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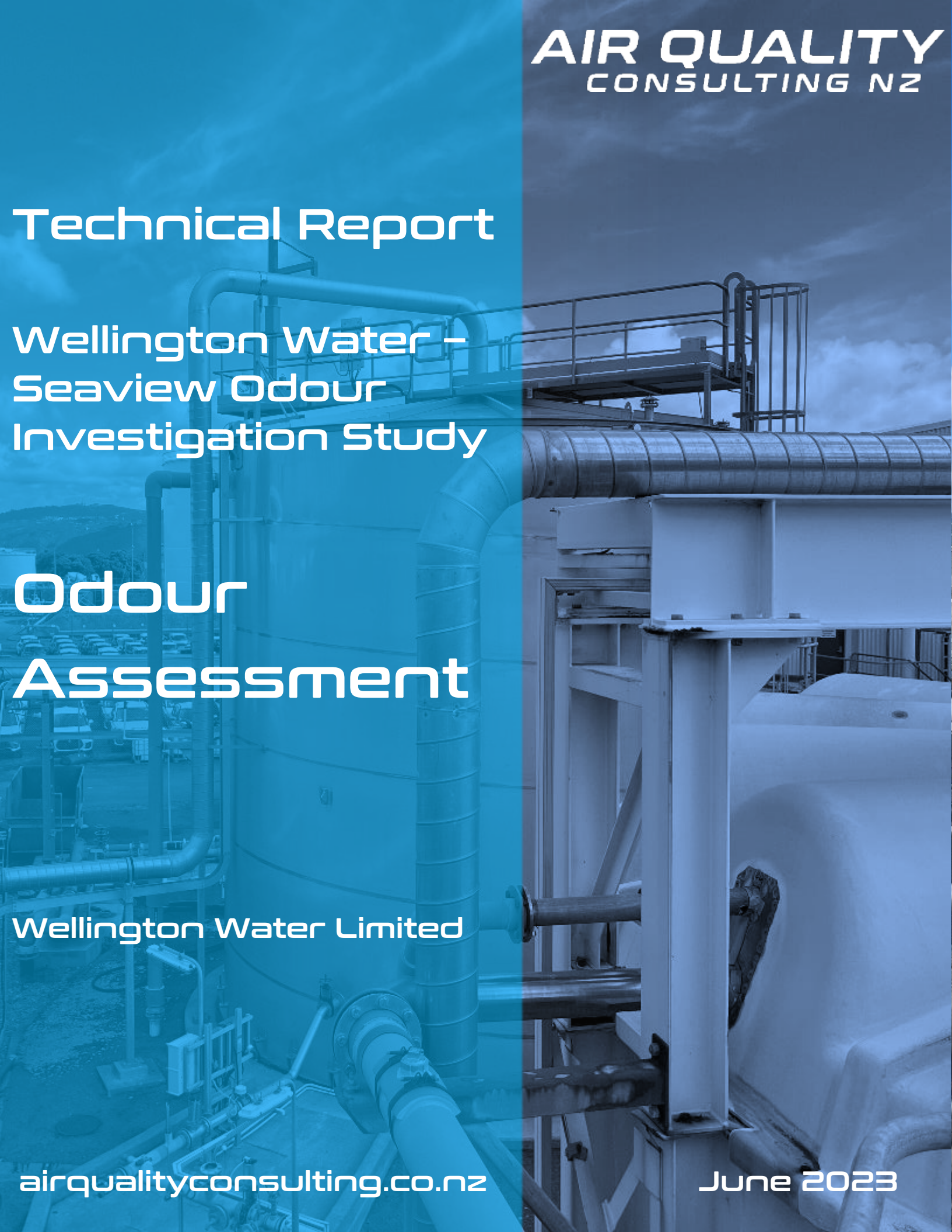
Technical Report

Wellington Water – Seaview Odour Investigation Study

Odour Assessment

Wellington Water Limited



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Glossary of Abbreviations UPDATE

AWS	Automatic Weather Station
AQCNZ	Air Quality Consulting NZ Limited
DAF	Dissolved Air Flotation
E	East
GPG	Good Practice Guide
GPG Odour	Ministry for the Environment Good Practice Guide for Assessing and Managing Odour (2016)
GWRC	Greater Wellington Region Council
km	Unit of distance: kilometre
MfE	Ministry for the Environment
N	North
NZ Air	New Zealand Air Limited
NZTM	New Zealand Transverse Mercator
PST	Primary Sedimentation Tanks
RMA	Resource Management Act 1991
S	South
STNZ	Source Testing New Zealand Limited
SWWTP	Seaview Waste Water Treatment Plant
UTM	Universal Transverse Mercator
W	West
WWL	Wellington Water Limited
%	Percentage
m	Unit of distance: metre
ppm	Parts per million
ppb	Parts per billion

1 Introduction

Air Quality Consulting NZ Limited (**AQCNZ**) has been engaged by Wellington Water Limited (**WWL**) to undertake an odour investigation study for the Seaview Waste Water Treatment plant (**SWWTP**).

AQCNZ understands that SWWTP has experienced an increasing number of odour complaints over the past six months, which has culminated in Greater Wellington Regional Council (**GWRC**) issuing two infringement notices in relation to odour complaints received on 31 January and 9 February 2023.

The first infringement notice was for breaching section 15(1)(c) of the Resource Management Act 1991 (**RMA**), and the second infringement notice was for breaching Abatement Notice A956, which was issued on 14 June 2021.

The infringement notices state that complaints made on the above dates were verified by GWRC enforcement officers, whereby in their opinion, the odours were at a level considered to be "offensive" and "objectionable". Consequently, it is considered by GWRC that WWL is in breach of consent condition Condition 6 of WGN950162(01)

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

In response to recent odour complaints and the two infringement notices, WWL is investigating the need for an odour system renewal/upgrade project and intends to kick-off the project by July 2023, pending on funding availability. However, to inform these improvements, WWL has asked AQCNZ to undertake an odour study and present a report which provides information on the sources and strength of odour generated by the site. This analysis will be used to identify and prioritise the odour control measures required to best mitigate the odour issues at the site.

This odour study also provides information on nearby sources unrelated to SWWTP that could contribute to odour complaints.

As part of this odour investigation study, AQCNZ has undertaken the following tasks to understand the Site's odour potential and identify measures to reduce off-site odour.

- Completed a review of odour complaints received over the past 16 months and analysis of the potential source of odour that could've contributed to complaints (**Section 2**).
- Undertaken an odour-scouting survey over a period of 8 days (**Section 3**).
- Conducted on-site ambient and process-related H_2S Monitoring (**Section 4**).
- Provided findings from visual and odour observations made during a Site visit on 31 March 2023 by AQCNZ (**Section 5**).
- Provided recommended improvements to the plant to mitigate odour and minimise the potential for odour complaints (**Section 6**). These have been ranked in order of priority (**Section 7**).

2 Review of Odour Complaints

To assist with understanding potential sources of odour from SWWTP, AQCNZ has reviewed odour complaints made in relation to SWWTP between the period 01 January 2022 and 31 April 2023. These complaints come from various sources, including observations made by WWL Staff, complaints made to GWRC's compliance team or complaints made directly to WWL from members of the public.

To assist with interpreting the complaints, AQCNZ has presented the location of the complainants as red dots in Figure 1. This Figure shows that complaints were from four distinct locations: 1) Bell Road residential area, 2) Hutt Park Road, 3) Gough St/ Seaview/Parkside Roundabout, and 4) Port Road and Meachen Street.

Figure 1: Odour Complaintant Location

In addition to reviewing the location of the complaints, AQCNZ has considered the wind direction and speed at the time of complaint and plant operating conditions to help understand whether the plant was the likely cause of the complaint.

While SWWTP has a meteorological station installed at the Site on top of the dryer building, the data for the period reviewed was unavailable due to a fault with the data logging system (Refer to Section 6, where AQCNZ recommended that the system is repaired/replaced to allow for future data collection). AQCNZ has therefore used the nearest publically available wind data measured at the GWRC's air quality monitoring station at Birch Lane (**Birch Lane AWS**) to assist with analysing the complaints.

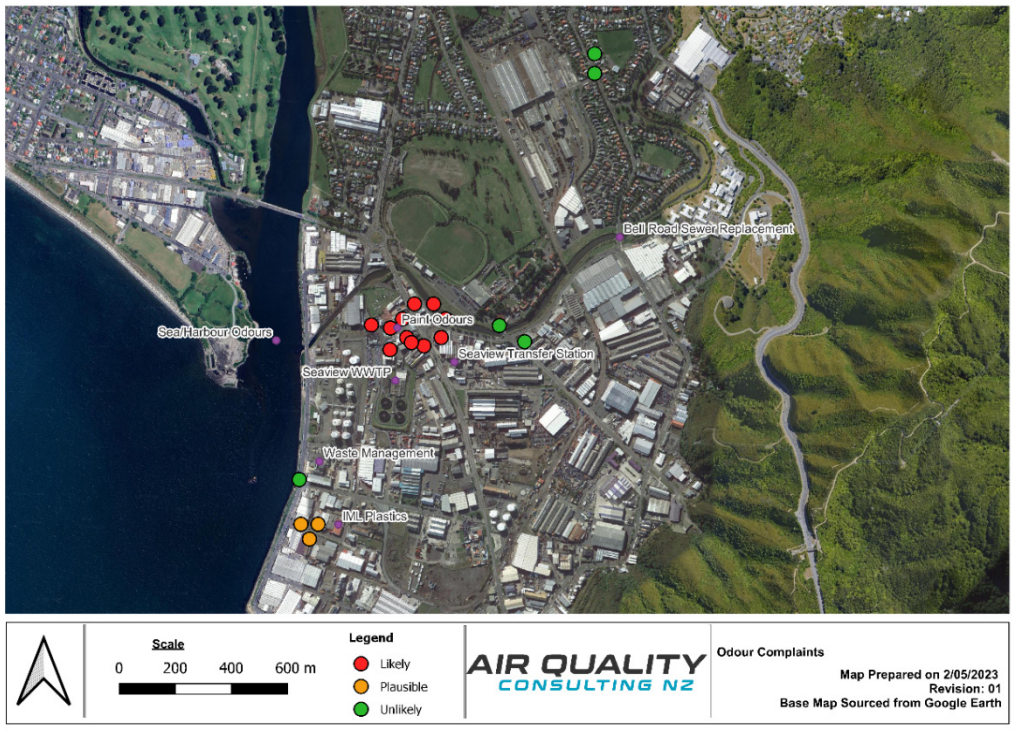
2.1 Complaints Analysis

Based on a review of the complaint data, the prevailing winds at the time of the complaint and process information, the following observations can be made:

- In total, 31 complaints were received over the 16-month period.
- The nearest complaints were made from locations on Gough St, <50 m from the northern site boundary.
- The furthest complaints were received from locations on Bell Road and Meachen St, approximately 800 m and 400 m from the Site boundary, respectively.
- Of the 31 complaints, only 19 provided information on their location; for these complaints, SWWTP was upwind of the complainant on 13 occasions, indicating that the plant could've been the source of odour causing these complaints. For the remaining six complaints, it is likely the odour was from another source.
- For the 13 complaints where the wind direction was aligned with the Site, the biosolid dryer was operating on 11 of these occasions. Noting that it normally operates five days a week and, therefore, from a probability basis, if this is not the primary odour source, it is difficult to determine whether this activity could be the cause of odour complaints.
- Complaints occurred during a variety of wind speeds, ranging from calm conditions to fresh breezes.

Using prevailing wind data at the time of the complaint, AQCNZ has assessed the likelihood of each complaint being attributed to odour from SWWTP. This information is presented in Figure 2, with the coloured dots indicating whether the complaint is considered 'Likely', 'Plausible' or 'Unlikely' to be attributed to SWWTP. AQCNZ has also annotated on the Figure the location of other sources of odour that could cause complaints.

Figure 2: Odour Complaintants – the likelihood of odour being attributed to SWWTP



2.1.1 Bell Road and Hutt Park Road Complaints

The complaints on Bell Road and Hutt Park Road occurred while the plant was downwind of the complainant, suggesting that these odours were from another source. AQCNZ understands that a significant wastewater network project is currently underway near this location, and construction works have been identified as a source of odour. This odour was observed as part of the independent odour study, as discussed in the following section of the report. Overall, the complaints from these locations are unlikely to be attributed to SWWTP discharges and are more likely related to construction works.

2.1.2 Gough Street/ Seaview/Parkside Roundabout Complaints

The complaints on Gough Street typically aligned with conditions where the complainant was downwind of the plant. This factor, combined with the limited distance between the plant and the complainant, suggests that the plant is the most likely cause of the complaint. Similarly, the complaints triggered by odours observed near Seaview/Parkside Roundabout are likely from the plant. However, not all of these occurred while the plant was upwind of the complainant, suggesting that some could be related to the Barber Grove to Seaview Wastewater Pipe Duplication Project. For the purposes of this assessment, given the close distance to the plant, AQCNZ has classified all of these complaints to be “likely” caused by SWWTP odours.

2.1.3 Port Road and Meachen Street Complaints

Some of the complaints made from locations on Port Road and Meachen Street potentially align with SWWTP. However, in most instances, they were typically better aligned with being downwind of [redacted] waste processing facility on Port Road. It is important to note that odour from this facility was detected by the independent odour scout, as discussed in the following section, with odours around Meachen Street often classified as ‘extremely strong’ with a distinctive sulphur character. While different in character from WWTP odour, the odour scout indicated that it could easily be confused with odours from SWWTP.

Given that these complaints were close to [redacted] and the lack of complaints downwind of SWWTP during northerly wind conditions at locations to the east of Port Road, AQCNZ considers that these complaints are more likely to be attributed to [redacted] operations instead of SWWTP. However, given that both sources are upwind of the complainants, these complaints have been classified as ‘plausible’.

Based on the complaint data, it is impossible to determine if [redacted] odours could be detected along Gough Street during southerly winds and potentially be the cause of some of the complaints received at this location. However, it is recommended that this potential is further explored through continuous boundary H_2S monitoring.

2.2 Complaints Analysis Conclusion

Complaints most likely to be attributed to odours from SWWTP typically occurred within 150 m of the on-site odour sources, with these occurring north of the plant.

Complaints occurred during a range of wind speeds, not just during calm to low-speed winds.

Most complaints occurred while the dryer was in operation. However, it is not possible to conclude that this correlation equals causation, as the dryer operates the majority of the time (five days per week), and the complaints dataset is small.

Complaints on Bell Road and Hutt Park Road are more likely related to network upgrade construction activities as the wind directions at the time of the complaints typically don't align with SWWTP being the source. Furthermore, independent odour scouting verified construction works as a cause of a recent odour complaint and odour from these sources was observed on multiple occasions during the odour survey.

There have been no complaints from residential areas where SWWTP has been identified as being the likely source of odour.

[redacted]s waste processing facility on Port Road is a source of odour that has the potential to be mistakenly characterised as being related to SWWTP.

Based on the complaint data, it appears that odours from SWWTP are most likely to cause odour nuisance effects relatively close to the site boundary (<150 m).

2.3 Complaints Analysis Recommendations

As part of investigating the odour complaint record, AQCNZ has identified two recommendations:

1) The existing on-site weather station should be replaced with a suitable system to allow wind speed and wind direction data to be recorded to assist with any future complaint investigations.

2) AQCNZ noticed that the odour complaint record often didn't identify the complainant's location, making it difficult to investigate the cause of odour. While complainants are often reluctant to provide location information, where possible, WWL/GWRC should encourage the complainant to at least provide their general location, i.e., the odour was observed to the northeast of the site. This will protect their identity while still providing helpful information to investigate the complaint.

3 Odour Scouting Survey

Given that odours are highly variable in terms of frequency, duration, intensity and character, it is only possible to characterise odour from a site by surveying odour frequently and over a long period of time. For this project, AQCNZ considered that eight (8) days of odour surveys would be adequate to assess the variability in odour in the area around SWWTP, noting that this period would likely cover a range of meteorological conditions and plant operating conditions.

3.1 Odour Scouting Methodology

To undertake this study, AQCNZ utilised one of its independent odour scouts. The odour scout has a calibrated nose with a normal sense of smell (63 ppb n-butanol (normal range is 20 to 80 ppb)) and has been trained in accordance with the guidance provided in the Ministry for the Environment Good Practice Guide for Assessing and Managing Odour (2016) (MfE GPG Odour) as well as international guidance/standards.

Before undertaking the odour survey, an upwind odour observation was made, upwind of the WWTP, followed by a series of downwind observations, generally starting at the furthest extent of any observed odour plume. Observations were then made in a zig-zag pattern moving towards the Site. In this way, the odour scout can determine the extent and intensity of any odour plume being emitted from the source. This methodology is based on the 'dynamic downwind surveillance' methodology described in the Draft Odour Surveillance Guidance produced by EPA Victoria[1].

The methodology for making odour observations was based on the German reference method VDI 3940: 2006 and described in Section 4 and Appendix 3 of GPG Odour.

At each odour observation location, the odour scout records the odour intensity (on a 0 – 6 scale) and character (from a large range of descriptors) every 10 seconds for a period of 10 minutes. In addition to these observations, the following parameters are also recorded at each Site:

- A unique sample site ID along with the GPS coordinates of the assessment location.
- The date and the time of the observation.
- The wind direction, as observed at ground level (in cardinal directions).
- The windspeed (in m/s as measured by a handheld anemometer).
- The cloud cover (in octas).
- The ground level ambient temperature (as recorded on a handheld digital thermometer).
- The overall hedonic tone (on a scale of -4 to +4).

During a period of eight (8) days, the odour scout mapped the extent of the odour plume over the course of a normal business day (typically 8 am – 5 pm). This was achieved by taking multiple surveys - between three and four campaigns per day consisting of up to 8 measurements.

In addition to the 10-minute observations, the odour scout also made instantaneous measurements to indicate either the end of the plume, i.e. the point where odour from the WWTP

[1] EPA Victoria “Odour Surveillance Method Draft” December 2019

could not be observed or locations where a significant odour was present, often observed when moving between monitoring locations.

Odour surveys were collected over the following days/times:

- Day 1 - Friday 31 March 2023, 14:00 to 18:30
- Day 2 - Saturday, 1 April 2023, 09:00 to 15:30
- Day 3 - Sunday, 2 April 2023, 09:00 to 16:30
- Day 4 - Monday, 3 April 2023, 09:00 to 15:00
- Day 5 - Tuesday, 4 April 2023, 08:00 to 14:00
- Day 6 - Sunday, 9 April 2023, 09:00 to 16:00
- Day 7 - Monday, 10 April 2023, 09:00 to 15:00
- Day 8 - Tuesday, 11 April 2023, 08:00 to 14:00

This odour-scouting survey was supplemented with additional surveys by Peter Stacey (AQCNZ) and Donovan Van Kekem (NZ Air) on the first day of monitoring (31 March 2023). Both are appropriately trained and have a normal sense of smell (n-butanol calibration results of 42 ppb and 59 ppb, respectively).

3.2 Odour Survey Results

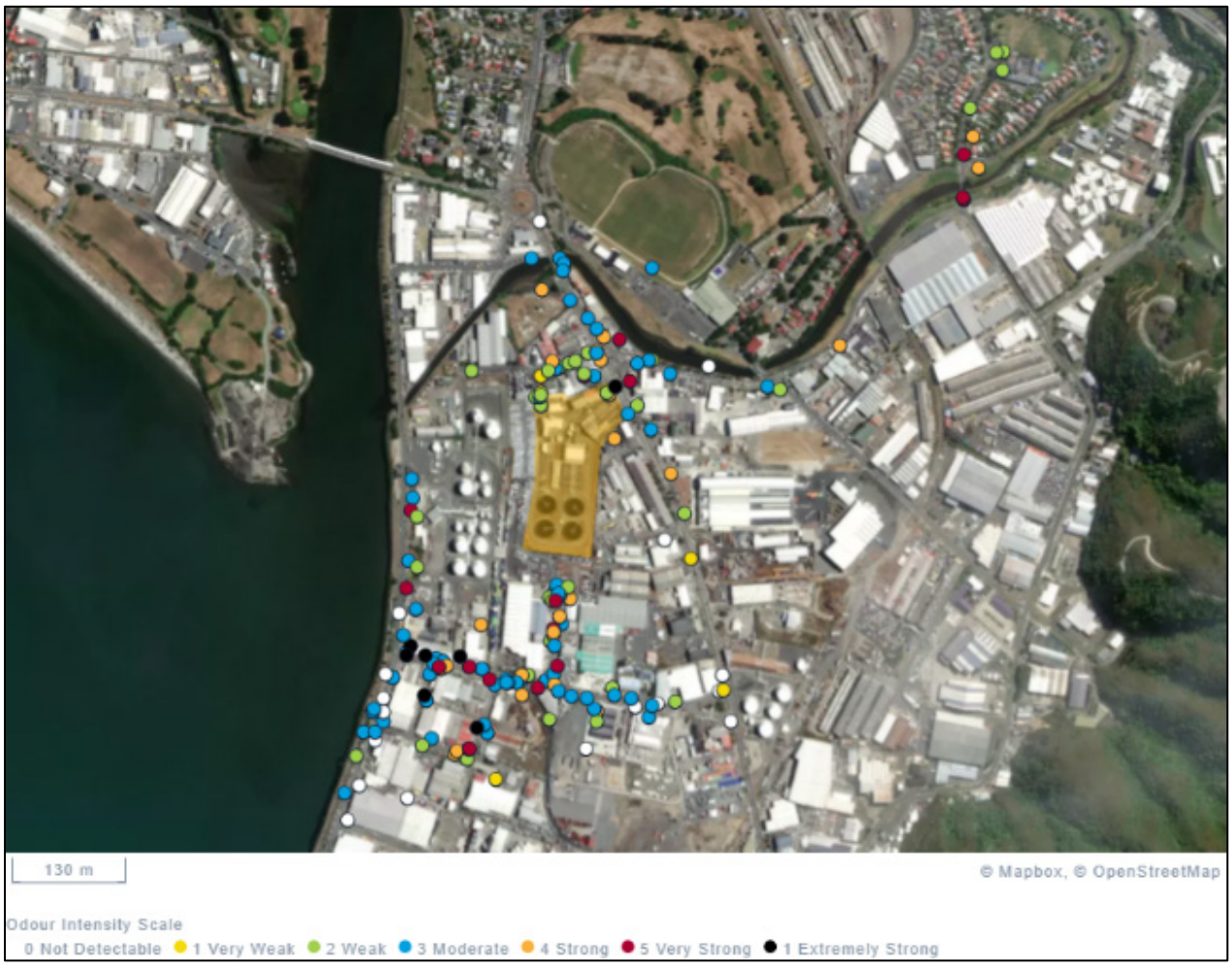
During the various odour surveys, odour characters frequently observed included:

- Gas
- Paint
- **Wastewater**
- **Rotten Egg**
- **Foul/Putrid/Pungent**
- Fishy
- Ozone/Grinding Metal/Welding
- Grassy
- **Earthy**
- **Acrid**
- Rubbish
- **Musty**
- Vehicles
- Sweet
- Petrol
- Natural harbour odours
- Food
- Woody

AQCNZ has highlighted in bold the odour characters that have the potential to be related to activities at SWWTP.

Figure 3 presents the results of the complete odour Survey. The coloured dots indicate the maximum odour intensity observed at each location, ranging from “Very Weak” to “Extremely Strong”.

Figure 3: Odour Survey Results – All observations



Given the surrounding industrially zoned landuse, AQCNZ considers that odours classified with an intensity of “Very Weak” or “Weak” are unlikely to cause acute effects leading to complaints. The only exception will be if these odour intensities are frequently experienced in residentially zoned locations, leading to chronic odour nuisance.

Based on a review of historical complaints, it does not appear that odour from the SWWTP is causing odour complaints in residential areas to the northwest, north and northeast of the plant, assuming that complaints on Bell Road are related to construction activities, as suggested in the complaints analysis section.

For the industrial zones around the plant, the threshold for what could be considered to be offensive and objectionable odour is higher. For example, the odour surveys undertaken by GWRC enforcement officers when responding to the odour complaints on Gough Street that led to the infringement notices, observed odour intensities that frequently ranged between “Moderate” and “Extremely Strong”.

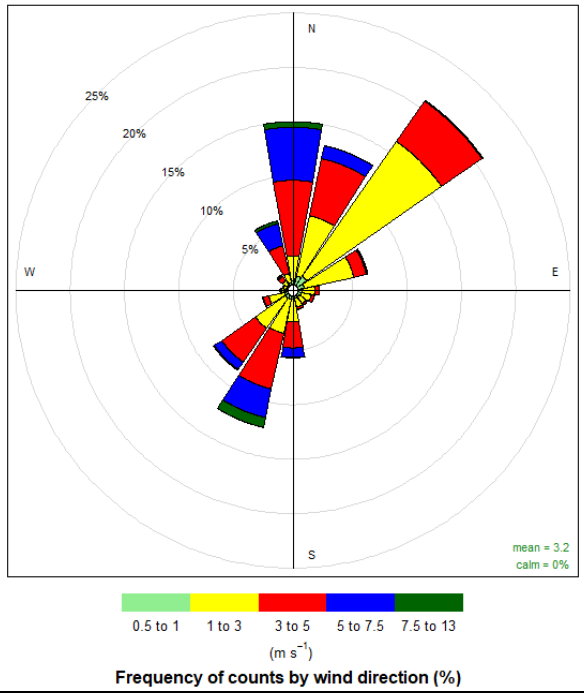
Given that odours with an intensity of “Very Weak” or “Weak” are unlikely to trigger complaints, AQCNZ has focussed on odour intensities “Moderate” and above. Figure 4 shows all of the locations where odour observations detected odours with an intensity of “Moderate” and “Extremely Strong”. This includes all types of odours, including those likely to be attributed to other sources, i.e. construction activities and neighbouring industries etc.

Figure 4: Odour Survey Results – Odour Intensities >= Moderate

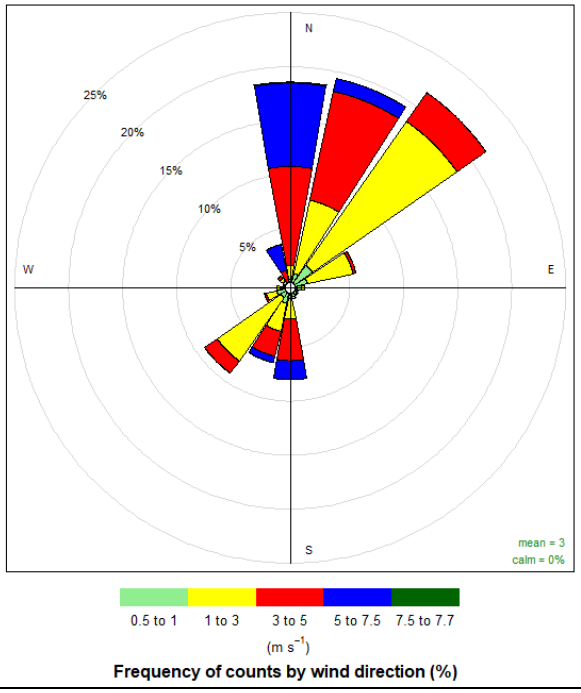
As is typical for the Wellington region, the prevailing winds are either from the north or south or slight deviations from these primary directions depending on local topography.

Figure 5 presents two windroses, both based on wind data from Birch Lane AWS. The windrose on the left is for the approximate 16-month period 01 January 2022 to 4 May 2023, and the windrose on the right covers the period of the odour survey. The wind data shows that for the majority of time odour surveys were undertaken, the wind was from the north/northeast. However, measurements recorded by the odour scout showed the wind was from southerly directions on the 3 April and the morning of 9 April. Overall, the wind conditions at the time of the odour survey reflect the range of wind conditions that could typically be experienced at SWWTP.

Figure 5: Birch Lane AWS Wind Data presented as windroses



01 January 2022 to 4 May 2023



31 March to 4 April and 9 April to 11 April 2023

3.3 Moderate to Strong Odours during Southerly Winds

Figure 6 presents odour observations when the wind was from the south (135° to 225°) and the maximum intensity was moderate or above.

Based on the data collected during this wind direction, the following can be concluded:

- Moderate intensity odours associated with WWTP can be detected 250 m from the Site boundary.
- Strong intensity odours associated with WWTP can be detected 190 m from the Site boundary.
- Very Strong intensity odours associated with WWTP can be detected 85 m from the Site boundary.

Figure 6: Odour Survey Results – Southerly Wind Direction and Odour Intensities >= Moderate

3.4 Moderate to Strong Odours during Northerly/Northeasterly Winds

Figure 7 presents odour observations when the wind was from the north/northeast (0° to 45°), where the maximum intensity was moderate or above.

Based on the data collected during this wind direction, the following can be concluded:

- Moderate intensity odours associated with WWTP can be detected 470 m from the Site boundary.
- Strong intensity odours associated with WWTP can be detected 320 m from the Site boundary.
- Very Strong intensity odours associated with WWTP can be detected 240 m from the Site boundary.

There were five observations where extremely strong odours were detected. However, only one of these observations identified odour characters associated with SWWTP. For this single observation, odour characters were primarily identified as being related to [redacted] operations, with odour characters such as acrid and putrid being noted with intensities ranging between moderate and extremely strong. Odours identified as being related to SWWTP were detected only 20% of the time, with the odour intensity ranging between "Weak" and "Extremely Strong".

This location was approximately 300 m from the SWWTP boundary and adjacent to [redacted] on the corner of Port Road and Barnes St. AQCNZ considers there is insufficient information to conclude that "Extremely Strong" odours are frequently present this far from SWWTP.

Figure 7: Odour Survey Results – Northerly Wind Direction and Odour Intensities >= Moderate

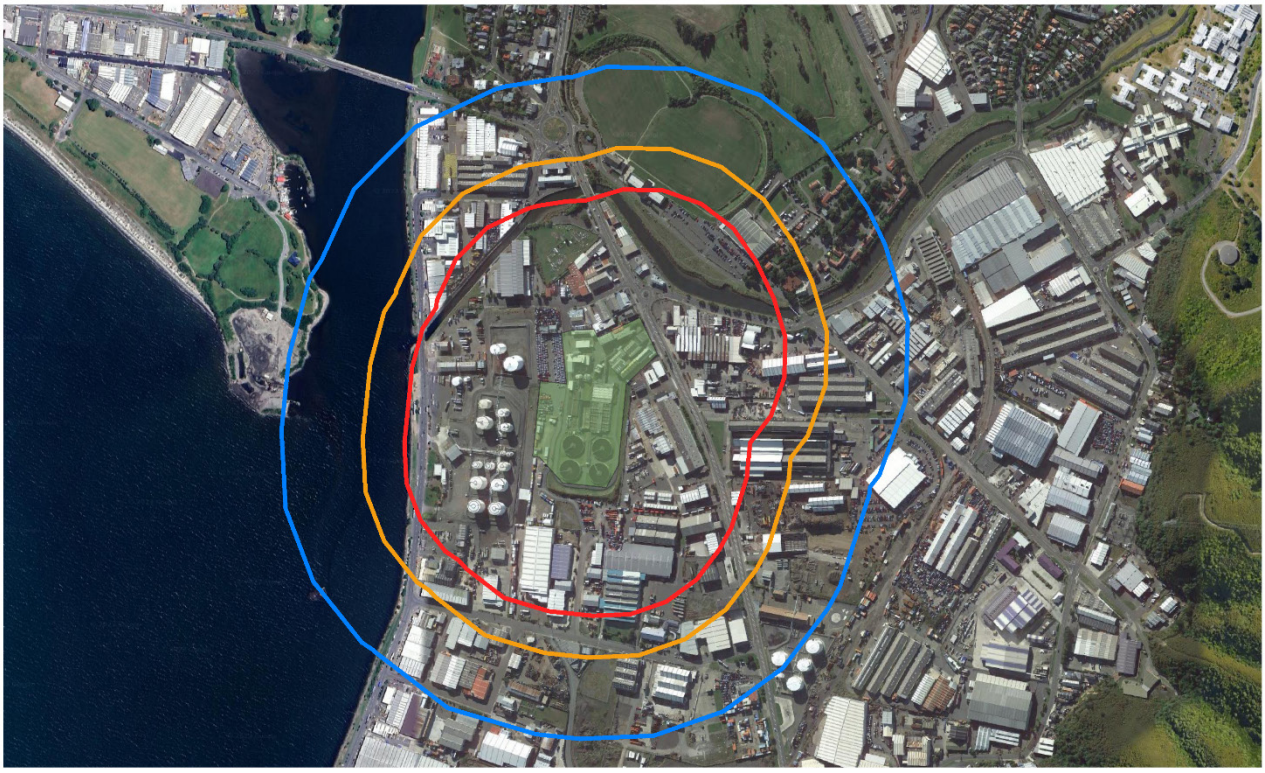
3.5 Maximum Extend of Odours Observed from SWWTP

Based on the maximum extent that “Moderate”, “Strong”, and Very Strong” odours were detected from the boundary of SWWTP, AQCNZ has generated buffer distances showing the maximum extent that these types of odours could be experienced.

As previously mentioned, AQCNZ considers that odours with intensities greater than “Moderate” have the potential to cause odour complaints depending on how frequently they are observed, i.e. the occasional strong odour might not be sufficient to trigger a complaint, but if this type of odour was to be sustained for a few hours, it is more likely that a complaint will be made.

The findings from the odour survey support the complaints analysis that widespread odour nuisance is not being caused in the residential areas to the north of the plant. However, there are occasions where odours from the SWWTP have the potential to cause odour complaints, particularly at locations close to the site boundary, such as along Gough St.

It is expected that the odour improvements recommended, as set out in Sections 6 and 7, will reduce the extent of the intensity buffers and the frequency and duration that odour could be experienced, reducing the overall likelihood of the plant causing complaints.



3.6 Other Sources of Odour

Other sources of odour identified by the odour scout, not attributed to SWWTP, included:

- Paint from vehicle repair shops on Gough St
- [redacted] processing facility on Port Road
- Construction works at the intersection of Bell Road and Parkside Road
- Grinding/Welding fume at the western end of Barnes St
- Plastics odour from [redacted]
- Natural Sources, sea aerosols/harbour areas
- Natural sources, plants, flowers etc

[redacted] was identified as having the potential to generate significant odour. During the eight-day odour survey, the odour scout was equipped with a handheld, low-level (ppb) H_2S monitor and used this equipment to undertake instantaneous measurements at each monitoring location. For most of the surveys, the monitor did not record any H_2S (i.e. 0 ppb). However, on Tuesday, 11 April, while surveying downwind of [redacted] facility, several H_2S detections were measured, with concentrations ranging from 11 ppb to 162 ppb. These values compare with ambient values measured within the SWWTP boundary during a Site visit on 31 March 2023, which were typically less than 20 ppb. The extent to which this odour source could be confused with SWWTP odour or cause cumulative odour effects could not be determined as part of this study. However, it is important to acknowledge the potential for this source to cause odour nuisance at locations around SWWTP.

4 H_2S Monitoring Results

To identify potential sources of odour from SWWTP that could cause odour nuisance/complaints, several Accrulog continuous H_2S sensors were installed at various locations around the plant.

The locations and period of deployment are summarised as follows:

- Milliscreen Building (PPM model): 31 March to 14 April 2023
- Biofilter (PPM model), 04 April to 14 April 2023
- Dryer Building (PPM model) 4 April to 05 April 2023
- Northern Gate (PPB Model) 14 April to 26 April 2023
- Southwestern Boundary (PPB Model) 02 May to 18 May 2023

The data collected from these monitors is presented in Table 1, along with spot measurements undertaken during the site visit on 31 March 2023 using a low-range (ppb level) handheld sensor.

Table 1: H_2S Monitoring Results

Monitoring Location	Minimum H_2S concentration	Average H_2S concentration	Maximum H_2S Concentration
Milliscreen Building	0 ppm	0.2 ppm	2.9 ppm
Biofilter	0 ppm	<0.1 ppm	0.6 ppm
Dryer Building	0 ppm	0 ppm	0 ppm
Northern Gate	0 ppb	0 ppb	8 ppb
Southwestern Boundary	0 ppb	0.2 ppb	16 ppb
Instantaneous Measurements			
Milliscreen Building	-	-	6 ppb
On top of primary sedimentation tanks	-	-	13 ppb
Close to biofilter fan seal	-	-	67 ppb
Centrifuge Room	-	-	12 ppb
Inside Dryer Building	-	-	0 ppb

The monitoring undertaken within the milliscreen building showed that over the 15-day sampling period, maximum daily concentrations were typically less than 0.7 ppm. The only notable exception was on 6 April 2023, where concentrations were significantly higher than on other days, with a maximum concentration of 2.9 ppm being measured. On this day, concentrations ranged between 1 ppm and 2.5 ppm between 10:30 am and 6:00 pm.

Continuous measurements of H_2S at the biofilter were low. However, measurements during the site visit with a handheld (ppb level) H_2S monitor suggested that the biofilter is a potential source of odour.

No H_2S was detected within the dryer building, indicating that H_2S monitoring is not useful for understanding odours from this source, with odours from the drying process likely to consist of a range of volatile organics such as mercaptans, amines, indole, and skatol and ammonia which are more difficult to measure continuously. All of these other compounds, while likely to be at relatively low concentrations, have the potential to generate odour that can cause nuisance effects.

H_2S measurements undertaken at the northern gate and southwest boundary have been paired with wind direction data from Birch Land AWS to generate polar plots to provide information on the potential sources of odour. Polar plots for the northern gate and southwest boundary monitoring locations are presented in Figure 8 and Figure 9. This analysis shows that SWWTP is the most likely source of odour at these locations, as there is a strong correlation between maximum concentrations while the plant is upwind of the monitor. AQCNZ notes that based on the data, it is difficult to assign specific sources within the plant, given that the wind data from Birch Lane AWS is unlikely to accurately reflect conditions at the Site. For any future monitoring, it is recommended that collected H_2S Monitoring data is paired with onsite wind observations.

Figure 8: Front Gate – H_2S Polar Plot (14 April to 26 April 2023)

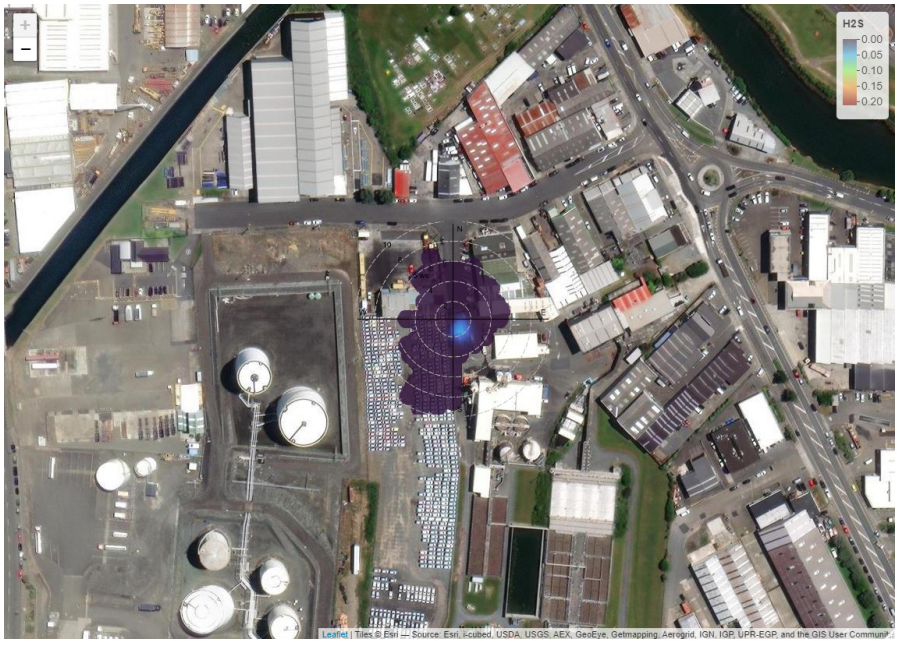


Figure 9: Southern Boundary – H_2S Polar Plot (02 May to 18 May 2023)

5 Findings from the Site Visit

The following section of the report presents observations by Peter Stacey (AQCNZ) and Donovan Van Kekem (NZ Air) during the site visit undertaken on 31 March 2023. Table 2 provides a summary of the areas visited and observations made. AQCNZ has also made reference in this section to some of the information presented in a report prepared for Veolia by Source Testing New Zealand Limited (STNZ), titled, Hutt Valley Wastewater Treatment Plant Odour Control System Assessment, July 2021.

Table 2 Site visit observations

Location	Comments	Photograph
Milliscreen Building	**General Observation -** Corrosion at various places near floor level in the lower level of the plant – Indicative of H_2S pooling in low-lying areas (as it is heavier than air) and resulting in increased corrosion. Relatively high levels of H_2S are required to result in corrosion of metal structures, acknowledging that the building is ~40 years old. A H_2S concentration of 6 ppb was observed in the building at the time of the site visit. However, the corrosion would indicate that levels of H_2S in this building have been elevated in the past.	

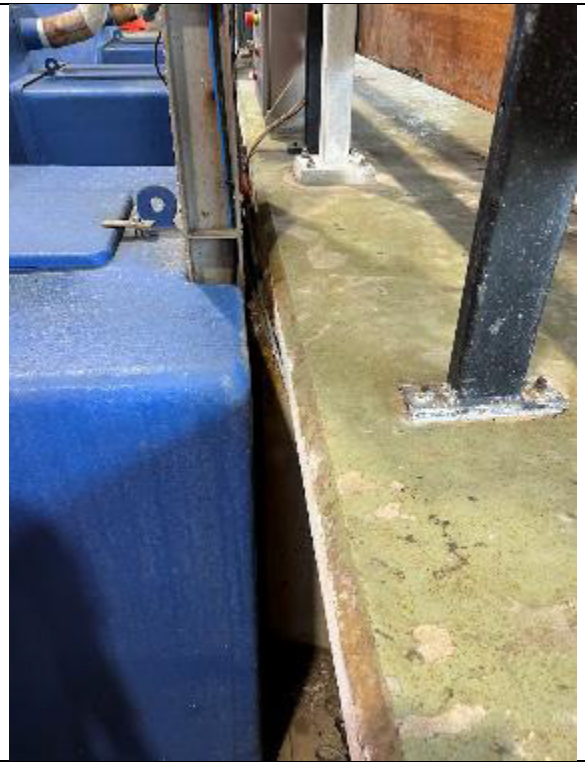
Milliscreen Building	Also noted were a number of water leaks potentially resulting in wastewater on floors and slip drains. Wastewater odour was observed during the site visit at relatively low intensities, with the odour masking agent providing a more obvious odour.	

Milliscreen Building		

Milliscreen Building	Screenings bin open – Minor odour source.		

Milliscreen Building	Inspection port left open – Minor odour source.	

Milliscreen Building	Plant door open – Minor fugitive odour source.	

Milliscreen Building	Minor source of odour – Odour observed coming from a seal at the back of the milliscreens – corrosion evident on nearby metalwork. The STNZ report states that screens are in poor condition, and the cleaning jets are no longer operational, potentially resulting in higher odour levels within the drums. STNZ recommended blocking roof vents and installing additional ventilation/odour treatment. Not observed during the site visit, but mill screens are opened for cleaning on a daily basis which could generate elevated odour.		

Milliscreen Building	**General Observation** – Bin closed/sealed.	

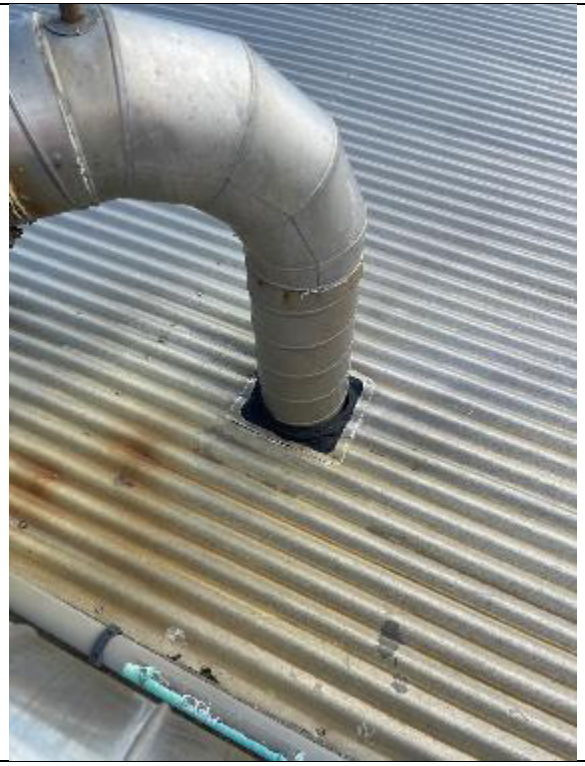
Odour Cannon	**General Observation** – Very low levels of odour were observed around this part of the plant. This odour cannon has a limited effective range. For the odour cannon to be effective, it needs to be positioned adjacent to/downwind of an odour source. AQCNZ considers that this odour cannon in its current location will likely have a very limited/negligible effectiveness at reducing/masking off-site odour. AQCNZ recommends that the cannon be redeployed to areas where odour has been identified as being a significant source, the biofilter, for example.		

Grit Bin	A minor source of odour - cover not in place. It appeared to be a minor source of odour (i.e. very low-level odour).		

UV Inlet Channel	A minor source of odour – low-intensity odour from contamination – Very unlikely to be the source of off-site odour complaints.	

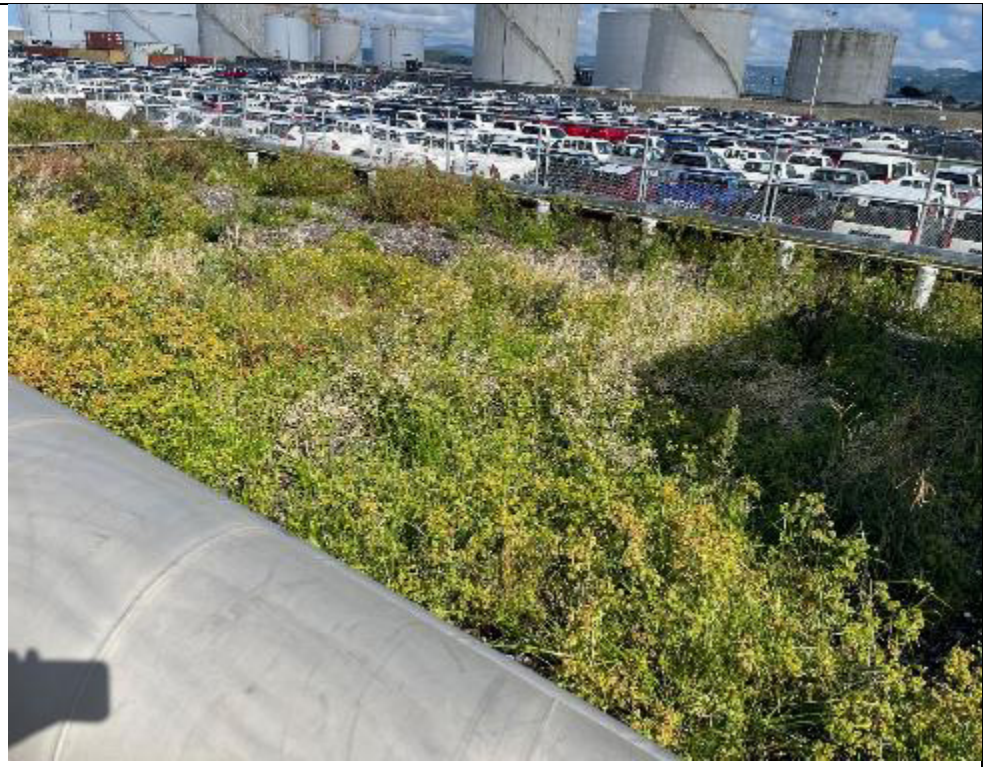
Primary Sedimentation Tank (PST)	Minor to Moderate source of odour – Corrosion on steel structures around covers indicates leaks/lack of negative pressure in the PST headspace. There was also evidence of the seals along the edges of the PST corrugated iron covering missing/deteriorated. Again corrosion of metal structures around these leaks indicated fugitive odour discharges and a lack of a negative pressure environment within the PST. 13 ppb of H_2S was observed on top of the PST.	

PST	Minor source of odour – leaking around the flange on PST.		

Storage Basin	During the site visit, it was discussed whether or not any sludge was left at the base of this basin when emptied. If so, then the sludge could turn anaerobic and result in odour discharges when empty.	

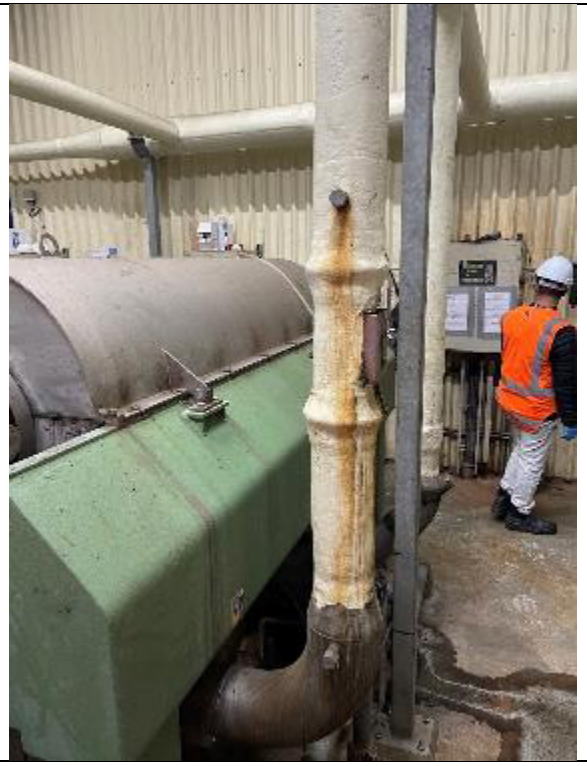
Aerobic tanks	Minor odour source – the odour observed from these tanks has an odour character described as 'fresh wastewater'. This type of odour has been observed during odour scouting beyond the site boundary but is considered to be of a lower offensiveness than other odour discharges from the site (i.e. putrid/acrid odour from the biofilter, rotten egg-like odour from high-level H_2S discharges).	

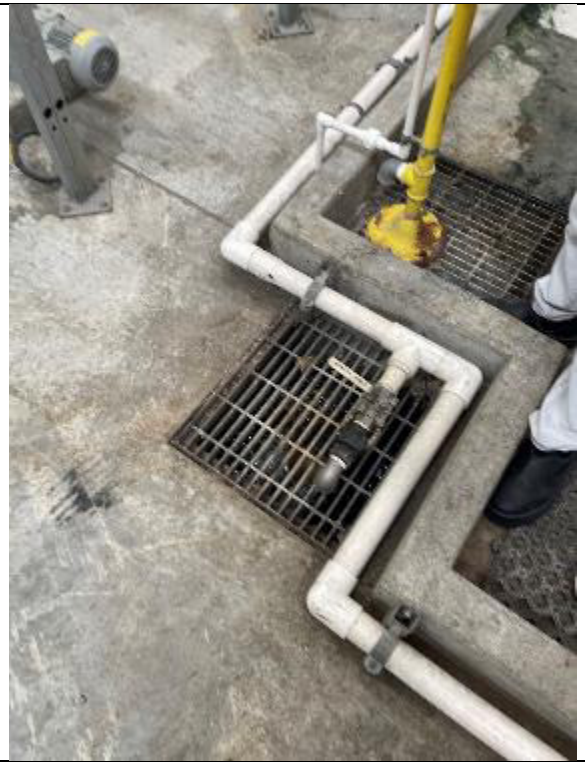
Biofilter	Moderate source of odour - Rubber seal around fans split/leaking on both fans. AQCNZ understands that this has now been repaired.	

Biofilter	A significant source of odour: - Media is likely to be at end of life. - Significant short-circuiting of gas flow was observed during the site visit – particularly around edges of the biofilter - highly odorous on top of the biofilter – odour character appeared to be most consistent with those from the dryer. However, it is likely that odour from all point source extraction sources is being emitted from the biofilter with limited treatment. - No vegetation should be present on the biofilter – this creates preferential pathways and removes moisture from the biofilter. An H_2S concentration of ~50 ppb was measured near the biofilter. This indicates the odour from other extraction points is likely to be being discharged from the biofilter as well, i.e. PST, milliscreens etc. Uneven distribution of air through the media bed and degraded media is resulting in excessive odour discharges from the biofilter.	

Biofilter	Example of short-circuiting around edges of the biofilter.		

Gravity Thickener	Minor source of odour – leaking around the flange on top of gravity thickener. Strong H_2S like odour was briefly observed along walkway near top of tank.	

Centrifuge room	A minor source of odour – low level odour observed in centrifuge room – H_2S concentration of 12 ppb.		

Polymer Room	Polymer Room – very strong unusual strong odour observed. Odour source was traced back to a floor sump – see picture. This appeared to relate to the dryer process. Potentially related to the biofilter leachate drainage system.		

Dryer Building	Possible source of odour - One roof fan was not operational. - STNZ air flow checks appeared to be within expected values. - Building under slight negative pressure 5-10 Pa. - STNZ noted gaps around cyclones and roof – potential pathway for odour. - STNZ recommended sealing these gaps + roof fans and having additional extraction to a biofilter. - Very distinctive odour, not like other parts of the process. - GWRC staff indicate this is the primary source of odour complaints but have not been taken into building to correlate observations. - Odour in the building was 'distinct'. - H_2S measurements in the building – very low to negligible concentrations of H_2S. The latest observation from WWL is that the odour observed at the biofilter that smelt like the drier could be observed at the northern gate. Potentially suggesting that the biofilter could be the cause of some of the recent complaints attributed to the dryer building.	

6 Recommendations

6.1 Biofilter

AQCNZ has reviewed the biofilter design documentation and the associated recommended monitoring and maintenance schedule[2]. This document is extensive and provides information on regular monitoring, maintenance, and tuning of the air extraction system and biofilter.

AQCNZ has reviewed the design specifications and compared these against recommended design parameters for a biofilter of this nature, treating foul air of the likely composition and concentration generated by the wastewater treatment plant. The following has been observed/calculated:

- Biofilter area = 850 m²
- Design flow rate is 43,000 m^3/hr
- Based on the above area – the biofilter should be able to treat up to an airflow rate of 42,500 m³/hr
- The EBRT at the design flow rate is 85 seconds.
- STNZ measured the total flow to be 42,100 m³/hr

The biofilter size and capacity are consistent with industry good practice. The STNZ measured flow rates through the biofilter are similar to the design flow rate and are indicative of good fan performance.

AQCNZ has reviewed a spreadsheet of biofilter monitoring data (backpressure, pH, and moisture) from June 2020 – March 2023 provided by WWL and compared the measured data against the design/recommended operational range in the Operations Manual. This data analysis is presented in Sections 6.1.1 – 6.1.3 below.

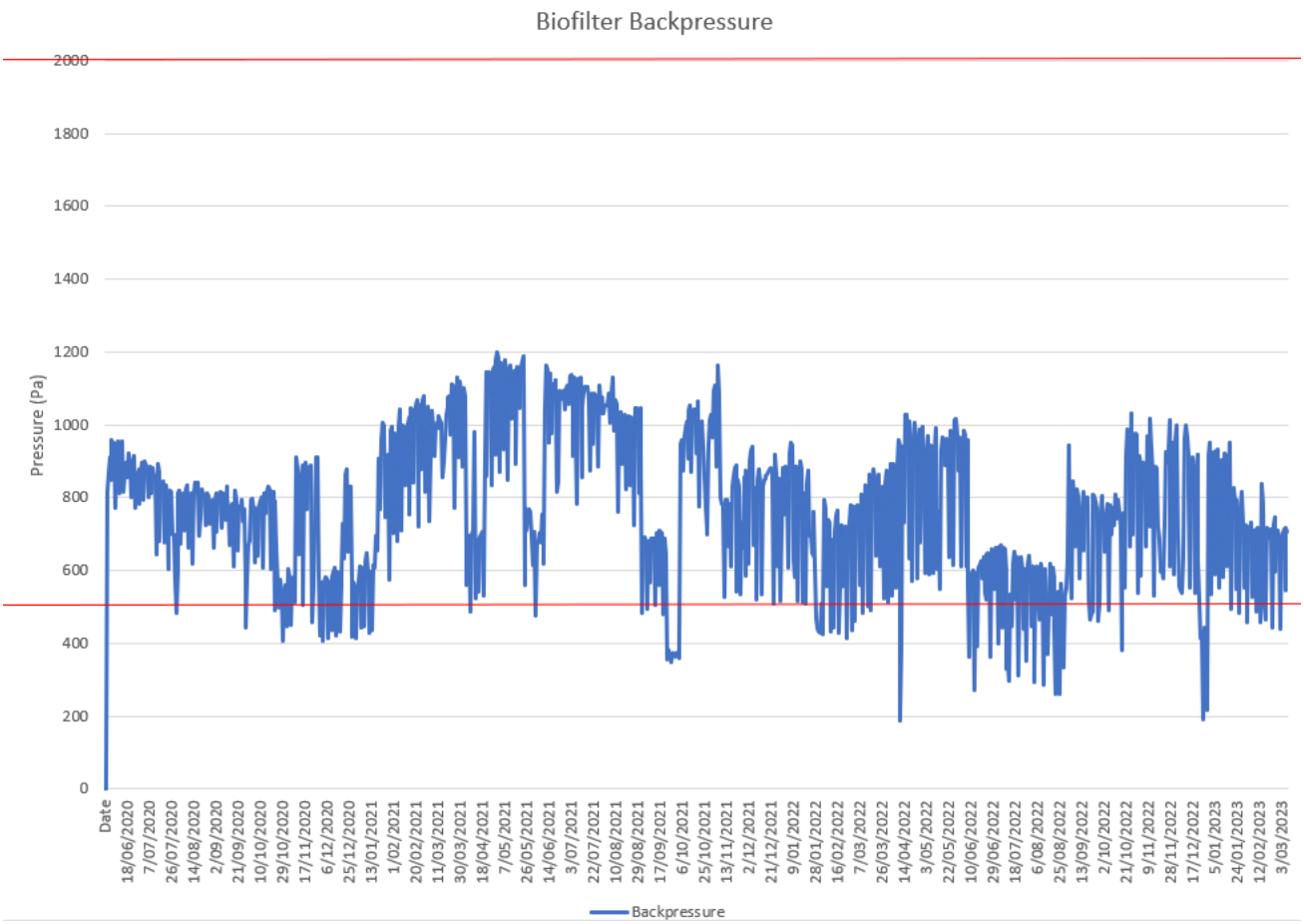
Due to time constraints, analysis of individual cell data (for moisture and pH) has not been undertaken; however, a cursory view of the data indicates that each cell appears reasonably consistent with the average.

6.1.1 Backpressure

A graph of daily measured backpressure is presented in Figure 10. The recommended backpressure design range is between 500 and 2,000 Pa (represented by red lines in Figure 10). The measured backpressure is at the bottom end of this range and, at times, falls below the range. This is indicative of short-circuiting, as has been observed during the site visit.

[2] OPERATIONS MANUAL VOL II, Odour control. HVOPS UPCP - 70

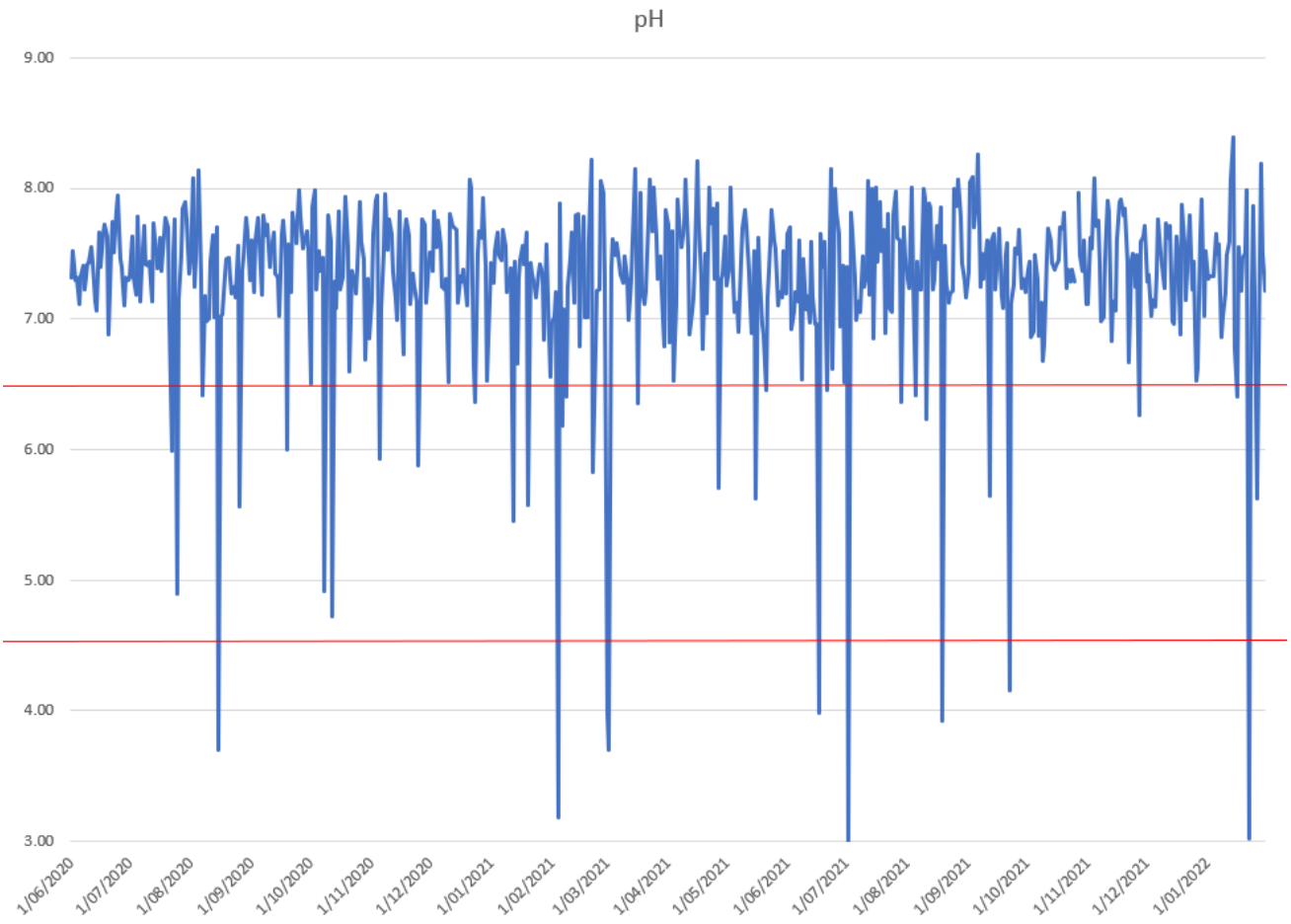
Figure 10: Biofilter Backpressure



6.1.2 pH

A graph of daily measured pH is presented in Figure 11. The recommended pH range is between 4.5 and 6.5 (represented by red lines in Figure 11). The measured pH is mostly above this range averaging around 7.5. This may also be a result of short-circuiting as the foul air is not being directed evenly through the biofilter media resulting in more neutral pH of the media.

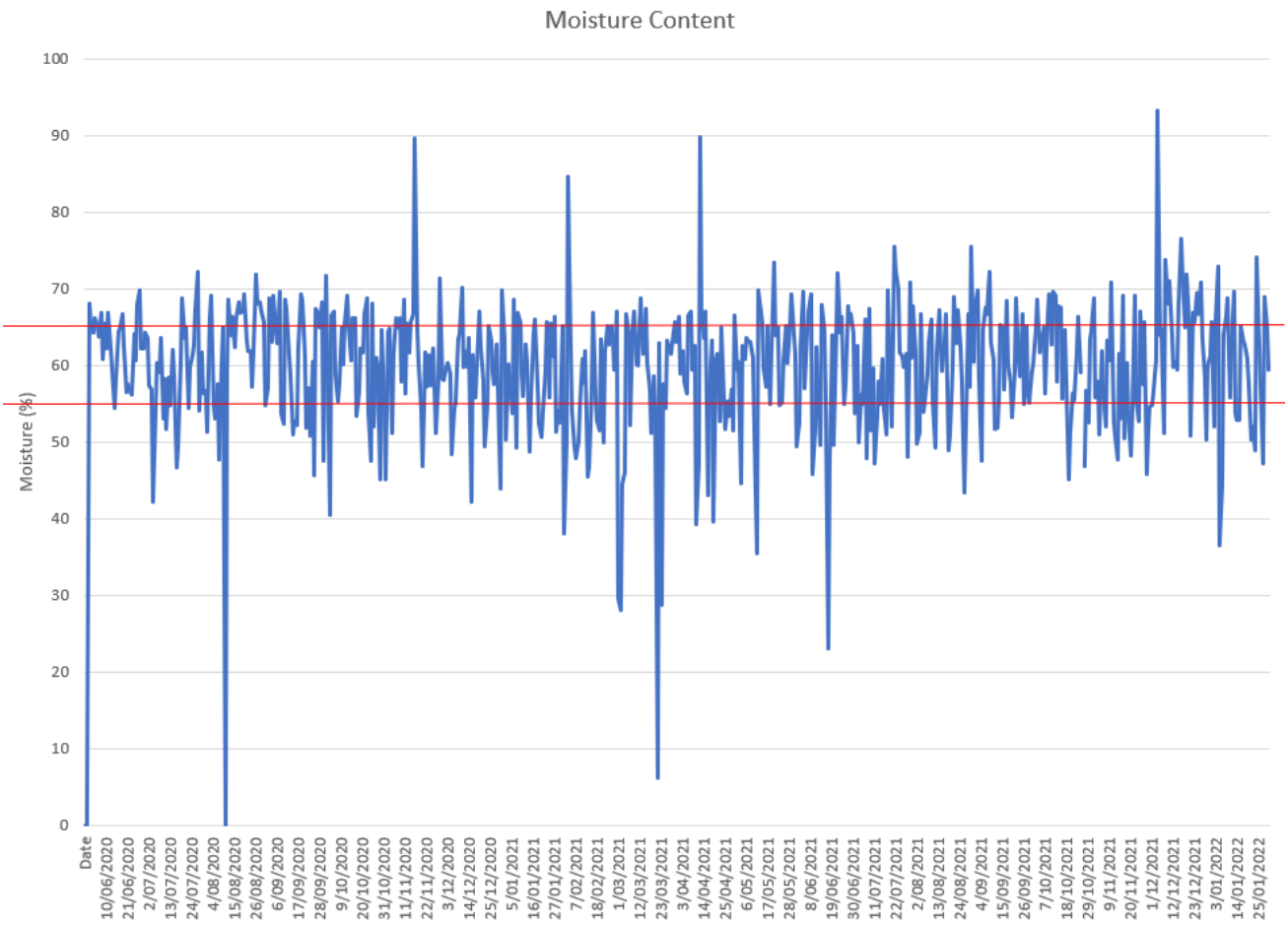
Figure 11: Biofilter pH



6.1.3 Moisture

A graph of daily measured moisture is presented in Figure 12. The recommended backpressure design range is between 55% and 65% (represented by red lines in Figure 12). The measured moisture is generally between the recommended this range. This is indicative of good irrigation management.

Figure 12: Biofilter moisture

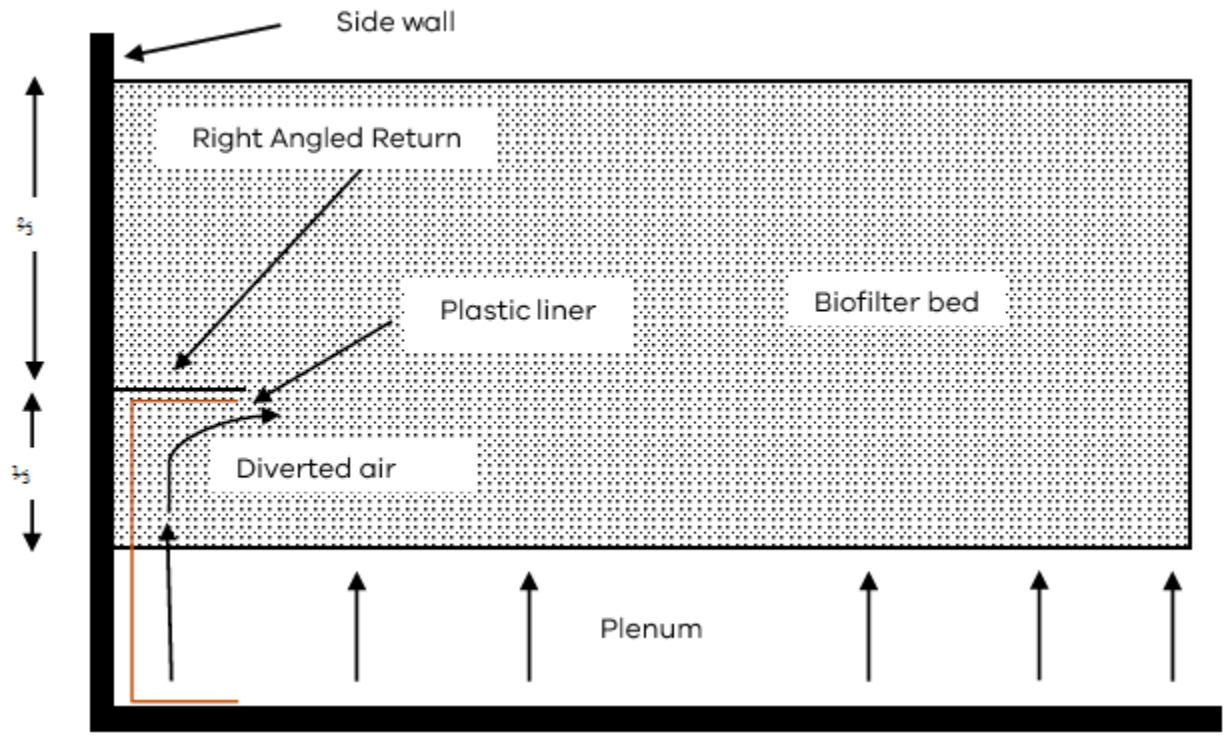


In conclusion, uneven distribution of air through the media bed and degraded media is resulting in excessive odour discharges from the biofilter.

AQCNZ understands that the biofilter media was replaced approximately five years ago. AQCNZ considers it good practice to replace biofilter media once every five years. Therefore, it is recommended that the media be replaced.

As there is obvious short-circuiting of the media along the walls of the biofilter, it is recommended that during the media replacement, a wall return/fin is installed around the inner perimeter of the biofilter cells (see Figure 13 for an example). This return is designed to divert air from the wall back into the main body of the media. Further guidance on the design parameters for such a return is outlined in the EPA Victoria *Biofilter Design and Maintenance* publication 1880 May 2021.

Figure 13: Biofilter wall return



Additionally, during the media replacement, it is recommended that the leachate drains, leachate return system, foul air lines, plenum material, air distribution ducts, etc., are inspected, cleaned and replaced as necessary. This should be undertaken in accordance with the guidance in HVOPS UPCP – 70. Note that the odour observed in the polymer room may result from blockages/incorrect operation of the leachate system.

It is also recommended that the foul air extraction system is inspected to ensure that negative pressure is being maintained across all extraction points and there is sufficient airflow in each branch of the ducting. Note that there are notes on how to inspect and balance the extraction system in HVOPS UPCP – 70.

It is also recommended that the foul air extraction fans are inspected to ensure they are running at optimum levels.

After this media replacement and foul air extraction system inspection is completed, it is recommended that more regular monitoring and maintenance of the biofilter, leachate management, and foul air extraction system are undertaken. This should be undertaken in accordance with the recommended procedures and frequency in HVOPS UPCP – 70. In addition to the procedures in HVOPS UPCP – 70, it is recommended that smoke tests (or steam observations on cold mornings) are undertaken to visualize the air distribution across the biofilter and identify any short-circuiting. Where short-circuiting is observed, then media fluffing up (turning) is required to reinstate even distribution of airflow across the media bed.

Where any of the monitoring parameters for the biofilter or foul air extraction system are outside the recommended guidelines or deficient, then a Corrective Action Record (or equivalent) needs to be instigated and actioned as soon as possible. The biofilter and foul air extraction system is critical to the operation of the WWTP and associated compliance with the air discharge consent.

6.1.4 Extraction System Ducting

Simple flag tests (using a thin piece of plastic to see if it is sucked in or blown out) coupled with surveys using a ppb H_2S monitor (where available) should be undertaken at gaps/holes in areas under extraction e.g. around plate lids on the PST. Where negative pressure environments are not observed or H_2S is detected, either increase extraction from these areas or progressively seal up openings/vents. Note that there are a number of gaps listed in Section 5 above.

6.2 Dryer and Milliscreen Buildings

AQCNZ recommends further investigation into the dryer building air tightness and associated negative pressure. Whilst fugitive emissions from these buildings were not observed during the site visit, under different wind conditions/operational conditions, it is possible that they will be occurring.

Furthermore, while the odour levels in these buildings were not considered to be excessive on the date of the site visit, it appears that there may be a correlation between hot weather and higher odour emission rates from the WWTP/dryer or the cleaning of the millscreens.

It is recommended that flag tests are undertaken at downwind doors/windows/vents during stronger wind conditions to see if the building is being maintained under negative pressure during these conditions. Noting that it is preferential for odour to be discharged via the roof vents as opposed to leaks in the building envelope as this provides better odour dispersion.

It is also recommended that other potential odour emission activities/points be further investigated, i.e. during pellet load out, from roof vents, from silo vents, etc. Where required, additional point source or building air extraction may be required, with the odour treated using an appropriate odour control system, biofilter/chemical scrubber etc. These upgrades would be undertaken as part of Stage 3 improvements discussed further below.

6.3 Odour Cannon

AQCNZ recommends that the cannon should only be used when a specific odour source has been identified that cannot be easily mitigated or quickly mitigated. An example being that the cannon is redeployed closer to the biofilter before and while it is being remediated.

If no specific source can be identified, AQCNZ sees little value in operating the equipment.

6.4 Weather station

It is recommended that the existing site weather station (Figure 14) should be replaced with a suitable system to allow wind speed and wind direction data to be recorded. This will help with future complaint investigations and inform site odour surveys.

Figure 14: Weather station

6.5 Complaint and on-site odour investigations

It is recommended that in the event of a complaint being received site staff shall undertake a full site survey to identify where odour is being emitted from on the site.

The odour plume is to be tracked back to the source by starting in a downwind location and then zig zagging across the plume back to the source. It is important to note the character of the odour as the character of odour discharged from the dryer is distinctly different to that from other processes on-site.

Where GWRC officers are attending the complaint, invite them on-site and have them track the odour plume back to the source. If the plume is not present at the time of the site visit, then show the officer(s) the different odour sources and associated characters such that they can comment on which character was most similar to that observed during their off-site observations.

Ideally, site staff will have a ppb H_2S monitor during this site survey. Areas like on top of the biofilter, downwind of the dryer building and associated loadout points, at building wall vents, inside/adjacent to the milliscreen building, on the platforms above the PST, DAFs and other site processes are recommended. Site staff are to identify the character of odour at each of these points and note if there is any elevated odour/H_2S observed at each potential source.

The site processes which are occurring at the time of the complaint should also be recorded as a part of the complaint investigation.

In general, AQCNZ considers that the complaint investigation procedure needs to be updated.

In addition, AQCNZ noticed that the odour complaint record often didn't identify the complainant's location, making it difficult to investigate the cause of odour. While complainants are often reluctant to provide location information, where possible, WWL/GWRC should encourage the complainant to at least provide their general location, i.e., the odour was observed to the northeast of the site. This will protect their identity while still providing helpful information to investigate the complaint.

6.6 General

Ensure site staff are aware of potential fugitive odour emission points and follow site processes. For example, inspection port lids to remain closed, milliscreen bin lid to be closed, roller doors to remain shut, skip bin covers to remain on, etc.

7 Odour Improvements - Order of Priority

Stage 1

AQCNZ recommends that the measures presented in Sections 6.1 to 6.6 of this report should be undertaken as a priority: namely:

- Remediate biofilter
- Check the extraction system ducting/tanks/vessels for leaks
- Undertake further investigations of fugitive odour from the dryer and milliscreen buildings
- Redeploy odour cannon
- Improve odour investigation procedures to help identify odour sources
- Repair weather station to assist with odour investigations

Stage 2

Once these have been implemented then, follow-up odour plume investigations (odour scouting), site surveys, and H_2S monitoring should be undertaken to measure the effectiveness of the changes.

Stage 3

Should it then be determined that these changes are not sufficiently effective at reducing off-site odour to levels that will not cause complaints, then WWL should consider the following additional mitigation measures (contingency measures):

- Increasing the air extraction rates off current point source extraction points to further reduce potential fugitive emissions.
- Add additional point source extraction points (points that should be subject to this extraction would need to be investigated further but may include aspects of the dryer building and associated activities).
- Building air extraction from the dryer building, milliscreen building or other buildings identified as having fugitive odour discharges. Note that any substantive increase in the volume of air being extracted via the foul air extraction system may necessitate an increase in the biofilter size or different treatment systems.
- Post the biofilter media replacement and associated addition of wall return fins, measure the biofilter odour removal efficiency via olfactometry. Where removal efficiencies are too low, the biofilter capacity should be increased.
- Consider covering the DAF tanks and adding point source air extraction (if these are identified as being a significant odour source).
- Installing aerators in the overflow storage basin to reduce the potential for sludge to accumulate and cause odour.

8 Limitations

Air Quality Consulting NZ Limited has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Wellington Water Limited, and only those third parties who have been authorised in writing by Air Quality Consulting NZ Limited to rely on this report.

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