5	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE **812-2023-00034612**

Client Reference: ST1111/17
Sample described as: Cell 5-Site 1 250 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 15:00 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	1200	cfu/g	10
③NU223	**Moisture**			
	Moisture	67.9	%	0.1
③NU012	**pH**			
	pH	3		1

SAMPLE CODE **812-2023-00034613**

Client Reference: ST1111/18
Sample described as: Cell 5-Site 1 750 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 14:55 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	1500	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.2	%	0.1
③NU012	**pH**			
	pH	3		1

SAMPLE CODE **812-2023-00034614**

Client Reference: ST1111/19
Sample described as: Cell 5-Site 2 250 mm
Reception Date & Time: 16/03/2023 14:50
Analysis Start Date & Time: 23/03/2023 15:01 **Analysis Ending Date:** 05/04/2023
Sampled Date & Time 16/03/2023 00:00

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	2400	cfu/g	10
③NU223	**Moisture**			
	Moisture	66.2	%	0.1

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		RESULTS		LOQ
③NU012	**pH**			
	pH	3		1

SAMPLE CODE	812-2023-00034615		
Client Reference:	ST1111/20		
Sample described as:	Cell 5-Site 2 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	3900	cfu/g	10
③NU223	**Moisture**			
	Moisture	59.1	%	0.1
③NU012	**pH**			
	pH	3		1

SAMPLE CODE	812-2023-00034616		
Client Reference:	ST1111/21		
Sample described as:	Cell 6-Site 1 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:00	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	56000	cfu/g	10
③NU223	**Moisture**			
	Moisture	58.4	%	0.1
③NU012	**pH**			
	pH	6		1

SAMPLE CODE	812-2023-00034617		
Client Reference:	ST1111/22		
Sample described as:	Cell 6-Site1 750 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 14:55	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	44000	cfu/g	10
③NU223	**Moisture**			
	Moisture	69.1	%	0.1
③NU012	**pH**			
	pH	7		1

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SAMPLE CODE	812-2023-00034618		
Client Reference:	ST1111/23		
Sample described as:	Cell 6-Site 2 250 mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 15:01	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	20000	cfu/g	10
③NU223	**Moisture**			
	Moisture	65.7	%	0.1
③NU012	**pH**			
	pH	7		1

SAMPLE CODE	812-2023-00034619		
Client Reference:	ST1111/24		
Sample described as:	Cell 6-Site 2 750mm		
Reception Date & Time:	16/03/2023 14:50		
Analysis Start Date & Time:	23/03/2023 14:55	**Analysis Ending Date:**	05/04/2023
Sampled Date & Time	16/03/2023 00:00		

		RESULTS		LOQ
①ZM1QB	**Enumeration of Aerobic Bacteria**			
	Aerobic Plate Count 35°C	2.30×10^5	cfu/g	10
③NU223	**Moisture**			
	Moisture	64.7	%	0.1
③NU012	**pH**			
	pH	7		1

LIST OF METHODS

NU012 **pH:** Internal Method, Electrometry [pH Electrode]

NU223 **Moisture:** Internal Method, Thermo-gravimetry [Dried at 100°C]

ZM1QB **Aerobic Plate Count 35°C E (Food & Feed) [NZ] <10 >30 000 000 /g (1-5) PCA Agar-P:** FDA BAM Chapter 3; Online Edition

Signature

[redacted] [redacted]

[redacted] Senior Analyst Senior Analyst

[redacted] Laboratory Manager

EXPLANATORY NOTE

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⑤Test is subcontracted outside Eurofins group and is not accredited
⑥Test result is provided by the customer and is not accredited
⑦Tested at the sampling point by Eurofins and is not accredited
⑧Tested at the sampling point by Eurofins and is accredited

N/A means Not Applicable
Not Detected means not detected at or above the Limit of Quantification (LOQ)
LOQ means Limit of Quantification and the unit of LOQ is the same as the result unit

END OF REPORT

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Veolia Water Services (ANZ) Pty Ltd

HUTT VALLEY WASTEWATER TREATMENT PLANT,
ODOUR CONTROL SYSTEM ASSESSMENT,
FEBRUARY 2023

Issue

April 2023

Veolia Water Services (ANZ) Pty Ltd

HUTT VALLEY WASTEWATER TREATMENT PLANT, ODOUR CONTROL SYSTEM ASSESSMENT, FEBRUARY 2023

Issue

April 2023

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Approved by

Name	Title	Signature
[redacted], CAQP	Senior Air Quality Scientist	[redacted]

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Contents

Executive Summary

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia Water Services (ANZ) Pty Ltd (Veolia) to undertake an assessment of the odour control system at the Hutt Valley Wastewater Treatment Plant (WTP), Seaview, Wellington. Veolia have been experiencing a number of odour complaints from the community. Condition 7 of the Company's Air Discharge Consent (WGN950162(01)) stipulates that "there shall be no discharges to air that are obnoxious, dangerous, offensive or objectionable at or beyond the boundary of the property. These discharges include odour and dust". To comply with Condition 7, the plant odour control system extracts foul air from odorous processes and discharges them to a bark/compost biofilter for treatment.

On 24 February 2023, STNZ conducted an assessment of the odour control system to confirm the operational condition of the system and identify any potential sources of fugitive odour which may be resulting in the observed odour complaints. Flows from key areas of the extraction system were also determined to allow comparison with previous assessments, the Biofilter Operations Manual and Odour Model. The following discussion summarises the findings of the Hutt Valley WTP odour control system assessment.

The odour control system extracts foul air from the TWPS via the ID fan located within the Milliscreen plant. On 24 February 2023 the extraction rate from the TWPS was approximately 6,100 m^3/hr which was similar to 2021. The pressures within the wet wells measured were -0.1 and -0.3 mmH_2O for Wet Wells 1 and 2 respectively, which was approximately half that observed in 2021. Given the extraction rate was slightly higher than observed in 2021, one would expect the vacuum to be similar. *This would suggest potential leaks in the system and it is recommended that the extraction ducting be inspected to identify any potential leaks.*

With regards to the Milliscreening plant, on 24 February 2023, the extraction rates from screening enclosures 1 to 5 averaged 1,000 m^3/hr and screening enclosures 6 to 10 averaged 700 m^3/hr, which was similar to the flows observed in 2021. *Please note, the extraction rate from Milliscreen 1 was significantly higher than the other enclosures and it is recommended that the flow be adjusted*.

The total flow from milliscreens 1 to 5 and the total flow from milliscreens 6 to 10 were 3,400 m^3/hr and 4,500 m^3/hr respectively, which was similar to the flows measured in 2021. However, the extraction rates for screens 6 to10 were generally lower than for screens 1 to 5 which would suggest possible leaks in the ducting extracting from screens 6 to 10. It is worth noting that the static pressure in the Milliscreens 1 to 4 ducts has increased significantly from approximately -35 mmH_2O in 2021 to -148 mmH_2O indicating a possible blockage in the ducting.

On 24 February 2023, the total volume extracted from the Milliscreen Plant was approximately 11,300 m^3/hr. The extraction rate from the TWPS was approximately 6,100 m^3/hr and 7,500 m^3/hr

from the milliscreening enclosures, and an unknown volume from the screenings skip (Total 13,600 m^3/hr). As the extraction rates from the milliscreens and TWPS is higher than the extraction rates from the main plant fans, there is a potential for the excess flow to be discharged via the skip bay extraction. The main plant fans maybe being hindered by upstream blockages, potentially the biofilter. *It is highly recommended that the main fans be investigated to improve the extraction rates.*

The extraction rate from the TWPS was slightly higher than measured in July 2021, however the extraction rate from the milliscreening enclosures was approximately 25 % lower than 2021. *Given the high vacuums observed on the milliscreen enclosures, it appears that there may be some blockages in the ducting.*

Given the observed flows discrepancies and pressures, it is recommended that the extraction ducting be closely examined to identify any potential leaks or blockages.

With regards to the screening skip, there appeared to be negligible extraction. This would have been hindered by the cover to the skip not being in place. Furthermore, the roller door to the skip bay was open allowing foul air to discharge. As the extraction rate was not able to be measured, it is unknown how effective the capture system is. *Hence, it is highly recommended that the skip extraction flow sampling port be repaired to allow the flow to be measured and ensure there is active extraction from the skips.*

It is also recommended that all ducting be inspected to ensure there are no blockages.

It is also recommended that the covers for the screening skip should be in place and the roller door closed at all times.

The flow rate extracted from the Milliscreen Plant equated to 3.2 m^3/s, which was significantly less than the 4.2 m^3/s observed in 2021 and was even lower than the 3.6 m^3/s observed in 2018. This reduction in flow indicates potential blockages in the extraction ducting. *It is recommended that all the milliscreen plant extraction ducting be thoroughly inspected to identify any potential blockages. Given the ducting has been encased in fibreglass, a camera may need to examine the interior of the ducts.*

The observed extraction rates are still significantly higher than the 1.8 m^3/s presented in the Operations Manual or the 1.6 m^3/s specified in the Odour System Model primarily due to both milliscreen fans operating. This suggests that the extraction system no longer conforms with the design models.

The Milliscreen Plant building has four approximately 600 mm roof mounted fans. The two fans at the control room end of the plant were not operating but were still open to atmosphere. The two fans located above the skip load out area were still operating. As a result, odours within the milliscreen building are being discharged directly to atmosphere.

To prevent discharges from the milliscreen building, it is recommended that the ceiling fans are sealed with additional building extraction applied to contain the odours within the Milliscreen Plant. The foul air would then need to be treated by the biofilter or other air pollution control technology.

For the primary sedimentation tanks, the volume of air extracted from the inlet channel was approximately 21,500 m^3/hr, which was similar to 2021. The total volume extracted from the primary sedimentation tanks was 4,500 m^3/hr, which was approximately 25 % lower than observed in July 2021. This is most likely due to an upstream blockage, potentially the biofilter.

With regards to the sludge tanks, on 24 February 2023, approximately 1,000 m^3/hr was extracted from the Gravity Thickener with a further 2,800 m^3/hr being extracted from the Sludge Blend tank. While the extraction rate from the Gravity Thickener was slightly lower than observed in July 2021, this is unlikely to adversely affect the containment. The extraction from the Gravity Thickener was the same as observed in 2021.

For the Centrifuge Room, the building pressures measured on 24 February 2023 indicated the room was under vacuum. However, it was noted that in the afternoon the side roller door was opened resulting in the potential for foul air to be discharge. *It is recommended that this door remains closed unless in use*.

While the RLPS is covered with active extraction to the biofilter, there were significant leaks and the cover was generally in poor condition. However, the slump was under a good vacuum with a pressure of -0.5 mmH_2O, however this was lower than observed in July 2021.

On 24 February 2023, the total flow extracted from the three centrifuges was approximately 2,600 m^3/hr with approximately 350 m^3/hr extracted from the RLPS. The extraction rate from the centrifuges was approximately 30 % higher than in 2021 while the RLSP was similar.

The assessment of the sludge dryer showed the total flow discharged by the dryer fan to the biofilter was approximately 12,300 m^3/hr, which was similar to 2021. The condenser fan flow rate was approximately 19,300 m^3/hr which was slightly higher than measured in 2021. Assuming the gas stream at both locations is saturated and correcting for moisture and temperature, the condenser fan was operating at approximately 9,200 m^3/hr and the main dryer fan was running at approximately 9,800 m^3/hr.

While the main fan is operating at a slightly higher flow than the condenser fan, the difference is quite small, and it is recommended the flow at the inlet to condenser drum three be confirmed by measuring the pressure and/or flow at the inlet.

The extraction rate from the sludge dryer measured on 24 February 2023 equated to 3.4 m^3/s, which was similar to the 3.5 m^3/s presented in the Operations Manual and lower than the 3.9 m^3/s specified in the Odour System Model. Hence, it may be possible to increase the extraction rate from the sludge dryer to reduce odours within the building. However, this will be dependent on the process operation conditions.

The sludge dryer building has three ground level passive vents approximately 1500 mm x 1500 mm in size. On 24 February 2023, the building pressure measured at these passive vents was in the range -0.2 to -0.6 mmH_2O indicting the building was under negative pressure. However, the negative pressure was most likely due to the four approximately 700 mm roof mounted fans which discharge directly to atmosphere.

There are also significant areas in the roof space at the top of the primary sludge cyclones. As a result, foul air from within the plant is discharged directly to atmosphere. This has the potential to allow significant odours to be released and is likely a key cause of current odour complaints. *It is highly recommended that the building be sealed with active extraction to the plant biofilter.*

The main biofilter fan captures foul air extracted from the Primary Sedimentation works (which includes the Milliscreen Plant), the Gravity Thickener tank, Sludge Blend tank, Centrifuge Room and RLPS. On 24 February 2023, the total flow discharged to the biofilter from the biofilter fans was approximately 30,500 m^3/hr. Combined with the flow from the biofilter fans and sludge dryer (approximately 12,300 m^3/hr) the total flow to the biofilters was approximately 42,800 m^3/hr, which is at the designed flow rate of 43,000 m^3/hr (Operations Manual).

The flow rate of the main biofilter fans measured on 24 February 2023 equated to 8.5 m^3/s, which was similar to the 8.3 m^3/s measured in 2011. However, the flows are significantly higher than the 3.6 m^3/s presented in the Operations Manual or the 3.3 m^3/s specified in the Odour System Model. This would indicate that the extraction system is handling over twice the volume of air the system was designed for. However, the biofilter ventilation rate and retention times are still being maintained. However, any further extraction from the plant will need to be directed to a new odour control system.

It is worth noting that there was a significant sludge odour present in the vicinity of the Return Liquor slump and biofilter fans. Inspection of the biofilter plenum identified a number of holes and cracks which resulted in foul air being directly discharged into the atmosphere. Further holes/cracks were also observed at the opposite end of the biofilter. *It is recommended that the plenum be repaired to prevent fugitive emissions.*

1. Introduction

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia Water Services (ANZ) Pty Ltd (Veolia) to undertake an assessment of the odour control system at the Hutt Valley Wastewater Treatment Plant (WTP), Seaview, Wellington. Condition 7 of the Company's Air Discharge Consent (WGN950162(01)) stipulates that "there shall be no discharges to air that are obnoxious, dangerous, offensive or objectionable at or beyond the boundary of the property. These discharges include odour and dust".

In order to comply with Condition 7, the plant odour control system extracts foul air from odorous processes and discharges them to a bark/compost biofilter for treatment. The objective of the current assessment of the odour control system was to assess the extraction rates from the various processes and compare them against previous assessments, the Biofilter Operations Manual and the Odour Model

The following processes are under active extraction to the plant biofilter:

- Trade waste pump station (TWPS);
- Milliscreen process equipment;
- Inlet channel and primary sedimentation tanks including channels, sumps and scum pump stations;
- Gravity thickener;
- Sludge blend tank;
- Centrifuges and dewatered cake conveyors;
- Return liquor pump station (RLPS);
- Sludge dryer; and
- Emergency sludge bins when in use.

On 24 February 2023, STNZ conducted an assessment of the odour control system to confirm the operational condition of the hardware and identify any potential sources of fugitive odour. Flows from key areas of the extraction system were also determined to allow comparison with previous assessments, the Biofilter Operations Manual and Odour Model.

[redacted], Senior Air Quality Scientist, carried out the assessment of the Hutt Valley WTP Odour Control System. [redacted] has over 25 years air quality monitoring and consulting experience and is designated as a key technical person under STNZ's IANZ accreditation. [redacted] is also a Certified Air Quality Professional (CAQP) under the Clean Air Society of Australia and New Zealand (CASANZ) certification programme.

The following report documents the findings of the Hutt Valley WTP odour control system assessment. A brief summary of the basis of the system is presented followed by the details of the flow measurements and operational status of the system. The data has also been compared to the results of previous assessments conducted and the Biofilter Operations and Odour Model. Any potential sources of fugitive odour emissions that are identified are discussed along with recommendations of potential mitigation methods.

2. Odour Control System

The Hutt Valley WTP odour control system extracts foul air from contained odorous processes and discharges the foul air to a six-bed bark biofilter for treatment. The biofilter is designed to treat a foul air flow rate of 43,000 m^3/hr with a 90 second retention time (refer to the Operations Manual). The total surface area of the biofilter is 850 m^2 with a bed depth of 1.2 m. Foul air is discharged to a 2 m x 2 m plenum by ID fans located in the Milliscreening Plant, the Sludge Dryer and the inlet to the biofilter. Nine pipes per cell evenly distribute air to the base of the biofilter for treatment. A water spray within the plenum removes particulates from the sludge dryer and other process areas. The spray is drained to the return liquor pump station.

The following processes are under active extraction to the plant biofilter:

- Trade waste pump station (TWPS);
- Milliscreen process equipment;
- Inlet channel and primary sedimentation tanks including channels, sumps and scum pump stations;
- Gravity thickener;
- Sludge blend tank;
- Centrifuges and dewatered cake conveyors;
- Return liquor pump station (RLPS);
- Sludge dryer; and
- Emergency sludge bins when in use.

Foul air is extracted from the TWPS and milliscreening equipment by two fixed speed fans which were initially designed to operate in a duty/assist configuration with an operation set point of 1.8 m^3/s (Operations Manual). However, currently both fans are operated to improve extraction from the TWPS and the milliscreens. Foul air from the milliscreening plant is discharged to the void above the screened effluent channel.

The main biofilter fans extract foul air from the screened effluent channel via the primary sedimentation tanks and associated processes, gravity thickener, sludge blend tank, centrifuges and RLPS and discharges directly into the biofilter plenum. The fans were initially designed to operate in a duty/assist configuration with each fan having an operating point of 3.6 m^3/s (Operations Manual). Again, Veolia are operating both fans to optimise extraction rates.

The sludge dryer fan discharges directly to the biofilter plenum with an operating point of 3.5 m^3/s (Operations Manual).

3. Odour Control System Assessment

3.1 Introduction

One of the key objectives of the Hutt Valley WTP odour control system assessment was to determine extraction rates at various points in the odour control system to ensure odorous process areas were maintained under negative pressure, thus preventing the release of foul air, and to determine if the observed flow rates were consistent with designed operating flow rates. The condition of the control system was also investigated to identify any potential sources of fugitive odour emissions. The data has also been compared to previous assessments to identify any significant differences which may need investigating.

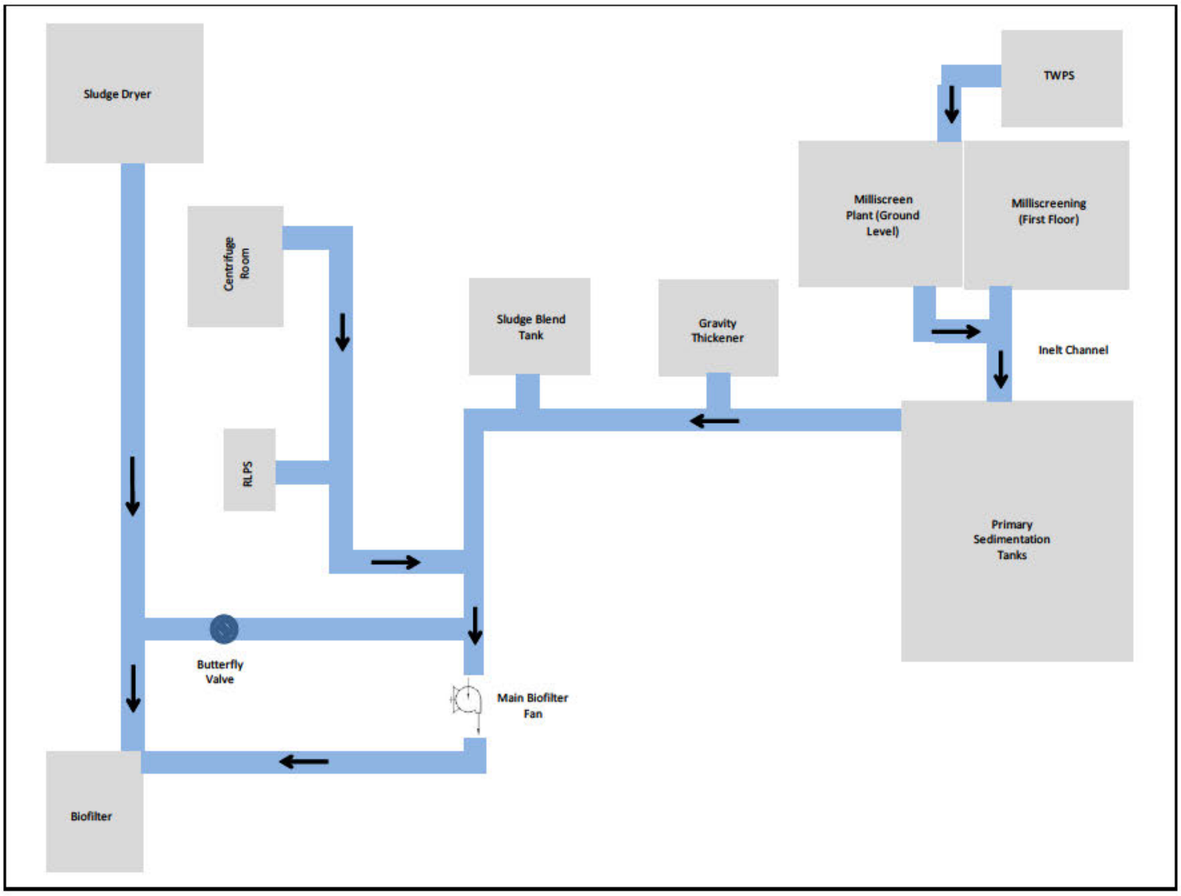
The assessment of flow rates involved the measurement of duct diameter, velocity, temperature, and static pressure. Velocity and temperature were measured using a TSI 9545 Hot Wire Anemometer with the static pressure being determined using a Colmark C9551 pressure meter. Due to the high temperature and moisture content of the discharges from the sludge dryer, the velocity of the condenser and main dryer fan were measured using an 'S' Type Pitot tube with the temperature determined using a 'K' Type thermocouple.

As a number of the measurement sites were located close to flow disturbances such as baffles, bends and/or fans, the accuracy of the velocity measurements would have been affected. The uncertainty of measurement for the flow rate determinations has been estimated to be ± 15%. Furthermore, all data is presented at actual flow rate conditions with no correction for temperature or moisture content.

The following sections detail the odour control system extraction rates for each of the odorous processes. The extraction rate data is presented in a schematic of the relevant section of the odour control system.

3.2 Odour Control System Schematic

A schematic of the Hutt Valley WTP Odour Control System identifying the primary odour sources and how these interact with the odour control system is presented in Figure 1. Subsequent sections provide flow rate details for each of the sources.



▪ **Figure 1: Hutt Valley WTP Odour Control System**

3.3 Trade Waste Pump Station

The Trade Waste Pump Station (TWPS) acts as the inlet works for the plant, accepting effluent from a number of different communities including Wainuiomata, Seaview, Lower Hutt and Upper Hutt. The TWPS has two entrance stair wells which have vented doors (See Figure 2). The pumps are located within a sump which is covered by large concrete plates which have had new seals applied since the 2021 assessment.

- **Figure 2: TWPS Wet Wells Entrance**

The odour control system extracts foul air from the TWPS via the ID fan located within the Milliscreen plant. On 24 February 2023 the extraction rate from the TWPS was approximately 6,100 m^3/hr which was similar to the 5,500 m^3/hr observed in 2021. The flow rate calculation data is presented in Appendix A.

The pressures within the wet wells measured on 24 February 2023 were -0.1 and -0.3 mmH_2O for Wet Wells 1 and 2 respectively which was approximately half that observed in 2021. Given the extraction rate was slightly higher than observed in 2021, one would expect the vacuum to be similar indicating possible leaks in the system. *It is recommended that the extraction ducting and containment hardware thoroughly investigated to identify any possible leaks.*

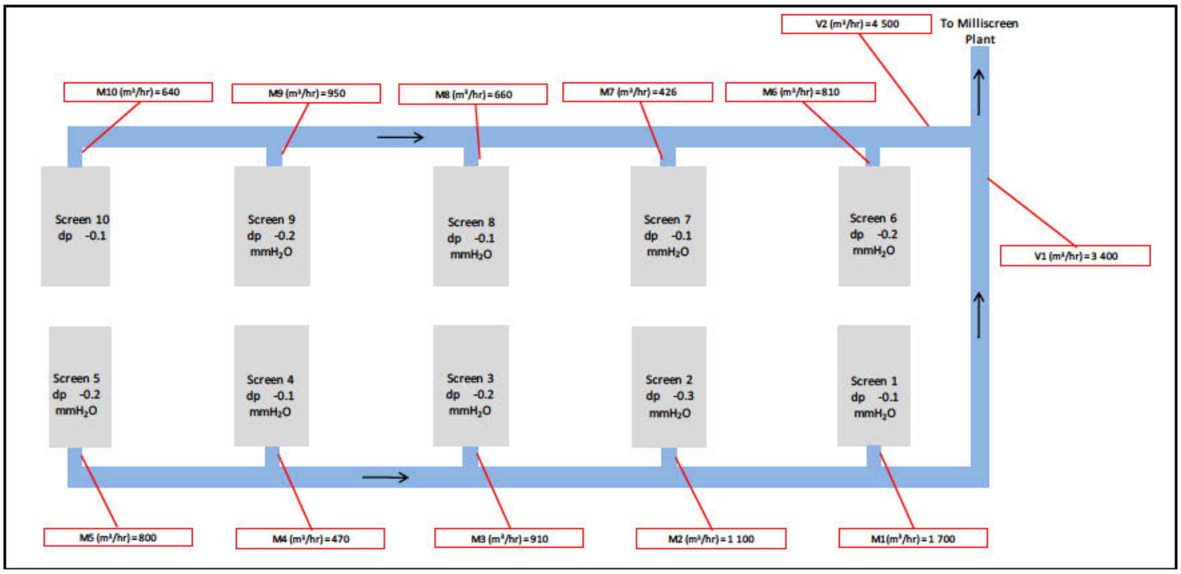
3.4 Milliscreen Plant

The Milliscreen Plant incorporates a number of different processes. Milliscreening is carried out on the first floor (Milliscreen (First Floor). On the ground floor of the Milliscreen Plant (Milliscreen Plant (Ground Floor) includes disposal of the screened material, odour control fans, the plant pump station and discharge wet well. The odour control system only extracts foul air from the milliscreen enclosures (First Floor) and the skip bin used for the disposal of the screened material. The milliscreening process consists of 10 enclosed milliscreening rotary drums, each of which is under extraction to the biofilter (See Figure 3).

- **Figure 3: Milliscreen Plant**

In 2018, all the ducting in the Milliscreen Plant had been sealed with fibre glass and two of the four extraction ducts from the screw conveyers had been disconnected and sealed. In 2021, all 10 of the milliscreen enclosures were replaced. In addition, a section of ducting from the milliscreen skip to the extraction ducting had been replaced.

Figure 4 depicts the flow schematics for the Milliscreen Plant (First Floor) measured on 24 February 2023. The flow rate calculation data is presented in Appendix A.



- **Figure 4: Milliscreen (First Floor) Extraction Rates, 24 February 2023**

On 24 February 2023, the extraction rates were measured and showed that for screening enclosures 1 to 5 the flow ranged from 470 to 1,700 m^3/hr with an average of 1,000 m^3/hr and for screening enclosures 6 to 10 the flow rate ranged from 430 to 950 m^3/hr with an average of 700 m^3/hr. The total flow from milliscreens 1 to 5 and the total flow from milliscreens 6 to 10 were 3,400 m^3/hr and 4,500 m^3/hr respectively, which was similar to the flows measured in 2021.

The extraction rates for screens 6 -10 was generally lower than for screens 1 to 5, however the total extracted from screen 1 to 5 was lower than what was extracted from screens 6 to 10 indicating a possible leak in the ducting. *The extraction rate from Milliscreen 1 was significantly higher than from the others and it is recommended that the flow be adjusted.*

It is worth noting that the static pressure in the Milliscreen 1 to 4 ducts has increased significantly from approximately -35 mmH_2O in 2021 to -148 mmH_2O indicating a possible blockage in the ducting.

In addition to the extraction rates, the pressures within each of the enclosures were also determined. On 24 February 2023 all screens were under negative vacuum ranging from -0.1 to – 0.3 mmH_2O which was similar to the vacuum observed in 2021.

Given the observed flows discrepancies and pressures, it is recommended that the extraction ducting be closely examined to identify any potential leaks or blockages.

Figure 5 depicts the flow rates measured on the ground floor of the Milliscreen Plant on 24 February 2023. The flow rate calculation data is presented in Appendix A.

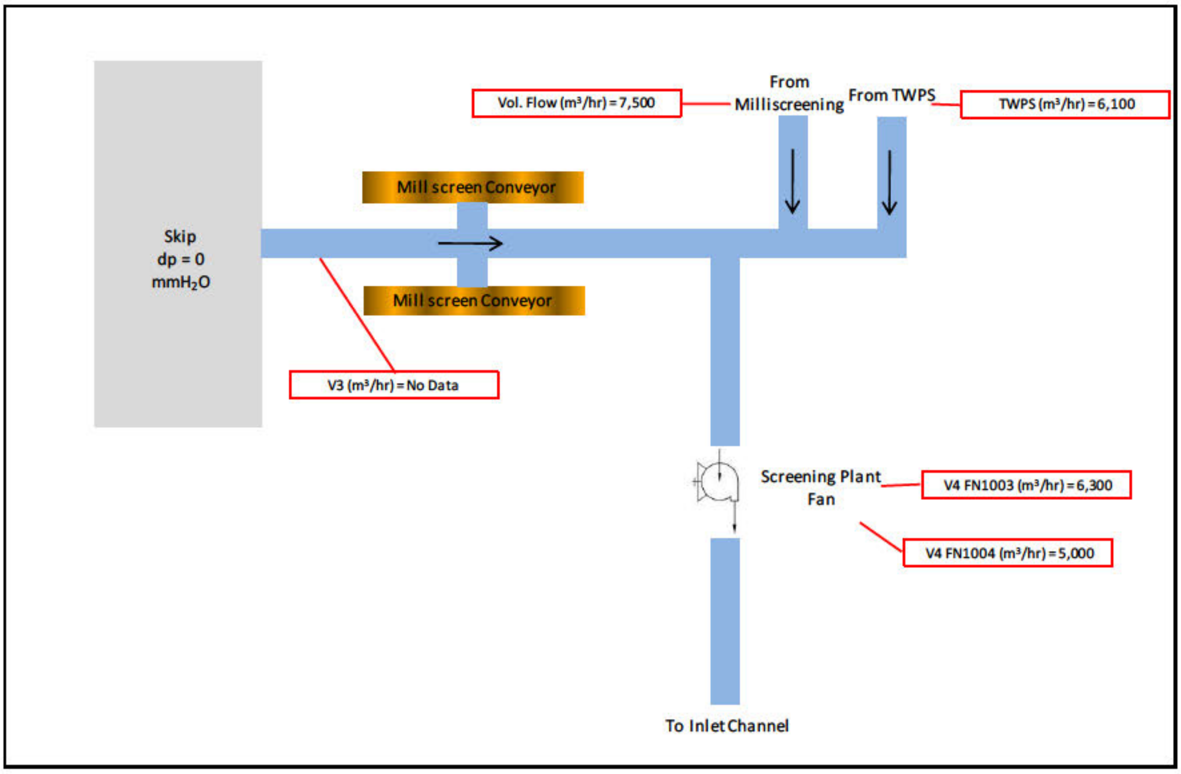


Figure 5: Milliscreen Plant (Ground Floor) Extraction Rate, 24 February 2023

On 24 February 2023, the total volume extracted from the Milliscreen Plant was approximately 11,300 m^3/hr. The flow consisted of approximately 6,100 m^3/hr from the TWPS, 7,500 m^3/hr from the milliscreening enclosures, and an unknown volume from the screenings skip (Total 13,600 m^3/hr). As the extraction rates from the milliscreens and TWPS is higher than the extraction rates from the main plant fans, there is a potential for the excess flow to be discharged via the skip bay extraction. The main plant fans may be being hindered by upstream blockages, potentially the biofilter. *It is highly recommended that the main fans be investigated to improve the extraction rates.*

The extraction rate from the TWPS was slightly higher than measured in July 2021, however the extraction rate from the milliscreening enclosures was approximately 25 % lower than 2021. *Given the high vacuums observed on the milliscreen enclosures, it appears that there may be some blockages in the ducting.*

With regards to the screening skip, there appeared to be negligible extraction. This would have been hindered by the cover to the skip not being in place, furthermore, the roller door to the skip bay was open allowing foul air to discharge (see Figure 6). As the extraction rate was not able to be measured, it is unknown how effective the capture system is. Furthermore, as indicated above, the TWPS fan may be resulting in air being discharged via the skip extraction system.

Hence, it is highly recommended that the skip extraction flow sampling port be repaired to allow the flow to be measured and ensure there is active extraction from the skips.

It is also recommended that all ducting be inspected to ensure there are no blockages.

It is also recommended that the covers for the screening skip should be in place and the roller door closed at all times.

Figure 6: Screening Skip, 24 February 2023

The flow rate extracted from the Milliscreen Plant equated to 3.2 m^3/s, which was significantly less than the 4.2 m^3/s observed in 2021 and was even lower than the 3.6 m^3/s observed in 2018. This reduction in flow further indicates there are blockages in the extraction ducting which requires investigation. The observed extraction rates are still significantly higher than the 1.8 m^3/s presented in the Operations Manual or the 1.6 m^3/s specified in the Odour System Model primarily due to both milliscreen fans operating. This suggests that the extraction system no longer confirms with the design models.

There are two passive vents on the access door to the plant and on 24 February 2023 they were at ambient pressure allowing for possible fugitive emissions. The plant extraction was likely hindered by the open roller door.

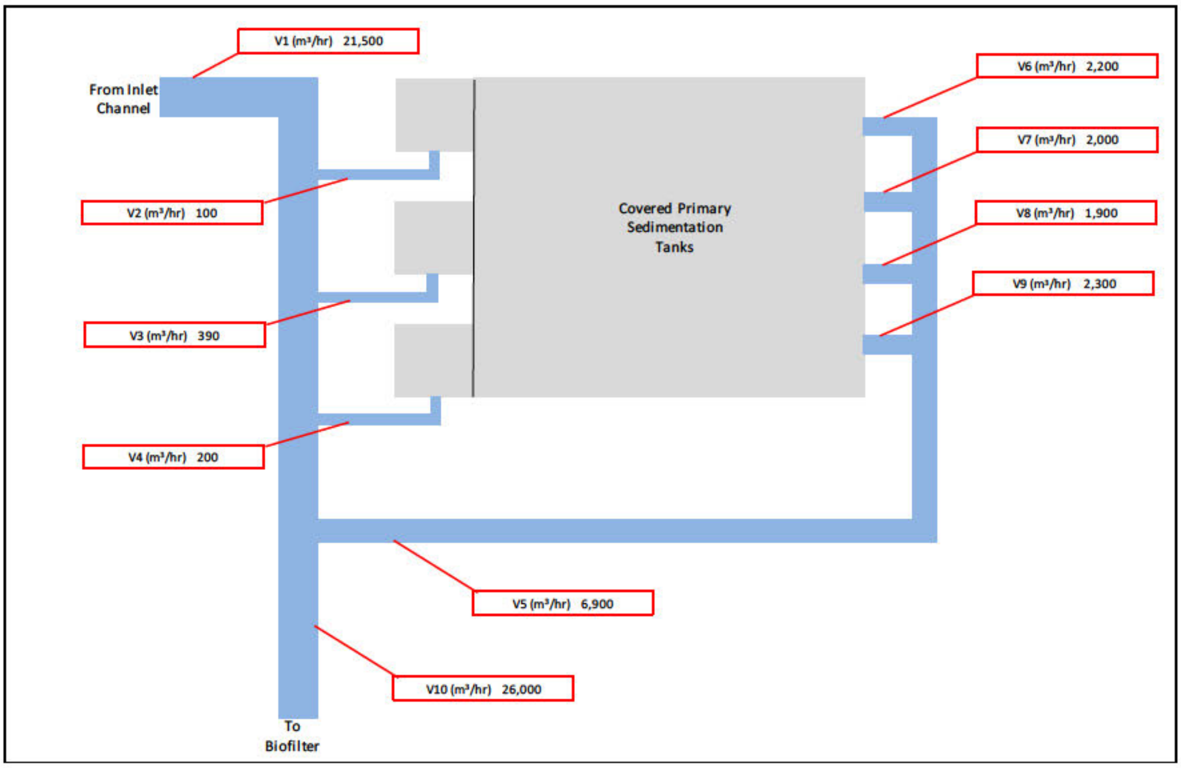
The Milliscreen Plant building has four approximately 600 mm roof mounted fans. The two fans at the control room end of the plant were not operating but were still open to atmosphere. The two fans located above the skip load out area were still operating. As a result, odours within the milliscreen building are being discharged directly to atmosphere.

To prevent discharges from the milliscreen building, it is recommended that the ceiling fans are sealed with additional building extraction applied to contain the odours within the Milliscreen Plant. The foul air could then be directed to the biofilter or similar air pollution control technology.

3.5 Primary Sedimentation

The odour control system for the primary sedimentation process consists of the inlet channel, primary sedimentation tanks, channels, sumps and scum pumping stations, all of which are covered. Foul air from the process is extracted by the main biofilters fans and discharged to the plenum of the biofilter. Inspection of the primary sedimentation process and extraction ducting was all in good working order with little odour observed.

Figure 7 depicts a schematic of the odour control system extraction of the primary sedimentation process measured on 24 February 2023. The flow rate calculation data is presented in Appendix A.



- **Figure 7: Primary Sedimentation Extraction Rate, 24 February 2023**

On 24 February 2023, the volume of air extracted from the inlet channel was approximately 21,500 m^3/hr, which was similar to the 20,600 m^3/hr observed in 2021. The total volume extracted from the primary sedimentation tanks was 4,500 m^3/hr (26,000 – 21,500 m^3/hr) which was approximately 25 % lower than observed in July 2021. This is most likely due to an upstream blockage, potentially the biofilter.

3.6 Gravity Thickener & Sludge Blend Tank

Foul air from the Gravity Thickener and Sludge Blend tanks are extracted to the biofilter by the main biofilter fans. Inspection of the Gravity Thickener and Sludge Blend tanks extraction system showed they were generally in good working order with the processes under a good level of vacuum preventing any fugitive emissions.

On 24 February 2023, approximately 1,000 m^3/hr was extracted from the Gravity Thickener with a further 2,800 m^3/hr being extracted from the Sludge Blend tank. The flow rate calculation data is presented in Appendix A. While the extraction rate from the Gravity Thickener was slightly lower than observed in July 2021, this is unlikely to adversely affect the containment. The extraction from the Gravity Thickener was the same as observed in 2021.

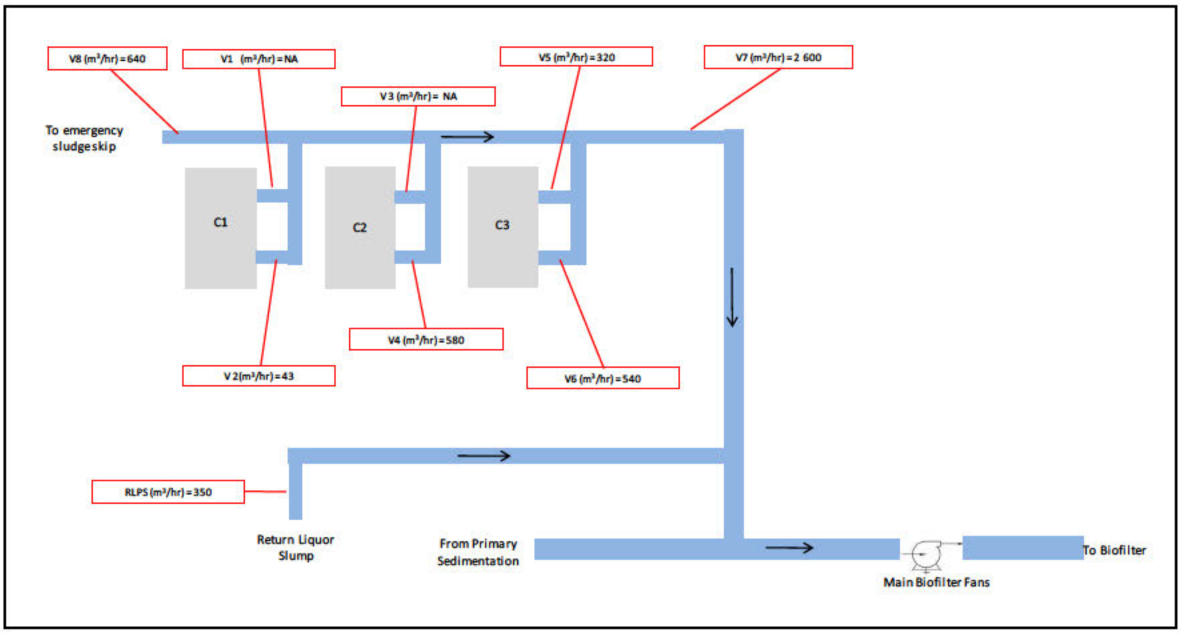
3.7 Centrifuge Room

The Hutt Valley WTP has three sludge centrifuges located in the Centrifuge Room. Each unit has active extraction at either end to remove foul air from the centrifuges. The flow rates from only two of the six extraction ducts could be measured as some of the sampling ports had been sealed. There are two floor and two ceiling passive wall vents within the Centrifuge Room. Building pressures recorded from these vents indicated the room to be under a negative pressure of between -0.1 and -0.2 mmH_2O. Hence, while there was a significant odour within the centrifuge room, the likelihood of fugitive emissions would be low. However, it was noted that in the afternoon the side roller door was opened which would allow foul air to escape (See Figure 8). *It is recommended that this door remains closed unless in use.*

- **Figure 8: Centrifuge Room Side Roller Door, 24 February 2023**

The Return Liquor Pump Station (RLPS) captures liquor from a number of processes on site including the centrifuges and biofilter. The captured liquid is pumped back into the system for treatment. The RLPS is covered, with active extraction to the biofilter. Inspection of the RLPS identified significant leaks and was generally in poor condition. However, the slump was under a good vacuum with a pressure of -0.5 mmH_2O which was lower than observed in July 2021.

Figure 9 depicts a schematic of the odour control system extraction of the centrifuges and RLPS measured on 24 February 2023. The flow rate calculation data is presented in Appendix A.



- **Figure 9: Centrifuge Room & Return Liquor Pump Station Extraction Rate, 24 February 2023**

On 24 February 2023, the total flow extracted from the three centrifuges was approximately 2,600 m^3/hr with approximately 350 m^3/hr extracted from the RLPS. The extraction rate from the centrifuges was approximately 30 % higher than 2021 while the RLSP was similar.

3.8 Sludge Dryer

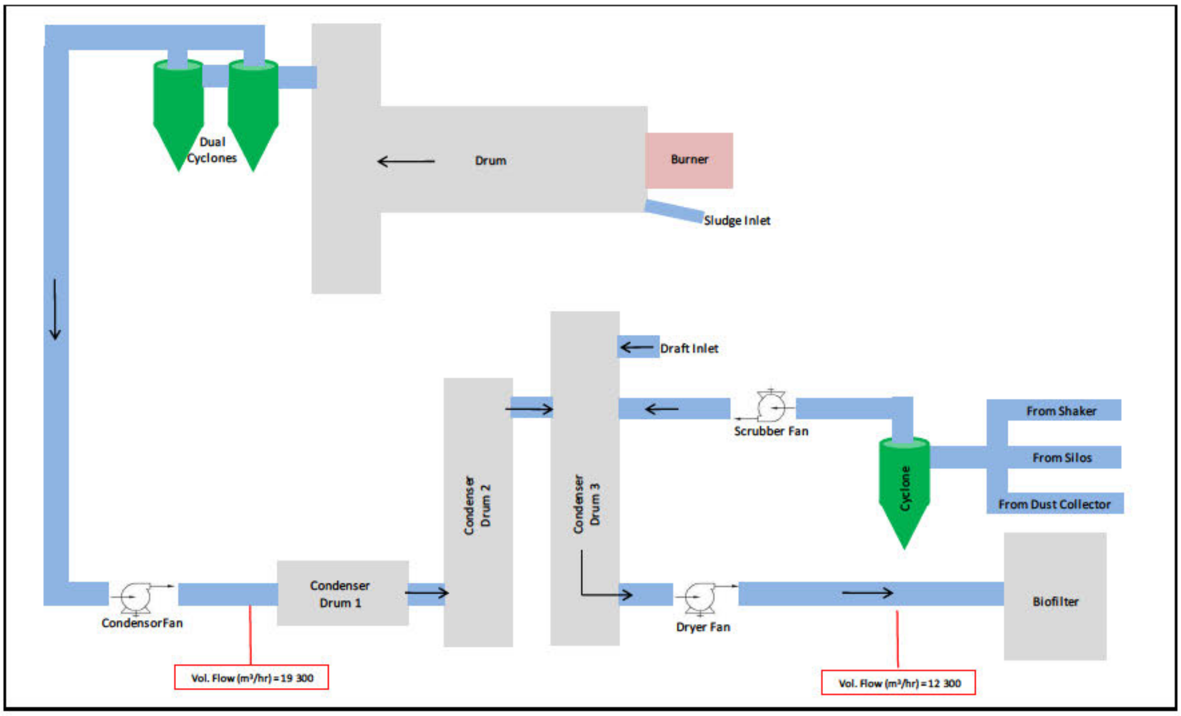
The sludge dryer consists of a rotary drum dryer fired on natural gas. At the outlet of the rotary drum the flow passes through two high efficiency cyclones to remove the entrained sludge. The captured dried sludge is transported by a screw conveyer to the storage silos for offsite disposal. The foul air is extracted from the dryer by two fans. The condenser fan extracts foul air from the dryer and discharges the air to a series of three condenser drums to remove excess moisture. The dryer fan then extracts foul air from the final condenser drum and discharges directly to the biofilter.

Close to the inlet to the biofilter, a separate duct links the dryer discharge duct to the inlet of the main biofilter fan. There is a butterfly valve on the duct which is closed during dryer operation to prevent interaction between the dryer fan and biofilter fan. When the dryer is not running, the valve opens to aid in extraction from the dryer plant.

When the dryer is operating, both the condenser and dryer fans are running. When the dryer is not operating, only the dryer fan runs at approximately 50% of maximum load.

A number of other associated processes are extracted via a secondary scrubber fan which operates continuously and discharges to the final condenser drum. These processes include the dry sludge shaker, storage silos and truck loading dust collector. The final condenser drum also has a butterfly valve open near the top of the drum.

Figure 10 depicts a schematic of the odour control system extraction for the sludge dryer measured on 24 February 2023. The flow rate calculation data is presented in Appendix A. Due to the high moisture content and temperature of the dryer exhaust gas; Pitot tubes were used to determine the gas velocity for the dryer fan with the raw data presented in Appendix B.



- **Figure 10: Sludge Dryer Extraction Rate Schematic, 24 February 2023**

On 24 February 2023, the total flow discharged by the dryer fan to the biofilter was approximately 12,300 m^3/hr which was similar to the 12,000 m^3/hr observed in July 2021. The condenser fan flow rate was approximately 19,300 m^3/hr, which was slightly higher than the 17,500 m^3/hr measured in 2021 and previous years. The difference between the flow from the condenser and the flow to the biofilter is due to the different temperature and moisture content of the two sources. Assuming the gas stream at both locations is saturated and correcting for moisture and temperature the condenser fan flow was operating at approximately 9,200 m^3/hr and the main dryer fan was running at approximately 9,800 m^3/hr. *While the main fan is operating a s slightly higher flow than the condenser fan, the difference is quite small, and it is recommended the flow at the inlet to condenser drum three be confirmed by measuring the pressure and/or flow at the inlet.*

The extraction rate from the sludge dryer measured on 24 February 2023 equated to 3.4 m^3/s, which was similar to the 3.5 m^3/s presented in the Operations Manual or the 3.9 m^3/s specified in the Odour System Model. Hence, it may be possible to increase the extraction rate from the sludge dryer to reduce odours within the building. However, this will be dependent on the process operation conditions.

The sludge dryer building has three ground level passive vents approximately 1500 mm x 1500 mm in size. On 24 February 2023, the building pressure measured at these passive vents was in the range -0.2 to -0.6 mmH_2O indicting the building was under negative pressure. However, the negative pressure was most likely due to the four approximately 700 mm roof mounted fans which discharge directly to atmosphere. There are also significant areas in the roof space at the top of the primary sludge cyclones which is not enclosed. As a result, foul air from within the plant is discharged directly to atmosphere. This has the potential to allow significant odours to be released and is likely a key cause of current odour complaints.

Hence, it is higly recommended that the building be sealed with active extraction to the plant biofilter.

3.9 Biofilter Inlet

The main biofilter fan incorporates foul air extracted from the Primary Sedimentation works (which includes the Milliscreen Plant), the Gravity Thickener tank, Sludge Blend tank, Centrifuge Room and RLPS. Figure 11 depicts a schematic of the odour control system inlet to the biofilter measured on 24 February 2023. The flow rate calculation data is presented in Appendix A.

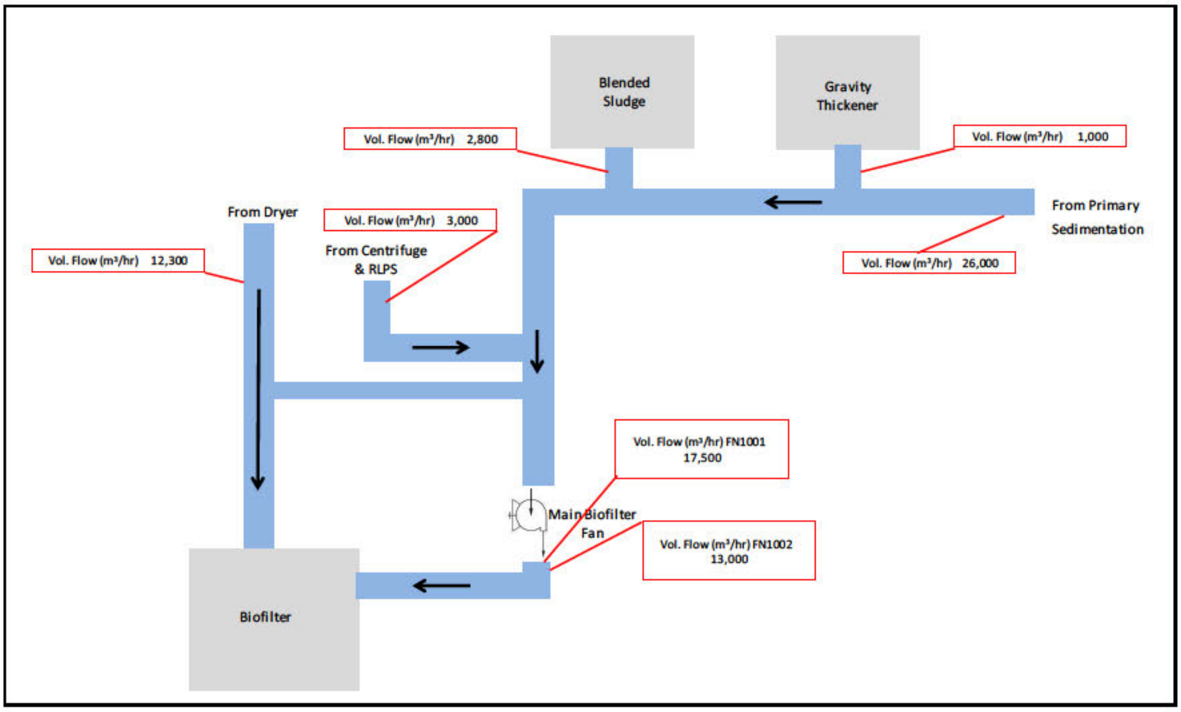


Figure 11: Biofilter Total Extraction Rate Schematic, 24 February 2023

On 24 February 2023, the total flow discharged to the biofilter from the biofilter fans was approximately 30,500 m^3/hr which consisted of approximately 26,000 m^3/hr from the Primary Sedimentation works (including the Milliscreen Plant/Inlet Channel), approximately 3,800 m^3/hr from the Gravity Thickener and Sludge Blend tank, and approximately 3,000 m^3/hr from the Centrifuge Room and RLPS.

Combining the flow from the biofilter fans with approximately 12,300 m^3/hr from the sludge dryer, the total flow to the biofilters was approximately 42,800 m^3/hr, which is at the designed flow rate of 43,000 m^3/hr (Operations Manual).

The flow rate of the main biofilter fans measured on 24 February 2023 equated to 8.5 m^3/s, which was similar to the 8.3 m^3/s measured in 2011. However, the flows are significantly higher than the 3.6 m^3/s presented in the Operations Manual or the 3.3 m^3/s specified in the Odour System Model. This would indicate that the extraction system is handling over twice the volume of air the system was designed for. However, the biofilter ventilation rate and retention time are still being maintained at the designed flow rate. However, any further extraction from the plant will need to be directed to a new odour control system.

It is worth noting that there was a significant sludge odour present in the vicinity of the Return Liquor slump and biofilter fans. Inspection of the biofilter plenum identified a number of holes and cracks which resulted in foul air being directly discharged into the atmosphere. Further holes/cracks were also observed at the opposite end of the biofilter (See Figure 12).

It is recommended that the plenum be repaired to prevent fugitive emissions.

- **Figure 12: Biofilter Plenum, 24 February 2023**

Appendix A Flow Rate Calculation Data

This Appendix contains 4 pages including cover.

Milliscreen Plant Raw Data, 24 February 2023

	TWPS	V1	V2	V3	V4	V5	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Date	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023
V (m/s)=	14.1	13.3	17.7	ND	9.7	5.2	26.4	17.9	14.3	7.3	12.5	12.7	6.7	10.4	15.0	10.0
T (^oC)=	18.1	20.3	19.6	ND	21.8	22.2	20.9	21.4	21.2	22.3	20	19.6	21.1	19.9	20.7	21.6
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	390	300	300	350	480	580	150	150	150	150	150	150	150	150	150	150
Static (mmH_2O)=	-196	-174	>225	ND	-27.8	-26.6	-164	-145	-146	-139	-34	-54.2	-51.2	-53.4	-44.9	-46.1
Vol (m^3/hr)=	6,071	3,388	4,509	ND	6,326	4,990	1,681	1,140	911	466	796	809	426	662	953	637
Vol (m^3/s)=	1.7				1.8	1.4										
2017 Data	2,901	866	994	3,261	8,138	NA	96	229	172	478	338	331	NA	331	331	331
2018 Data	5 095	2 293	2 013	5 752	5 237	7 501	389	484	471	414	560	529	573	503	554	382
2021 Data	5,468	3,337	4,178	1,872	4,109	11,046	611	1,089	834	650	643	376	503	490	471	605

Unable to access V3 due to being unable to remove flow sensor.

V1 = from milli screens 1-5
V2 = from milliscreens 6-10
V3 = Screeings skip
V4 = Milliscreen main ID fan FN1001
V5 = Milliscreen main ID fan FN1002

Design Flow Rate Op Manual
Vol (m^3/s)= 1.8
Design Flow Rate Odour Model
Vol (m^3/s)= 1.6

Primary Sedimentation Raw Data, 24 February 2023

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
Date	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023
V (m/s)=	19.8	6.4	13.9	12.6	15.3	12.6	11.1	10.8	13.2	15.1
T (^oC)=	19.0	21.0	19.0	19.1	19.4	20.1	19.9	20.4	20.8	19.0
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	620	75	100	75	400	250	250	250	250	780
Static (mmH_2O)=	-45.5	-24.0	-19.3	-18.4	-70	-14.2	-25.5	-31.9	-57.4	-85.8
Vol (m^3/hr)=	21,544	102	393	201	6,929	2,229	1,964	1,911	2,335	26,022
Vol (m^3/s)=										
2017 Data	10,119	57	147	70	2,400	920	NA	743	832	12,744
2018 Data	15,995	67	223	101	3,804	1,309	1,380	1,380	1,539	16,188
2021 Data	20,565	88	388	202	6,205	2,229	2,618	1,486	1,893	26,521

Notes
V1 From inlet channel
V10 = Flow to main biofilter ID fan

Centrifuges & RLPS Raw Data, 24 February 2023

	V1	V2	V3	V4	V5	V6	V7	V8	RLPS
Date	24/02/2023	24/02/2023	20/07/2021	24/02/2023	24/02/2023	24/02/2023	20/07/2021	20/07/2021	24/02/2023
V (m/s)=	NA	1.5	NA	20.6	11.3	19.1	14.8	5.7	12.4
T (^oC)=	NA	18.9	NA	18.8	17.2	16.4	18.9	18.1	19.0
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	NA	100	NA	100	100	100	250	200	100
Static (mmH_2O)=	NA	-0.2	NA	-54.2	-23.5	-51.3	-72.4	-48.7	-13.2
Vol (m^3/hr)=	NA	43	NA	583	320	541	2,618	640	351
Vol (m^3/s)=									
2017 Data	327	215	164	260	20	161	NA	NA	226
2018 Data	NA	261	NA	393	6	326	1,521	NA	388
2023 Data	NA	594	NA	563	Off	Off	1,769	951	328

V7 = Total Flow
V8 = Loadout Flow

Sludge Tanks Raw Data, 24 February 2023

	Blened Sludge	Gravity Thickener
Date	24/02/2023	24/02/2023
V (m/s)=	10.9	9.0
T (^{o}C)=	19.1	17.5
RH (%) =	NA	NA
D (mm) =	300	200
Static (mmH_2O)=	-26.5	-27.3
Vol (m^3/hr)=	2,777	1,024
Vol (m^3/s)=	0.77	0.28
2017 Data	1,070	679
2018 Data	2,094	645
2023 Data	2,751	1,291

Sludge Dryer Raw Data, 24 February 2023

	Condesor Fan	Dryer Fan
V (m/s)=	16.9	10.0
T (^{o}C)=	100.5	45.4
RH (%) =	100.0	100.0
D (mm) =	635	660
Static (mmH_2O)=	-2200	960
Vol (m^3/hr)=	19,278	12,253
Vol (m^3/s)=	5.4	3.4
2017 Data	18,363	10,123
2018 Data	NA	10,974
2021 Data	17,463	12,030

Design Flow Rate Op Manual

Vol (m^3/s)= 3.5

Design Flow Rate Odour Model

Vol (m^3/s)= 3.9

Biofilter Inlet Raw Data, 24 February 2023

	Primary Sedimentation	Sludge Blend Tank	Gravity Thickener	Centrifuges	RLPS	Biofilter Fan FN1001	Biofilter Fan FN1002	Dryer Fan	Biofilter Total
Date	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	24/02/2023	
Fan Speed						100%	100%		
V (m/s)=	15.1	10.9	9.0		12.4	15.3	11.4	10.0	
T (^oC)=	19.0	19.1	17.5		19.0	19.1	18.7	45.4	
RH (%) =	NA	NA	NA		NA	NA	NA	NA	
D (mm) =	780	300	200		100	635	635	660	
Static (mmH_2O)=	-85.8	-26.5	-27.3		-13.2	-116	-105		
Vol (m^3/hr)=	26,022	2,777	1,024	2,618	351	17,463	13,012	12,269	42,744
Vol (m^3/s)=		0.77	0.28			4.9	3.6	3.4	11.9
2017 Data	12,744	1,070	679	985	226	14,724	NA	10,111	24,835
2018 Data	16,188	2,094	645	1,521	388	7,191	14,610	10,875	32,676
2021 Data	26,521	2,751	1,291	1,769	328	16,664	13,468	12,047	42,179

	Biofilter Fan FN1001	Dryer Fan	Biofilter Total
Design Flow Rate Op Manual			
Vol (m^3/s)=	3.6	3.5	7.1
Design Flow Rate Odour Model			
Vol (m^3/s)=	3.3	3.9	7.2

Appendix B Pitot Velocity Calculation Data

This Appendix contains 3 pages including cover

Preliminary Stack Survey

Source	HVWTP Condesor Fan
Date	20-Jul-21
Pitot	S-Type Pitot
Number of lines used for survey	1
Which sampling line was used?	a

Molecular Weight of Stack Gas

Was CO2 measured in the stack?	No	
Accurately state fuel for CO2 calculation	None	Choose: None / Natural Gas / Light Fuel Oil / Heavy Fuel Oil / Coal
Calculated CO2 Value	0.00	
O2 Reference?	NA	%

Duct Characteristics

Type	Circular	
Depth/Dia	0.635	m
Width	-	m
Area	0.317	m^2
Port Depth	0	mm

Sampling Lines & Sample Points

Line A

Traverse Point	ΔP pt mmH$_2$O	ΔP pt Pa	Temp ^oC	Velocity (corrected for swirl) m	O_2 %	Angle of Swirl ^{o}
1	24.1	236.0	100.5	20.12	7.3	0
2	22.6	222.0	100.5	19.51	7.3	0
3	16.9	166.0	100.5	16.87	7.3	0
4	15.8	155.0	100.5	16.30	7.3	0
5	13.9	136.0	100.5	15.27	7.3	0
6	12.2	120.0	100.5	14.35	7.3	0
7	13.7	134.0	100.5	15.16	7.3	1
8	18.4	180.0	100.5	17.56	7.3	2
9						
10						
11						
12						
Mean	17.2	168.6	100.5	16.89	7.3	

Line B

Traverse Point	Distance into duct (m)	ΔP pt mmH$_2$O	ΔP pt Pa	Temp ^oC	Velocity m/s	O_2 % Vol	Angle of Swirl ^{o}
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	
AVERAGE	-	17.2	168.6	101	16.89	-	

Pitot tube velocity constant, K_p		34.97		
Velocity pressure coefficient, C_p	0.841			
Mean Oxygen		7.3	Moisture Cointent Calculations	
Mean CO_2		8.6	RH, %	100
Mean Md		29.67	Saturated Vapour Pressure. mmHg	
Moisture %	35.0	0.350		
Mean Ms		25.58		
Barometric Pressure, kPa	102.3	767.3		
Static Pressure, Pa	-2200	-16.50		
Absolute Stack Pressure		750.8		
Angle of Swirl		0		

Lowest Gas Velocity,m/s	14.35
Highest Gas Velocity, m/s	20.12
Mean Velocity, m/s	16.89

Duct Volumetric Flow Rates

Moist, m^3/h	19,262
Moist Standards, m^3/h	14,217
Dry Standard, m^3/h	9,241

SOURCE TESTING NZ

Preliminary Stack Survey Single Fan

Source	HVWTP Dryer Outlet
Date	24-Feb-23
Pitot	S-Type Pitot ST030
Number of lines used for survey	1
Which sampling line was used?	a

Molecular Weight of Stack Gas

Was CO2 measured in the stack?	No	
Accurately state fuel for CO2 calculation	None	Choose: None / Natural Gas / Light Fuel Oil / Heavy Fuel Oil / Coal
Calculated CO2 Value	0.00	
O2 Reference?	NA	%

Duct Characteristics

Type	Circular	
Depth/Dia	0.66	m
Width	-	m
Area	0.342	m^2
Port Depth	0	mm

Sampling Lines & Sample Points

Line A

Traverse Point	ΔP pt mmH_2O	ΔP pt Pa	Temp ^oC	Velocity (corrected for swirl) m	O_2 % Vol	Angle of Swirl ^{o}
1	3.8	37.0	45.4	6.87	16.4	0
2	8.5	83.0	45.4	10.29	16.4	0
3	9.3	91.0	45.4	10.77	16.4	0
4	9.1	89.0	45.4	10.66	16.4	0
5	8.3	81.0	45.4	10.17	16.4	0
6	8.8	86.0	45.4	10.47	16.4	0
7	6.9	68.0	45.4	9.31	16.4	0
8	9.5	93.0	45.4	10.89	16.4	0
9	8.7	85.0	45.4	10.41	16.4	0
10	8.9	87.0	45.4	10.54	16.4	0
11	8.6	84.0	45.4	10.35	16.4	0
12	9.1	89.0	45.4	10.66	16.4	0
Mean	8.2	80.0	45.4	10.04	16.4	

Line B

Traverse Point	Distance into duct (m)	ΔP pt mmH_2O	ΔP pt Pa	Temp ^oC	Velocity m/s	O_2 % Vol	Angle of Swirl ^{o}
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	
AVERAGE	-	8.2	80.0	45	10.04	-	

Pitot tube velocity constant, K_p		34.97		
Velocity pressure coefficient, C_p	0.841			
Mean Oxygen		16.4	Moisture Cointent Calculations	
Mean CO_2		4.60	RH, %	100
Mean Md		29.39	Saturated Vapour Pressure. mmHg	23.198
Moisture %	8.5	0.085		
Mean Ms		28.42		
Barometric Pressure, kPa	102.3	767.3		
Static Pressure, Pa	960	7.20		
Absolute Stack Pressure		774.5		
Angle of Swirl		0		

Lowest Gas Velocity,m/s	6.87
Highest Gas Velocity, m/s	10.89
Mean Velocity, m/s	10.04

Duct Volumetric Flow Rates

Moist, m^3/h	12,365
Moist Standards, m^3/h	10,705
Dry Standard, m^3/h	9,795

SOURCE TESTING NZ

Veolia

HUTT VALLEY WASTEWATER TREATMENT PLANT, ODOUR CONTROL SYSTEM ASSESSMENT, JULY 2021

Issue

August 2021

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Contents

Executive Summary

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia to undertake an assessment of the odour control system at the Hutt Valley Wastewater Treatment Plant (WTP), Seaview, Wellington. Veolia have recently taken over the management of the Hutt Valley WTP from Hutt Valley Water Services and have been experiencing a number of odour complaints from the community. Condition 7 of the Company's Air Discharge Consent (WGN950162(01)) stipulates that "there shall be no discharges to air that are obnoxious, dangerous, offensive or objectionable at or beyond the boundary of the property. These discharges include odour and dust". To comply with Condition 7, the plant odour control system extracts foul air from odorous processes and discharges them to a bark biofilter for treatment.

In July 2021, STNZ conducted an assessment of the odour control system to confirm the operational condition of the system and identify any potential sources of fugitive odour which may be resulting in the observed odour complaints. Flows from key areas of the extraction system were also assessed to allow comparison with the current Biofilter Operations Manual and Odour Model.

The following discussion summarises the findings of the Hutt Valley WTP odour control system assessment.

The Trade Waste Pump Station (TWPS) acts as the inlet works for the plant. The odour control system extracts foul air from the TWPS via an ID fan located within the Milliscreen plant. In July 2021, the extraction rate from the TWPS was similar to that observed in 2018. However, the sealing of the wet wells had been improved resulting in significantly better vacuum being applied, reducing the risk of any fugitive emissions from the plant. From an odour control perspective, the TWPS was operating effectively.

The Milliscreen Plant incorporates several different processes with milliscreening conducted on the first floor, and disposal of the screened material, odour control fans, the plant pump station and discharge wet well on the ground floor. In 2021, all 10 of the milliscreen enclosures were replaced. However, the screens themselves have not been replaced and were in poor working order. The high-pressure cleaning jets were also no longer operational resulting in clogging of the screens. This has the potential to adversely affect the quality of effluent discharged from the milliscreen plant and potentially odour generation within the drums.

Replacing the enclosure has improved the extraction rates from the screen from approximately 4,000 m^3/hr in 2018 to approximately 7,500 m^3/hr in 2021. This has acted to improve the vacuums applied to the screen reducing odours within the plant Building. However, milliscreen enclosure 9 was under positive pressure and needs to be investigated.

In July 2021, the total volume extracted from the Milliscreen Plant was approximately 15% higher than observed in 2018 and was primarily due to the improved extraction rates from the milliscreen enclosures. The extraction rate with the two milliscreen fans operating equated to 4.2 m^3/s, which was higher than the 1.8 m^3/s presented in the Operations Manual or the 1.6 m^3/s specified in the Odour System Model. This reflects both the main milliscreen fan operating.

There are two passive vents on the access door to the plant and on 2 July 2021 they were under a negative pressure of -0.2 mmH_2O. Similarly, the skip door was found to have a pressure of -0.1 mmH_2O indicating the building was generally under negative vacuum. However, the Milliscreen Plant building has four approximately 600 mm roof mounted fans. The two fans at the control room end of the plant were not operating but were still open to atmosphere. The two fans located above the skip load out area were still operating. As a result, odours within the milliscreen building are discharged directly to atmosphere. While the odour within the plant was minor there was a significant amount of deodorant being used to mask the smell primarily of the screening skip.

To prevent discharges from the milliscreen building it is recommended that sealing these fans be investigated with additional building extraction applied to contain the odours within the Milliscreen Plant. The foul air could then be directed to the biofilter or similar air pollution control technology.

The odour control system for the primary sedimentation process consists of the inlet channel, primary sedimentation tanks, channels, sumps and scum pumping stations, all of which are covered. Foul air from the process is extracted using the main biofilters fans and discharged to the plenum of the biofilter. In July 2021 the volume of air extracted from the inlet channel was approximately 22 % higher than observed in 2018, primarily because of the additional ventilation of the milliscreen enclosures. The total volume extracted from the primary sedimentation tanks was approximately 50 % higher than observed in 2018.

The covers of the primary sedimentation process and extraction ducting was all in good working order with little odour observed.

Foul air from both the Gravity Thickener tank and Sludge Blend tank are extracted to the biofilter by the main biofilter fans. In July 2021 the volumes extracted from the sludge tanks was slightly higher than observed in 2018. The Gravity Thickener and Sludge Blend tanks were generally in good working order with the processes under a good level of vacuum preventing any fugitive emissions. It is worth noting that an additional extraction vent had been ducted to the loadout of the Gravity Thickener which will further reduce any potential odour emissions.

The Hutt Valley WTP has three sludge centrifuges located in the Centrifuge Room. Each of the unit has active extraction at either end to remove foul air from the centrifuges. On 20 July 2021, Centrifuge 3 was out of commission. There are two floor and two ceiling passive wall vents within the Centrifuge Room. Building pressures recorded from these vents indicated the room to be under a negative pressure of between -0.2 and -0.3 mmH_2O. Hence, while there was a significant odour within the centrifuge room, the likelihood of fugitive emission would be low.

The Return Liquor Pump Station (RLPS) captures liquor from several processes on site including the centrifuges and biofilter. The captured liquid is pumped back into the system for treatment. The RLPS is covered, with active extraction to the biofilter. Inspection of the RLPS identified significant leaks and was generally in poor condition. However, the slump was under a good vacuum with a pressure of -0.9 mmH_2O. There were also several leaks in the pipes discharging into the slump all of which were a potential source of odours.

The observed extraction rates were similar to those observed in 2018. However, in 2014 the flow rates extracted from the centrifuges and RLPS were higher suggesting there may be potential blockages in the system. While all of the extraction ducting had been sealed with fibreglass in 2018 and were generally in good working order, the fibreglass may be hiding damages to the internal ducting.

The sludge dryer consists of a rotary drum dryer fired on natural gas. On 20 July 2021 the total flow discharged by the dryer fan to the biofilter was approximately 12,000 m^3/hr with the condenser fan operating at approximately 17,500 m^3/hr. These flows were similar to those observed in 2018. The difference between the flow from the condenser and the flow to the biofilter is primarily due to the different temperature and moisture content of the two sources.

The extraction rate from the sludge dryer measured on 20 July 2021 equated to 3.3 m^3/s, which was lower than the 3.5 m^3/s presented in the Operations Manual or the 3.9 m^3/s specified in the Odour System Model. Hence, it may be possible to increase the extraction rate from the sludge dyer to reduce the odour within the plant building.

The sludge dryer building has three ground level passive vents approximately 1500 mm x 1500 mm in size. On 20 July 2021, the building pressure measured at these passive vents was in the range -0.3 to -0.8 mmH_2O indicting the building was under negative pressure. However, the reason the building was under negative pressure was four approximately 700 mm roof mounted fans which discharge directly to atmosphere. There are also significant areas in the roof space at the top of the primary sludge cyclones which are not enclosed allowing foul air in the plant to be discharged to atmosphere.

As a result, foul air from within the plant is discharged directly to atmosphere. This has the potential to allow significant odours to be released and is likely a key cause of current odour complaints. Hence, it is recommended that the building be sealed with active extraction to the plant biofilter.

The main biofilter fan incorporates foul air extracted from the Primary Sedimentation works (which includes the Milliscreen Plant), the Gravity Thickener tank, Sludge Blend tank, Centrifuge Room and RLPS. In July 2021, the total flow discharged to the biofilter from the biofilter fans was approximately 30,100 m^3/hr, which when combined with the flow from the sludge dryer of approximately 12,000 m^3/hr, the total flow to the biofilters was approximately 42,100 m^3/hr, which is at the design flow rate of 43,000 m^3/hr (Operations Manual).

The flow rate of the main biofilter fans measured on 20 July 2021 equated to 8.3 m^3/s, which was higher than the 6.1 m^3/s measured in 2018. Both flows are significantly higher than the 3.6 m^3/s presented in the Operations Manual or the 3.3 m^3/s specified in the Odour System Model. Given the total flow to the biofilter is at the designed flow rate, the figures presented in the manual and model appear to be low.

The biofilter itself had a significant amount of vegetation on the surface which acts to restrict flow to the biofilter. The media had compacted by approximately 300 mm but was still friable and in reasonably good condition. The general biofilter structure was in reasonable conditions with only minor water leaks noted on the plenum. There was no significant odour observed while on the biofilter other than a very mild dirt odour consistent with the normal operation of biofilters. However, it is recommended that the vegetation be removed, and the media be topped up and mixed.

As the biofilter is now operating at the design flow rate, adding further foul air to the system will likely overload the capacity of the biofilter resulting in odour emissions. However, the plant does have sufficient land capacity for the biofilter to be extended to allow for additional extraction from the milliscreen and sludge dryer buildings.

1. Introduction

Source Testing New Zealand Limited (STNZ) was commissioned by Veolia to undertake an assessment of the odour control system at the Hutt Valley Wastewater Treatment Plant (WTP), Seaview, Wellington. Veolia have recently taken over the management of the Hutt Valley WTP and have been experiencing several odour complaints from the community. Condition 7 of the Company's Air Discharge Consent (WGN950162(01)) stipulates that "there shall be no discharges to air that are obnoxious, dangerous, offensive or objectionable at or beyond the boundary of the property. These discharges include odour and dust". In order to comply with Condition 7, the plant odour control system extracts foul air from odorous processes and discharges them to a bark biofilter for treatment.

The following processes are under active extraction to the plant biofilter:

- Trade waste pump station (TWPS);
- Milliscreen process equipment;
- Inlet channel and primary sedimentation tanks including channels, sumps and scum pump stations;
- Gravity thickener;
- Sludge blend tank;
- Centrifuges and dewatered cake conveyors;
- Return liquor pump station (RLPS);
- Sludge dryer; and
- Emergency sludge bins when in use.

In July 2021, STNZ conducted an assessment of the odour control system to confirm the operational condition of the system and identify any potential sources of fugitive odour which may be resulting in the observed odour complaints. Flow measurements were conducted on 2, 9 and 20 July 2021 from different areas of the plant and were used to confirm the sources were under negative pressure. Flows from key areas of the extraction system were also determined to allow comparison with the current Biofilter Operations Manual and Odour Model.

[redacted], Senior Air Quality Scientist, carried out the assessment of the Hutt Valley WTP Odour Control System. [redacted] has over 25 years air quality monitoring and consulting experience and is designated as a key technical person under STNZ's IANZ accreditation. [redacted] is also a Certified Air Quality Professional (CAQP) under the Clean Air Society of Australia and New Zealand (CASANZ) certification programme.

The following report documents the findings of the Hutt Valley WTP, odour control assessment commencing with a brief summary of the system followed by a detailed assessment of the flow rates and operational status of the system. The data has also been compared to the results of similar assessments conducted in 2017 and 2018 by the previous operator. Any potential sources of fugitive odour emissions that are identified are discussed along with potential mitigation methods.

2. Odour Control System

The Hutt Valley WTP odour control system extracts foul air from contained odorous processes and discharges the foul air to a six-bed bark biofilter for treatment. The biofilter is designed to treat a foul air flow rate of 43,000 m^3/hr with a 90 second retention time (refer to the Operations Manual). The total surface area of the biofilter is 850 m^2 with a bed depth of 1.2 m. Foul air is discharged to a 2 m x 2 m plenum by ID fans located in the Milliscreening Plant, the Sludge Dryer and the inlet to the biofilter. Nine pipes per cell evenly distribute air to the base of the biofilter for treatment. A water spray within the plenum removes particulates from the sludge dryer and other process areas. The spray is drained to the return liquor pump station.

The following processes are under active extraction to the plant biofilter:

- Trade waste pump station (TWPS);
- Milliscreen process equipment;
- Inlet channel and primary sedimentation tanks including channels, sumps and scum pump stations;
- Gravity thickener;
- Sludge blend tank;
- Centrifuges and dewatered cake conveyors;
- Return liquor pump station (RLPS);
- Sludge dryer; and
- Emergency sludge bins when in use.

Foul air is extracted from the TWPS and milliscreening equipment by two fixed speed fans which were initially designed to operate in a duty/assist configuration with an operation set point of 1.8 m^3/s (Operations Manual). However, Veolia currently operates both fans to improve extraction from the TWPS and the milliscreens. Foul air from the milliscreening plant is discharged to the void above the screened effluent channel.

The main biofilter fans extract foul air from the screened effluent channel via the primary sedimentation tanks and associated processes, gravity thickener, sludge blend tank, centrifuges and RLPS and discharges directly into the biofilter plenum. The fans were initially designed to operate in a duty/assist configuration with each fan having an operating point of 3.6 m^3/s (Operations Manual). Again, Veolia are operating both fans to optimise extraction rates.

The sludge dryer fan discharges directly to the biofilter plenum with an operating point of 3.5 m^3/s (Operations Manual).

3. Odour Control System Assessment

3.1 Introduction

One of the key objectives of the Hutt Valley WTP Odour Control System Assessment was to determine extraction rates at various points in the odour control system to ensure odorous process areas were maintained under negative pressure, thus preventing the release of foul air, and to determine if the observed flow rates were consistent with designed operating flow rates. The condition of the control system was also investigated to identify any potential sources of fugitive odour emissions. The data has also been compared to previous assessments to identify any significant difference which may need investigating.

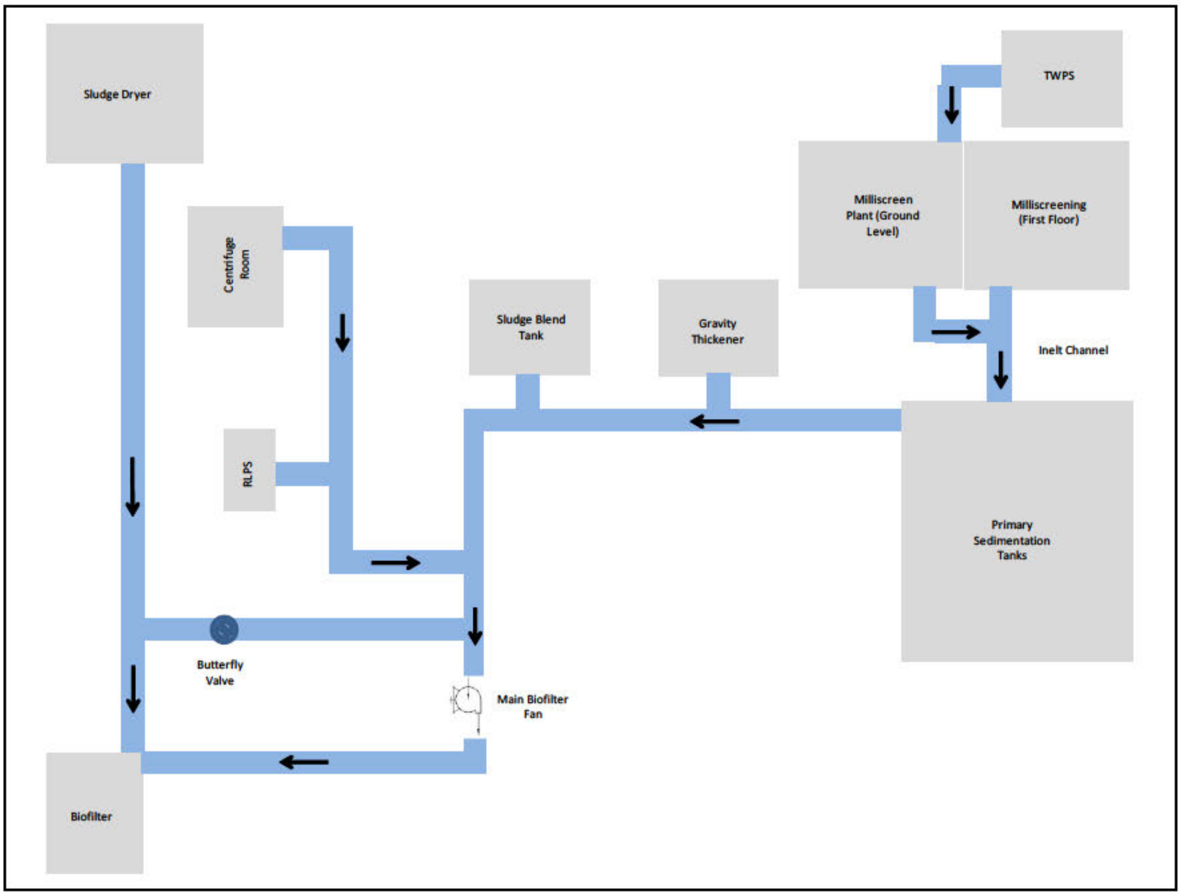
The assessment of flow rates involved the measurement of duct diameter, velocity, temperature, and static pressure. Velocity and temperature were measured using a TSI 9545 Hot Wire Anemometer with the static pressure being determined using a Colmark C9551 pressure meter. Due to the high temperature and moisture content of the discharges from the sludge dryer, the velocity of the main dryer fan was measured using an ‘S’ Type Pitot tube with the temperature determined using a ‘K’ Type thermocouple. The dryer fans gas was assumed to be saturated. Until recently, the condenser fan was unable to be tested due to the size of the sampling port and the hazard classification of the sludge dryer building. However, a new sampling port has been installed and an intrinsically safe manometer was used to measure the flow. Temperature and oxygen data were measured using the on-line analysers.

As a number of the measurement sites were located close to flow disturbances such as baffles, bends and/or fans, the accuracy of the velocity measurements could have been affected. The uncertainty of measurement for the flow rate determinations has been estimated to be ± 15%. Furthermore, all data is presented at actual flow rate conditions with no correction for temperature or moisture content.

The following sections detail the odour control system extraction rates for each of the odorous processes. The extraction rate data is presented in a schematic of the relevant section of the odour control system.

3.2 Odour Control System Schematic

A schematic of the Hutt Valley WTP Odour Control System identifying the primary odour sources and how these interact with the odour control system is presented in Figure 1. Subsequent sections provide flow rate details for each of the sources.



- **Figure 1: Hutt Valley WTP Odour Control System**

3.3 Trade Waste Pump Station

The Trade Waste Pump Station (TWPS) acts as the inlet works for the plant, accepting effluent from a number of different communities including Wainuiomata, Seaview, Lower Hutt and Upper Hutt. The TWPS has two entrance stair wells which have vented doors (See Figure 2). The pumps are located within a sump which is covered by large concrete plates which have been sealed since the last assessment in 2018.

- **Figure 2: TWPS Wet Wells Entrance**

The odour control system extracts foul air from the TWPS via the ID fan located within the Milliscreen plant. On 20 July 2021 the extraction rate from the TWPS was approximately 5,500 m^3/hr which was similar to the 5,100 m^3/hr observed in 2018. The flow rate calculation data is presented in Appendix A. The pressures measured on 2 July 2021 were -0.3 and -0.6 mmH_2O for Wet Wells 1 and 2 respectively which was higher than observed in 2018 when the pressure was slightly positive. At the time of the 2018 assessment an axal pump was being used and where this entered the wet well there were significant gaps around the pipe which would have adversely affected the vacuum to the wet well. Removal of the axal pump and sealing of the covers has seen improvement in the building vacuum, helping to prevent fugitive odour emissions from the TWPS.

3.4 Milliscreen Plant

The Milliscreen Plant incorporates a number of different processes. Milliscreening is carried out on the first floor (Milliscreen (First Floor)). On the ground floor of the Milliscreen Plant (Milliscreen Plant (Ground Floor)) includes disposal of the screened material, odour control fans, the plant pump station and discharge wet well. The odour control system only extracts foul air from the milliscreen enclosures (First Floor) and the skip bin used for the disposal of the screened material. The milliscreening process consists of 10 enclosed milliscreening rotary drums, each of which is under extraction to the biofilter (See Figure 3).

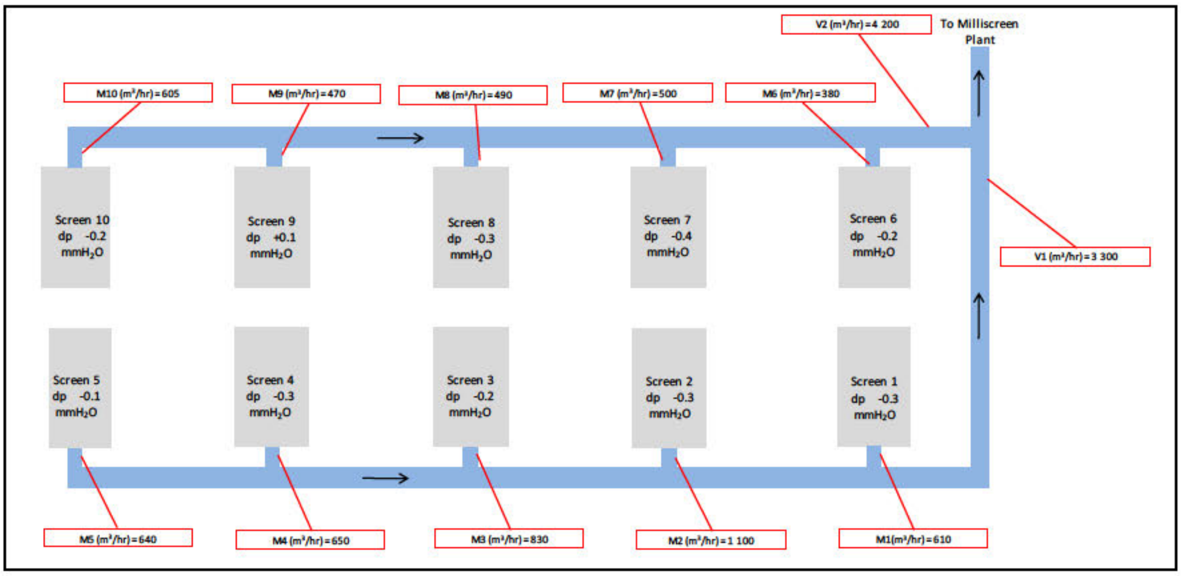
- **Figure 3: Milliscreen Plant**

In 2018, all the ducting in the Milliscreen Plant had been sealed with fibre glass and two of the four extraction ducts from the screw conveyers had been disconnected and sealed. In 2021, all 10 of the milliscreen enclosures were replaced. In addition, a section of ducting from the milliscreen skip to the extraction ducting had been replaced.

While the milliscreen enclosures have been replaced, the screens themselves have not been and are in poor working order. Figure 4 depicts the screens and some of the significant metal fatigue. The high-pressure cleaning jets are also no longer operational resulting in clogging of the screens. This has the potential to adversely affect the quality of effluent discharged from the milliscreen plant and potentially odour generation within the drums.

Figure 5 depicts the flow schematics for the Milliscreen Plant (First Floor) measured on 2 July 2021. The flow rate calculation data is presented in Appendix A.

- **Figure 4: Milliscreens, July 2021**



- **Figure 5: Milliscreen (First Floor) Extraction Rates, 2 July 2021**

On 2 July 2021, the extraction rates were measured and showed that for screening enclosures 1 to 5 the flow ranged from 610 to 1,100 m^3/hr with an average of 766 m^3/hr and for screening enclosures 6 to 10 the flow rate ranged from 380 to 610 m^3/hr with an average of 490 m^3/hr. The extraction rates for screens 6 -10 were generally lower than for screens 1 to 5 even though the total extracted from screen 1 to 5 was lower than what was extracted from screens 6 to 10 indicating a possible leak in the ducting. The extraction rate from Milliscreen 2 was significantly higher than from the others and it is recommended that the flow be adjusted.

The total flow from milliscreens 1 to 5 and the total flow from milliscreens 6 to 10 were also measured. The total extraction rate for screens 1 to 5 was 3,300 m^3/hr and for screens 6 to 10 was 4,200 m^3/hr. This was higher than the approximate flow rate of 2,000 m^3/hr measured in 2018 indicting additional extraction on the milliscreens over previous years.

In addition to the extraction rates, the pressures within each of the enclosures were also determined. On 2 July 2021 all screens except milliscreen 9 were under negative vacuum ranging from -0.1 to – 0.4 mmH$_2$O. Milliscreen 9 measured +0.1 mmH$_2$O indicating the potential for fugitive odour emissions. The observed vacuums are slightly higher than in 2018 but Milliscreen 9 needs to be investigated to determine the reason for the positive pressure.

Figure 6 depicts the flow rates measured on the ground floor of the Milliscreen Plant July 2021. The flow rate calculation data is presented in Appendix A.

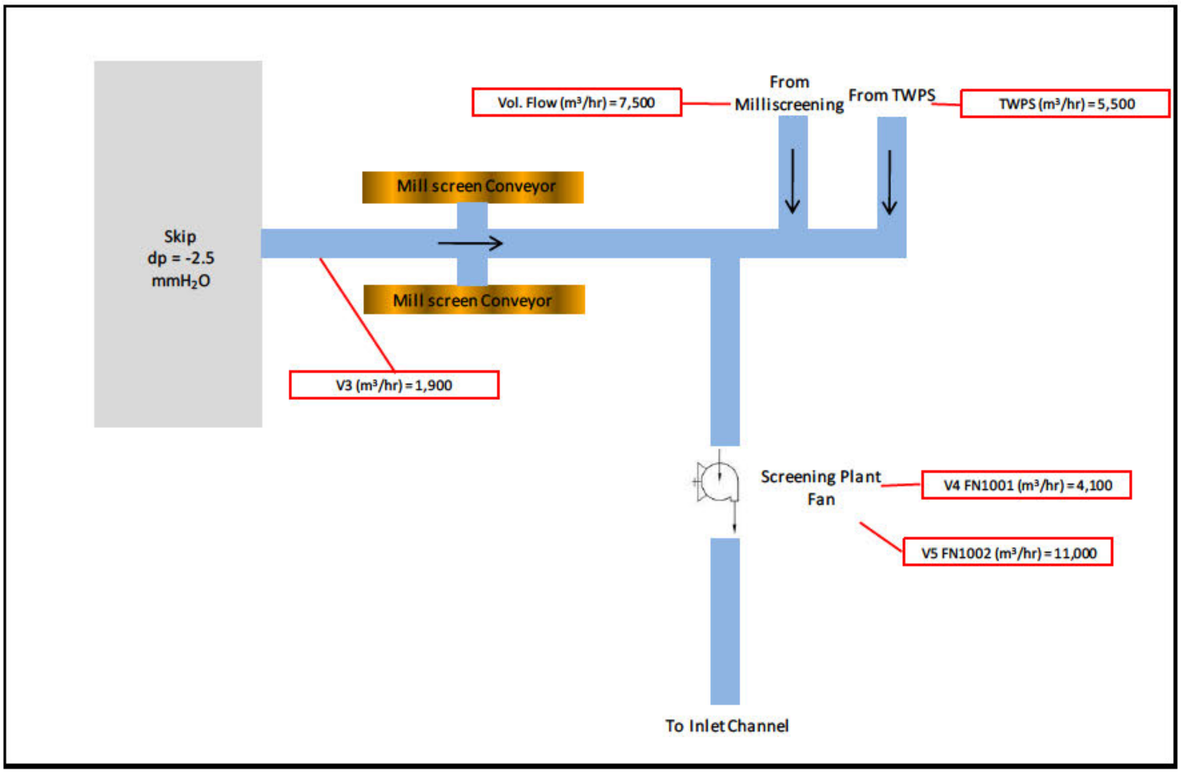


Figure 6: Milliscreen Plant (Ground Floor) Extraction Rate, July 2021

In July 2021 the total volume extracted from the Milliscreen Plant was approximately 15,200 m^3/hr. The flow consisted of approximately 5,500 m^3/hr from the TWPS, 1,900 m^3/hr from the screenings skip, and 7,500 m^3/hr from the milliscreening enclosures. The total extraction from the Milliscreen Plant was slightly higher than the 12,800 m^3/hr measured in 2018. This was primarily due to high volume extracted from the milliscreen enclosures.

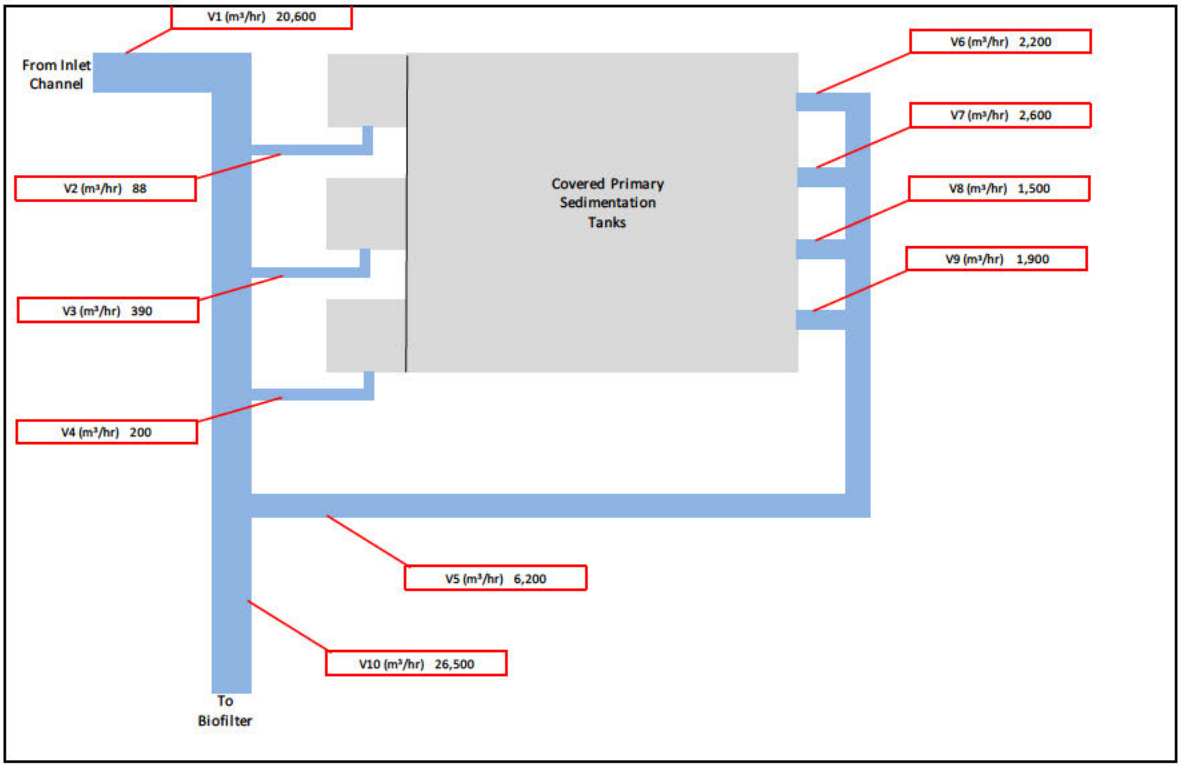
The flow rate extracted from the Milliscreen Plant measured with the two milliscreen fans operating equated to 4.2 m^3/s, which was higher than the 3.6 m^3/s observed in 2018. The flow rates are significantly higher than the 1.8 m^3/s presented in the Operations Manual or the 1.6 m^3/s specified in the Odour System Model primarily due to both milliscreen fans operating.

There are two passive vents on the access door to the plant and on 2 July 2021 they were under a negative pressure of -0.2 mmH_2O. Similarly, the skip door was found to have a pressure of -0.1 mmH_2O indicating the building was generally under negative vacuum. However, the Milliscreen Plant building has four approximately 600 mm roof mounted fans. The two fans at the control room end of the plant were not operating but were still open to atmosphere. The two fans located above the skip load out area were still operating. As a result, odours within the milliscreen building are discharged directly to atmosphere. While the odour within the plant was minor there was a significant amount of deodorant being used to mask the smell primarily of the screening skip.

To prevent discharges from the milliscreen building, it is recommended that sealing these fans be investigated with additional building extraction applied to contain the odours within the Milliscreen Plant. The foul air could then be directed to the biofilter or similar air pollution control technology.

3.5 Primary Sedimentation

The odour control system for the primary sedimentation process consists of the inlet channel, primary sedimentation tanks, channels, sumps and scum pumping stations, all of which are covered. Foul air from the process is extracted by the main biofilters fans and discharged to the plenum of the biofilter. Figure 7 depicts a schematic of the odour control system extraction of the primary sedimentation process measured on 2 and 20 July 2021. The flow rate calculation data is presented in Appendix A.



▪ **Figure 7: Primary Sedimentation Extraction Rate, July 2021**

In July 2021 the volume of air extracted from the inlet channel was approximately 20,600 m^3/hr, which was higher than the 16,000 m^3/hr observed in 2018 with the additional flow being a result of the higher ventilation rate of the milliscreen enclosures.

The total volume extracted from the primary sedimentation tanks was 5,900 m^3/hr (26,500 – 20,600 m^3/hr) which was approximately 50 % higher than observed in 2018 (4,000 m^3/hr).

The covers of the primary sedimentation process and extraction ducting was all in good working order with little odour observed.

3.6 Gravity Thickener & Sludge Blend Tank

Foul air from the Gravity Thickener and Sludge Blend tanks are extracted to the biofilter by the main biofilter fans. On 2 July 2021, approximately 1,300 m^3/hr was extracted from the Gravity Thickener with a further 2,800 m^3/hr being extracted from the Sludge Blend tank. The flow rate calculation data is presented in Appendix A. Compared to the 2018 data, these flows were higher for the Gravity Thickener (650 m^3/hr) and the Sludge Blend tanks (2,100 m^3/hr).

The Gravity Thickener and Sludge Blend tanks were generally in good working order with the processes under a good level of vacuum preventing any fugitive emissions. It is worth noting that an additional extraction vent had been ducted to the loadout of the Gravity Thickener which will further reduce any potential odour emissions.

3.7 Centrifuge Room

The Hutt Valley WTP has three sludge centrifuges located in the Centrifuge Room. Each unit has active extraction at either end to remove foul air from the centrifuges. On 20 July 2021, Centrifuge 3 was out of commission. The flow rates from only two of the six extraction ducts could be measured as some of the sampling ports had been sealed. However, an additional sampling port had been added which allowed the flow from the sludge emergency load out to be measured. There are two floor and two ceiling passive wall vents within the Centrifuge Room. Building pressures recorded from these vents indicated the room to be under a negative pressure of between -0.2 and -0.3 mmH_2O. Hence, while there was a significant odour within the centrifuge room, the likelihood of fugitive emission would be low.

The Return Liquor Pump Station (RLPS) captures liquor from a number of processes on site including the centrifuges and biofilter. The captured liquid is pumped back into the system for treatment. The RLPS is covered, with active extraction to the biofilter. Inspection of the RLPS identified significant leaks and was generally in poor condition. However, the slump was under a good vacuum with a pressure of -0.9 mmH_2O. There were also several leaks in the pipes discharging into the slump all of which were a potential source of odours.

Figure 11 depicts a schematic of the odour control system extraction of the centrifuges and RLPS on 9 and 20 July 2021. The flow rate calculation data is presented in Appendix A.

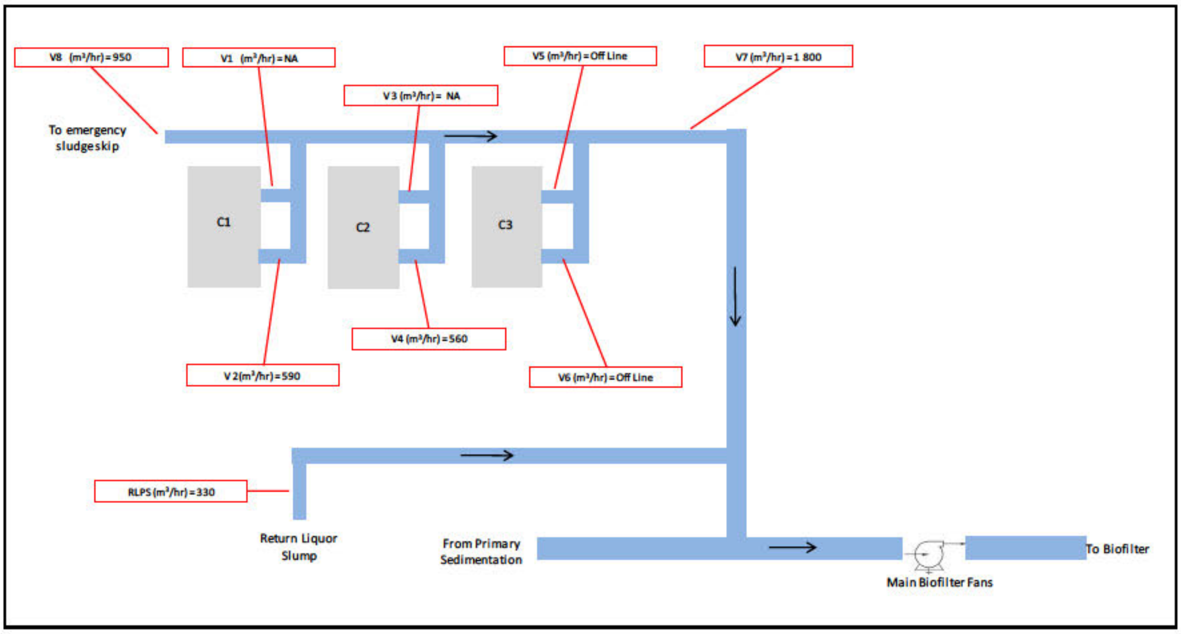


Figure 8: Centrifuge Room & Return Liquor Pump Station Extraction Rate, July 2021

On 20 July 2021, the total flow extracted from the three centrifuges was approximately 1,800 m^3/hr with approximately 330 m^3/hr extracted from the RLPS. The flows were similar to those measured in 2018 of 1,500 m^3/hr and 390 m^3/hr respectively.

It is worth noting that in 2014 the flow rates extracted from the centrifuges and RLPS were 2,500 and 500 m^3/hr respectively. This suggests there may be potential blockages in the system. All of the extraction ducting had been sealed in fibreglass in 2018 and was in good working order. However, the fibreglass maybe hiding damages to the internal ducting.

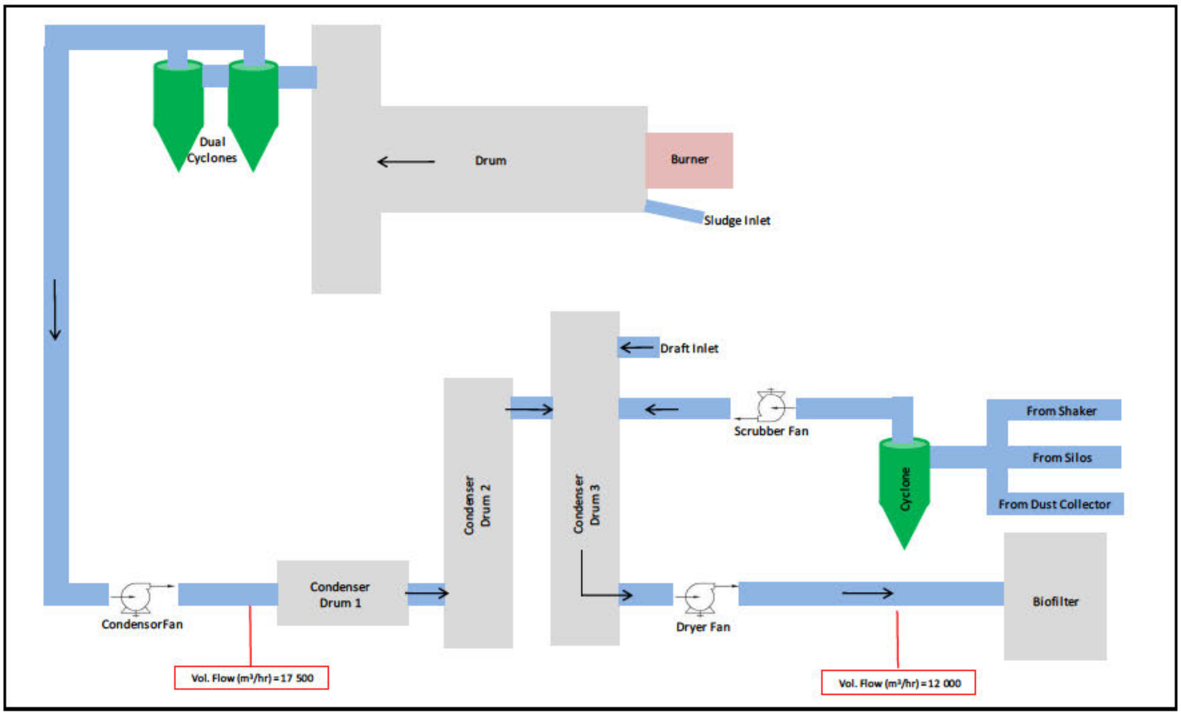
3.8 Sludge Dryer

The sludge dryer consists of a rotary drum dryer fired on natural gas. At the outlet of the rotary drum the flow passes through two high efficiency cyclones to remove the entrained sludge. The captured dried sludge is transported by a screw conveyer to the storage silos for offsite disposal. The foul air is extracted from the dryer by two fans. The condenser fan extracts foul air from the dryer and discharges the air to a series of three condenser drums to remove excess moisture. The dryer fan then extracts foul air from the final condenser drum and discharges directly to the biofilter. Close to the inlet to the biofilter, a separate duct links the dryer discharge duct to the inlet of the main biofilter fan. There is a butterfly valve on the duct which is closed during dryer operation to prevent interaction between the dryer fan and biofilter fan. When the dryer is not running, the valve opens to aid in extraction from the dryer plant.

When the dryer is operating, both the condenser and dryer fans are running. When the dryer is not operating, only the dryer fan runs at approximately 50% of maximum load.

A number of other associated processes are extracted via a secondary scrubber fan which operates continuously and discharges to the final condenser drum. These processes include the dry sludge shaker, storage silos and truck loading dust collector. The final condenser drum also has a butterfly valve open near the top of the drum.

Figure 9 depicts a schematic of the odour control system extraction for the sludge dryer measured on 20 July 2021. The flow rate calculation data is presented in Appendix A. Due to the high moisture content and temperature of the dryer exhaust gas; Pitot tubes were used to determine the gas velocity for the dryer fan with the raw data presented in Appendix B.



- **Figure 9: Sludge Dryer Extraction Rate Schematic, 20 July 2021**

On 20 July 2021, the total flow discharged by the dryer fan to the biofilter was approximately 12,000 m^3/hr which was similar to the 11,000 m^3/hr observed in 2018. The condenser fan flow rate was approximately 17,500 m^3/hr which was similar to the 18,400 m^3/hr measured in 2017. The difference between the flow from the condenser and the flow to the biofilter is primarily due to the different temperature and moisture content of the two sources and does not suggest that air from the dryer is being discharged into the building.

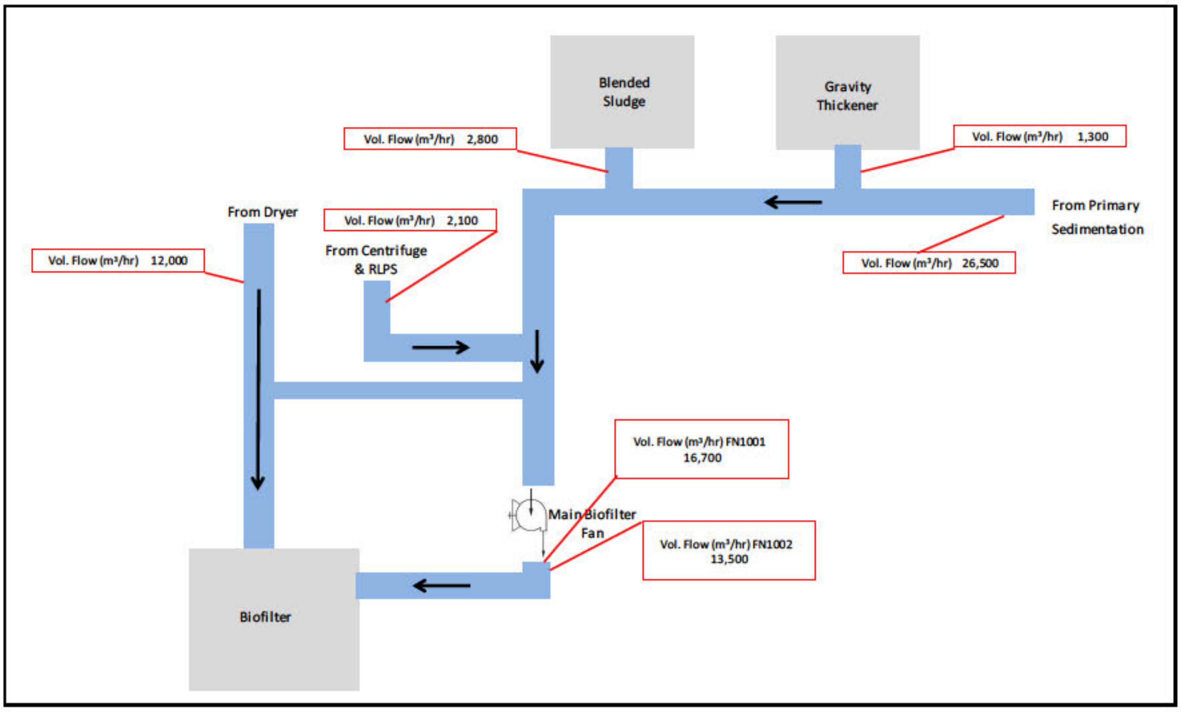
The extraction rate from the sludge dryer measured on 20 July 2021 equated to 3.3 m^3/s, which was lower than the 3.5 m^3/s presented in the Operations Manual or the 3.9 m^3/s specified in the Odour System Model. Hence, it may be possible to increase the extraction rate from the sludge dry to reduce odours within the building. However, this will be dependent on the process operation conditions.

The sludge dryer building has three ground level passive vents approximately 1500 mm x 1500 mm in size. On 20 July 2021, the building pressure measured at these passive vents was in the range -0.3 to -0.8 mmH_2O indicting the building was under negative pressure. However, the negative pressure was due to the four approximately 700 mm roof mounted fans which discharge directly to atmosphere. There are also significant areas in the roof space at the top of the primary sludge cyclones which is not enclosed allowing foul air in the plant to be discharged directly to atmosphere.

As a result of the roof fans and lack of sealing of the cyclones, foul air from within the plant is discharged directly to atmosphere. This has the potential to allow significant odours to be released and is likely a key cause of current odour complaints. Hence, it is recommended that the building be sealed with active extraction to the plant biofilter.

3.9 Biofilter Inlet

The main biofilter fan incorporates foul air extracted from the Primary Sedimentation works (which includes the Milliscreen Plant), the Gravity Thickener tank, Sludge Blend tank, Centrifuge Room and RLPS. Figure 10 depicts a schematic of the odour control system inlet to the biofilter measured in July 2021. The flow rate calculation data is presented in Appendix A.



- **Figure 10: Biofilter Total Extraction Rate Schematic, July 2021**

In July 2021, the total flow discharged to the biofilter from the biofilter fans was approximately 30,100 m^3/hr which consisted of approximately 26,500 m^3/hr from the Primary Sedimentation works (including the Milliscreen Plant/Inlet Channel), approximately 4,000 m^3/hr from the Gravity Thickener and Sludge Blend tank, and approximately 2,100 m^3/hr from the Centrifuge Room and RLPS.

Combining the flow from the biofilter fans with approximately 12,000 m^3/hr from the sludge dryer, the total flow to the biofilters was approximately 42,100 m^3/hr, which is at the designed flow rate of 43,000 m^3/hr (Operations Manual).

The flow rate of the main biofilter fans measured on 20 July 2021 equated to 8.3 m^3/s, which was higher than the 6.1 m^3/s measured in 2018. Both flows are significantly higher than the 3.6 m^3/s presented in the Operations Manual or the 3.3 m^3/s specified in the Odour System Model. Given the total flow to the biofilter is at the designed flow rate, the figures presented in the manual and model appear to be low.

It is worth noting that there was a significant sludge odour present in the vicinity of the Return Liquor slump and biofilter fans that was present over the whole month. STNZ understands one of the sludge pumps pipes had burst for a significant period of time resulting in large volumes of sludge discharging to the ground. While attempts had been made to address the problem, there was still visible sludge on the ground and a strong sludge odour present. It is highly recommended that further remediation work be conducted to reduce the odour.

The biofilter itself had a significant amount of vegetation on the surface which acts to restrict flow the biofilter. The media had compacted by approximately 300 mm but was still friable and in reasonably good condition. The general biofilter structure was in reasonable conditions with only minor water leaks noted on the plenum. There was no significant odour observed while on the biofilter other than a very mild dirt odour consistent with the normal operation of biofilters. However, it is recommended that the vegetation be removed, and the media be topped up and mixed to a depth of greater than 600 mm.

As the biofilter is now operating at the designed flow rate, adding further foul air to the system may overload the capacity of the biofilter resulting in odour emissions. However, the plant does have sufficient land capacity for the biofilter to be extended to allow for additional extraction from the milliscreen and sludge dryer buildings.

Appendix A Flow Rate Calculation Data

This Appendix contains 4 pages including cover.

Milliscreen Plant Raw Data, July 2021

	TWPS	V1	V2	V3	V4	V5	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
Date	20/07/2021	2/07/2021	2/07/2021	20/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021	2/07/2021
V (m/s)=	12.7	13.1	16.4	5.4	6.3	11.6	9.6	17.1	13.1	10.2	10.1	5.9	7.9	7.7	7.4	9.5
T (^{o}C)=	13.6	14.6	19.0	14.4	16.0	15.4	14.9	16.7	17.5	14.8	15.6	15.6	15.1	14.3	15.0	17.6
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	390	300	300	350	480	580	150	150	150	150	150	150	150	150	150	150
Static (mmH_2O)=	-183	-162	-186	-18.4	-26	-18.2	-17.2	-65.3	-36.9	-19.2	-32.2	-10.2	-40.1	-19.2	-20.5	-21.0
Vol (m^3/hr)=	5,468	3,337	4,178	1,872	4,109	11,046	611	1,089	834	650	643	376	503	490	471	605
Vol (m^3/s)=	1.5				1.1	3.1										
2017 Data	2,901	866	994	3,261	8,138	NA	96	229	172	478	338	331	NA	331	331	331
2018 Data	5,095	2,293	2,013	5,752	5,237	7,501	389	484	471	414	560	529	573	503	554	382

V1 = from milli screens 1-5
V2 = from milliscreens 6-10
V3 = Screeings skip
V4 = Milliscreen main ID fan FN1001
V5 = Milliscreen main ID fan FN1002

Design Flow Rate Op Manual
Vol (m^3/s)= 1.8
Design Flow Rate Odour Model
Vol (m^3/s)= 1.6

Primary Sedimentation Raw Data, July 2021

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
Date	20/07/2021	2/07/2021	2/07/2021	2/07/2021	20/07/2021	20/07/2021	2/07/2021	2/07/2021	2/07/2021	9/07/2021
V (m/s)=	18.9	5.5	13.7	12.7	13.7	12.6	14.8	8.4	10.7	15.4
T (^{o}C)=	13.4	15.9	14.0	16.2	15.4	16.0	16.5	16.5	15.5	14.0
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	620	75	100	75	400	250	250	250	250	780
Static (mmH_2O)=	-59.6	-12.1	-26.2	-10.6	-65.4	-18.1	-12.1	-42.2	-42.2	-79.5
Vol (m^3/hr)=	20,565	88	388	202	6,205	2,229	2,618	1,486	1,893	26,521
Vol (m^3/s)=										
2017 Data	10,119	57	147	70	2,400	920	NA	743	832	12,744
2018 Data	15,995	67	223	101	3,804	1,309	1,380	1,380	1,539	16,188

Notes
V1 From inlet channel
V10 = Flow to main biofilter ID fan

Centrifuges & RLPS Raw Data, July 2021

	V1	V2	V3	V4	V5	V6	V7	V8	RLPS
Date	20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021	20/07/2021	9/07/2021
V (m/s)=	NA	21.0	NA	19.9	Off	Off	10.0	8.4	11.6
T (^{o}C)=	NA	16.7	NA	16.2	Off	Off	14.7	14.6	12.7
RH (%) =	NA	NA	NA	NA	NA	NA	NA	NA	NA
D (mm) =	NA	100	NA	100	100	100	250	200	100
Static (mmH_2O)=	NA	-47.7	NA	-59.2	Off	Off	-82.4	-70.0	-11.5
Vol (m^3/hr)=	NA	594	NA	563	Off	Off	1,769	951	328
2017 Data	327Þ	215	164Þ	260	20	161	NA	NA	226
2018 Data	NA	261	NA	393	6	326	1,521	NA	388

Þ = average of measured flow rates
V7 = Total Flow
V8 = Loadout Flow

Sludge Tanks Raw Data, July 2021

	Blened Sludge	Gravity Thickener
Date	2/07/2021	2/07/2021
V (m/s)=	10.8	11.4
T (^oC)=	13.9	14.4
RH (%) =	NA	NA
D (mm) =	300	200
Static (mmH_2O)=	-28.8	-23.3
Vol (m^3/hr)=	2,751	1,291
Vol (m^3/s)=	0.76	0.36
2017 Data	1,070	679
2018 Data	2,094	645

Sludge Dryer Raw Data, July 2021

	Condesor Fan	Dryer Fan
V (m/s)=	15.3	9.8
T (^oC)=	107	33.6
RH (%) =	100.0	100.0
D (mm) =	635	660
Static (mmH_2O)=	-2234	-960
Vol (m^3/hr)=	17,463	12,030
Vol (m^3/s)=	4.9	3.3
2017 Data	18,363	10,123
2018 Data	NA	10,974

Design Flow Rate Op Manual

Vol (m^3/s)= 3.5

Design Flow Rate Odour Model

Vol (m^3/s)= 3.9

Biofilter Inlet Raw Data, July 2021

	Primary Sedimentation	Sludge Blend Tank	Gravity Thickener	Centrifuges	RLPS	Biofilter Fan FN1001	Biofilter Fan FN1002	Dryer Fan	Biofilter Total
Date	9/07/2021	2/07/2021	2/07/2021		9/07/2021	20/07/2021	20/07/2021	20/07/2021	
Fan Speed						100%	100%		
V (m/s)=	15.4	10.8	11.4		11.6	14.6	11.8	9.8	
T (^{o}C)=	14	13.9	14.4		12.7	13.6	14.0	33.6	
RH (%) =	NA	NA	NA		NA	NA	NA	NA	
D (mm) =	780	300	200		100	635	635	660	
Static (mmH_2O)=	-79.5	13.9	-23.3		-11.5	-140	-111	-960	
Vol (m^3/hr)=	26,521	2,751	1,291	1,769	328	16,664	13,468	12,047	42,179
Vol (m^3/s)=		0.76	0.36			4.6	3.7	3.3	11.7
2017 Data	12,744	1,070	679	985	266	14,724	NA	10,111	24,835
2018 Data	16,188	2,094	645	1,521	388	7,191	14,610	10,875	32,676

	FN1001	Dryer Fan	Total
Design Flow Rate Op Manual			
Vol (m^3/s)=	3.6	3.5	7.1
Design Flow Rate Odour Model			
Vol (m^3/s)=	3.3	3.9	7.2

Appendix B Pitot Velocity Calculation Data

This Appendix contains 3 pages including cover

Preliminary Stack Survey

Source	HVWTP Condesor Fan
Date	20-Jul-21
Pitot	S-Type Pitot
Number of lines used for survey	1
Which sampling line was used?	a

Molecular Weight of Stack Gas

Was CO2 measured in the stack?	No	
Accurately state fuel for CO2 calculation	None	Choose: None / Natural Gas / Light Fuel Oil / Heavy Fuel Oil / Coal
Calculated CO2 Value	0.00	
O2 Reference?	NA	%

Duct Characteristics

Type	Circular	
Depth/Dia	0.635	m
Width	-	m
Area	0.317	m^2
Port Depth	0	mm

Sampling Lines & Sample Points

Line A

Traverse Point	ΔP pt mmH_2O	ΔP pt Pa	Temp ^oC	Velocity (corrected for swirl) m	O_2 %	Angle of Swirl ^{o}
1	12.7	124.5	107.0	14.82	7.3	0
2	10.2	100.0	107.0	13.28	7.3	0
3	10.2	100.0	107.0	13.28	7.3	0
4	12.7	124.5	107.0	14.82	7.3	0
5	12.7	124.5	107.0	14.82	7.3	0
6	25.4	248.9	107.0	20.96	7.3	0
7						
8						
9						
10						
11						
12						
Mean	14.0	137.0	107.0	15.33	7.3	

Line B

Traverse Point	Distance into duct (m)	ΔP pt mmH_2O	ΔP pt Pa	Temp ^oC	Velocity m/s	O_2 % Vol	Angle of Swirl ^{o}
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	
AVERAGE	-	14.0	137.0	107	15.33	-	

Pitot tube velocity constant, K_p		34.97
Velocity pressure coefficient, C_p	0.841	
Mean Oxygen		7.3
Mean CO_2		8.6
Mean Md		29.67
Moisture %	35.0	0.350
Mean Ms		25.58
Barometric Pressure, kPa	101.3	759.8
Static Pressure, Pa	-2234	-16.75
Absolute Stack Pressure		743.0
Angle of Swirl		0

Moisture Cointent Calculations

RH, %	100
Saturated Vapour Pressure. mmHg	

Lowest Gas Velocity,m/s	13.28
Highest Gas Velocity, m/s	20.96
Mean Velocity, m/s	15.33

Duct Volumetric Flow Rates

Moist, m^3/h	17,478
Moist Standards, m^3/h	12,556
Dry Standard, m^3/h	8,161

SOURCE TESTING NZ

Preliminary Stack Survey Single Fan

Source	HVWTP Dryer Outlet
Date	20-Jul-21
Pitot	S-Type Pitot ST030
Number of lines used for survey	1
Which sampling line was used?	a

Molecular Weight of Stack Gas

Was CO2 measured in the stack?	No	
Accurately state fuel for CO2 calculation	None	Choose: None / Natural Gas / Light Fuel Oil / Heavy Fuel Oil / Coal
Calculated CO2 Value	0.00	
O2 Reference?	NA	%

Duct Characteristics

Type	Circular	
Depth/Dia	0.66	m
Width	-	m
Area	0.342	m^2
Port Depth	0	mm

Sampling Lines & Sample Points

Line A

Traverse Point	ΔP pt mmH_2O	ΔP pt Pa	Temp °C	Velocity (corrected for swirl) m	O_2 % Vol	Angle of Swirl °
1	5.2	51.0	33.6	7.93	16.4	0
2	7.0	68.6	33.6	9.20	16.4	0
3	8.3	81.3	33.6	10.02	16.4	0
4	8.2	80.4	33.6	9.95	16.4	0
5	8.4	82.3	33.6	10.08	16.4	0
6	8.6	84.3	33.6	10.19	16.4	0
7	8.0	78.4	33.6	9.83	16.4	0
8	8.6	84.3	33.6	10.19	16.4	0
9	8.4	82.3	33.6	10.08	16.4	0
10	8.6	84.3	33.6	10.19	16.4	0
11	7.0	68.6	33.6	9.20	16.4	0
12	6.2	60.8	33.6	8.66	16.4	0
Mean	7.9	77.7	33.6	9.77	16.4	

Line B

Traverse Point	Distance into duct (m)	ΔP pt mmH_2O	ΔP pt Pa	Temp °C	Velocity m/s	O_2 % Vol	Angle of Swirl °
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	
AVERAGE	-	7.9	77.7	34	9.77	-	

Pitot tube velocity constant, K_p		34.97
Velocity pressure coefficient, C_p	0.835	
Mean Oxygen		16.4
Mean CO_2		4.60
Mean Md		29.39
Moisture %	5.7	0.057
Mean Ms		28.74
Barometric Pressure, kPa	101.3	759.8
Static Pressure, Pa	-960	-7.20
Absolute Stack Pressure		752.6
Angle of Swirl		0

Moisture Cointent Calculations

RH, %	100
Saturated Vapour Pressure. mmHg	23.198

Lowest Gas Velocity,m/s	7.93
Highest Gas Velocity, m/s	10.19
Mean Velocity, m/s	9.77

Duct Volumetric Flow Rates

Moist, m^3/h	12,030
Moist Standards, m^3/h	10,710
Dry Standard, m^3/h	10,099

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