

19 March 2024

Joemar Cacnio
Process Engineer
Wellington Water

Private Bag 39804,
Wellington Mail Centre 5045

Dear Joemar,

**Wellington Water – Porirua Wastewater Treatment Plant - Odour Investigation Study
– February 2024**

Air Quality Consulting NZ Limited (**AQCNZ**) has been engaged by Wellington Water Limited (**WWL**) to undertake an odour investigation study for the Porirua Wastewater Treatment Plant (**PWWTP**) following odour complaints made by residents located within the Pikarere Farm subdivision. The purpose of this odour investigation study is to better understand recent odour observations and complaints made by these residents and advise of any potential interim improvements to the plant to reduce odour.

This odour survey follows two earlier baseline seven-day studies undertaken by AQCNZ at PWWTP. The first study was undertaken prior to plant improvements during July and August 2023 as required by resource consent (No. WGN200229 [36727]). The second study was undertaken in December 2023 following the plant improvements, whereby AQCNZ made recommendations regarding the management of the tunnel inlet fan.

The focus of this most recent February 2024 study was on late afternoon/early evening hours, as this was noted by residents to represent worst-case conditions for observing odour.

The following letter report sets out the methodology followed and the findings of a five-day odour survey undertaken at PWWTP between 12 and 16 February 2024.

1 Odour Scouting Methodology

Since odours are highly variable in frequency, duration, intensity and character, it is only possible to characterise odour from a site by surveying it frequently and over a long period of time. For this project, AQCNZ considered that five (5) days of odour surveys would be adequate to assess the variability in odour in the area around PWWTP, noting that this period would likely cover a range of meteorological and plant operating conditions.

To undertake this study, AQCNZ utilised one of its independent odour scouts. The odour scout had 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 PWWTP, followed by a series of downwind observations, generally starting at the furthest extent of any observed odour plume. In this way, the odour scout can determine the extent and intensity of any odour plume emitted from the source. This methodology is based on the 'dynamic downwind surveillance' methodology described in the Draft Odour Surveillance Guidance produced by EPA Victoria¹.

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 an extensive 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 and the assessment location's GPS coordinates.
- 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 5 days, the odour scout mapped the extent of the odour plume between 4 pm to 8 pm to assess the prevalence of any odours outside of the previously assessed 'normal business day' hours (typically 7 am – 4 pm). This was achieved by taking multiple surveys – approximately two campaigns per day consisting of up to twenty 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

¹ EPA Victoria "Odour Surveillance Method Draft" December 2019

PWWTP 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 – Monday, 12 February 2024, 16:10 to 19:50.
- Day 2 – Tuesday, 13 February 2024, 15:50 to 19:40
- Day 3 - Wednesday, 14 February 2024, 15:50 to 19:40
- Day 4 - Thursday, 15 February 2024, 16:00 to 19:30.
- Day 5 - Friday, 16 February 2024, 13:30 to 17:00.

During the monitoring study, the prevailing winds at Porirua were from the north, northwest or to the northeast, with limited winds from the west and south. Given that the receptors most at risk of experiencing odour are to the south of the plant, where possible, the timing of the odour surveys was aligned with winds from the northern sector (northwest to northeast).

Worst-case conditions for experiencing odour typically occur during low wind speeds as there is less mechanical mixing of odour plumes and minimal dilution of odours. AQCNZ, therefore, attempted to target these low-speed wind conditions; however, given the exposed nature and the high prevalence of moderate to high-speed winds at Porirua, this could not always be achieved for each day of surveying.

Figure 1 shows an aerial of PWWTP (yellow polygon), receptors located on Pikarere Street (red polygons), and areas frequently visited during the odour study (purple areas).

Figure 1: Odour Survey Locations



In addition to the odour scout measurements, AQCNZ has reviewed continuous H₂S monitoring data from the WWTP, namely the monitors installed in the tunnel vent and the milliscreen extraction vent. Data from the continuous H₂S monitor installed at the location of the Pikare farm weather station was also reviewed. The location of this monitor is annotated on Figure 1 as a blue star. H₂S is an odorous gas that is typically associated with discharges from WWTP. It can, therefore, be used as an indicator of odour.

2 Odour Survey Results

The following section of this letter report presents the results from the five days of odour observations.

The odour intensity figures presented in the following section of the report show the maximum odour intensity (represented with coloured dots) and the prevailing wind direction shown as an arrow. Notably, the maximum recorded intensities do not specifically relate to odour characters related to wastewater treatment processes. Instead, they represent the maximum intensity from all the odour characters observed.

Day 1 - Monday 12 February 2024

Meteorological Conditions

Odour observations were undertaken between 16:10 and 19:50. Winds primarily came from the north and the northwest, and wind speeds ranged between 0.3 m/s and 3.5 m/s. It was dry throughout the day, and the ambient temperature ranged between 11°C and 21°C.

Plant Conditions

During the monitoring period, the PWWTP tunnel vent stack fan was off, suggesting that this is not a source of odour detected off-site. This observation is reflected in the continuous H₂S data for the vent, which showed H₂S concentrations less than 0.5 ppm during the monitoring period. Continuous H₂S monitoring of the milliscreen vent during the monitoring period showed concentrations in the order of 20 ppm. This value compares with concentrations measured earlier in the day (6 am to 11 am), which ranged between 5 ppm and 15 ppm. From 11 am onwards H₂S concentrations were consistently around 20 ppm.

Odour Observations

Figure 2 presents the maximum odour intensities measured at each location during the odour survey and the wind direction at the time of the survey.

Upwind odour observations were undertaken twice, with no significant WWTP odours present. Downwind odour observations were undertaken along Pikarere Street. WWTP related odour was observed 45 times (individual 10-second sniffs) from a total of 420 sniffs along Pikarere Street on this day. This odour was detected at 'weak', 'moderate', 'strong' and 'very strong' odour intensities.

The worst-case odour observation where WWTP odours were detected occurred between 06:56 pm and 07:10 pm. Sewage odours (odours with a strong or pungent odour likely related to the inlet works) occurred 35% of the time over the 10-minute odour survey, with 10% of the odour detections noting a 'very strong' intensity and 12% reaching a 'strong' intensity.

Other odours detected were of a character defined as 'grass', 'plant smell', and 'animal/farm' at 'weak' intensities for fleeting periods.

Figure 2: Odour Survey Results – Day 1



Odour Intensity Scale

○ No data ○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 1 Extremely Strong

Day 2 - Tuesday, 13 February 2024

Meteorological Conditions

Odour observations were undertaken between 15:50 to 19:40. Throughout the monitoring period, the wind blew from the north and northeast with a wind speed ranging between 1.1 m/s and 4.5 m/s. The ambient temperature ranged between 10 and 21°C, and no rainfall was observed.

Plant Conditions

During the monitoring period, the PWWTP tunnel vent stack fan was off, suggesting that this is not a source of odour detected off-site. This observation is reflected in the continuous H₂S data for the vent, which showed H₂S concentrations less than 0.5 ppm. Continuous H₂S monitoring of the milliscreen vent during the monitoring period showed concentrations in the order of 15 ppm. This value compares with concentrations measured earlier in the day (6 am to 3 pm), which ranged between 5 ppm and 15 ppm.

Odour Observations

Figure 3 presents the maximum odour intensities measured at each location during the odour survey and the wind direction at the time of the survey. Upwind odour observations were undertaken twice, one for each survey round, with no WWTP odours being present. Downwind odour observations were undertaken along Pikerere Street. WWTP related odour was detected 21 times (individual sniffs) from a total of 360 sniffs throughout the monitoring periods. These odours were generally at a 'weak' intensity but reaching a 'moderate' intensity on occasions. Other odours detected on Pikerere Street were described as having 'grass', 'sewage', and 'animal/farm' characters.

The worst-case odour observation where WWTP odours were detected occurred between 04:13 pm and 04:26 pm. Odours with sewage and effluent (odours more likely related to partially treated WWTP effluent i.e. clarifier odours) characters occurred 32% of the time over the 10-minute odour survey. These odour detections were of a 'weak' intensity 25% of the time, but reached 'moderate', 'strong', and 'very strong' intensities each 2% of the time.

Fixed H₂S Monitoring

During the monitoring period, the fixed weather station H₂S monitor recorded values that ranged between 0 and 5 ppb, suggesting that odour was present.

Figure 3: Odour Survey Results – Day 2



Odour Intensity Scale

○ No data ○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 1 Extremely Strong

Day 3 - Wednesday, 14 February 2024

Meteorological Conditions

Odour observations were undertaken between 15:50 to 19:40. Throughout this day, the wind blew from the north and northeast wind directions, with wind speeds ranging between 0.8 m/s and 6.5 m/s. The ambient temperature was between 16 to 20 °C, with no rainfall observed.

Plant Conditions

During the monitoring period, the PWWTP tunnel vent stack fan was off, suggesting that this is not a source of odour detected off-site. This observation is reflected in the continuous H₂S data for the vent, which showed H₂S concentrations less than 0.5 ppm. Continuous H₂S monitoring of the milliscreen vent during the monitoring period showed concentrations in the order of 15 ppm. This value compares with concentrations measured earlier in the day (6 am to 3 pm) which ranged between 5 ppm and 15 ppm.

Odour Observations

Figure 4 presents the maximum odour intensities measured at each location during the odour survey and the wind direction at the time of the survey. Upwind odour observations were undertaken twice, one for each survey round, with no WWTP odours being present. Downwind odour observations were undertaken along Pikarere Street. Effluent odour was detected 23 times and sewage odour was detected 20 times (individual sniffs) from a total of 420 sniffs throughout the monitoring period. These odours were generally of a 'weak' intensity but reached a 'moderate' and 'strong' intensity on occasions. Other odours detected on Pikarere Street were described as having 'grass', and 'animal/farm' characters.

The worst-case odour observation where WWTP odours were detected occurred between 04:32 pm and 04:51 pm. Odours with sewage and effluent characters occurred 25% of the time over the 10-minute odour survey. These odour detections were of a 'weak' intensity 22% of the time, but reached a 'moderate' intensity 3% of the time.

Fixed H₂S Monitoring

During the monitoring period, the fixed weather station H₂S monitor recorded values that ranged between 0 and 5 ppb, suggesting that odour was present.

Figure 4: Odour Survey Results – Day 3



Odour Intensity Scale

○ No data ○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 1 Extremely Strong

Day 4 - Thursday, 15 February 2024

Meteorological Conditions

Odour observations were undertaken between 16:00 to 19:30. Throughout the monitoring period, the wind blew from the southwest, west, northwest, and north. Wind speed data was not available on this day, but was similar to the other monitored days where surveys were undertaken at the Site (i.e. low to moderate wind speeds). The ambient temperature was between 16 and 22 °C, with no rainfall observed.

Plant Conditions

During the monitoring period, the PWWTP tunnel vent stack fan was off, suggesting that this is not a source of odour detected off-site. This observation is reflected in the continuous H₂S data for the vent, which showed H₂S concentrations less than 0.5 ppm. Continuous H₂S monitoring of the milliscreen vent during the monitoring period showed concentrations in the order of 18 ppm. This value compares with concentrations measured earlier in the day (6 am to 3 pm) which ranged between 7 ppm and 18 ppm.

Odour Observations

Figure 5 presents the maximum odour intensities measured at each location during the odour survey and the wind direction at the time of the survey. Upwind odour observations were taken two times at the beginning of each survey round, with no odours present within 50 m of the WWTP. Downwind odour observations were undertaken along Pikarere Street. The odours observed were described as 'animal/farm', 'sewage' and 'effluent'. Throughout the monitoring period, effluent odour was detected 32 times (out of 300 sniffs) at a range of odour intensities reaching 'strong' and 'very strong' intensities on occasion. Sewage odour was detected 3 times (individual sniffs) at a moderate intensity. The 'animal/farm' odour detections were generally of 'weak' intensities.

The worst-case odour observation where WWTP odours were detected occurred between 05:13 pm and 05:24 pm. Odours with sewage and effluent characters occurred 27% of the time over the 10-minute odour survey. These odour detections were of a 'weak' intensity 18% of the time, but reached a 'moderate' intensity 8% of the time.

Fixed H₂S Monitoring

During the monitoring period, the fixed weather station H₂S monitor recorded a value of 0 ppb, suggesting no odour is present at this location.

Figure 5: Odour Survey Results – Day 4



Day 5 - Friday, 16 February 2024

Meteorological Conditions

Odour observations were undertaken between 13:30 to 17:00. Throughout the monitoring period, the wind blew from the north and northeast with a wind speed ranging between 0.3 m/s and 4.1 m/s. The ambient temperature ranged between 17 and 22°C, and no rainfall was observed.

Plant Conditions

During the monitoring period, the PWWTP tunnel vent stack fan was off, suggesting that this is not a source of odour detected off-site. This observation is reflected in the continuous H₂S data for the vent, which showed H₂S concentrations less than 0.5 ppm. Continuous H₂S monitoring of the milliscreen vent during the monitoring period showed concentrations ranged between 15 ppm and 23 ppm. This value compares with concentrations measured earlier in the day (6 am to 3 pm), which ranged between 5 ppm and 23 ppm.

Odour Observations

Figure 6 presents the maximum odour intensities measured at each location during the odour survey and the wind direction at the time of the survey. Upwind odour observations were undertaken twice, one for each survey round, with no WWTP odours being present. Downwind odour observations were undertaken along Pikarere Street.

The odours observed were described as 'animal/farm', 'sewage' and 'effluent'. Throughout the monitoring period, effluent odour was detected 53 times, generally at a 'weak' intensity but reaching 'moderate' and 'strong' intensities on occasion. Sewage odour was detected 10 times (individual sniffs) (out of a total of 360 sniffs) at 'weak' and 'moderate' intensities. The 'animal/farm' odour detections were generally of 'weak' intensities.

The worst-case odour observation where WWTP odours were detected occurred between 02:11 pm and 02:23 pm. Odours with sewage and effluent characters occurred 23% of the time over the 10-minute odour survey. These odour detections were of a 'weak' intensity 15% of the time, but reached a 'moderate' intensity 8% of the time.

Fixed H₂S Monitoring

During the monitoring period, the fixed weather station H₂S monitor recorded values that ranged between 0 and 4 ppb, suggesting that odour was present.

Figure 6: Odour Survey Results – Day 5



Odour Intensity Scale

○ No data ○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 1 Extremely Strong

Summary of Odour Observations

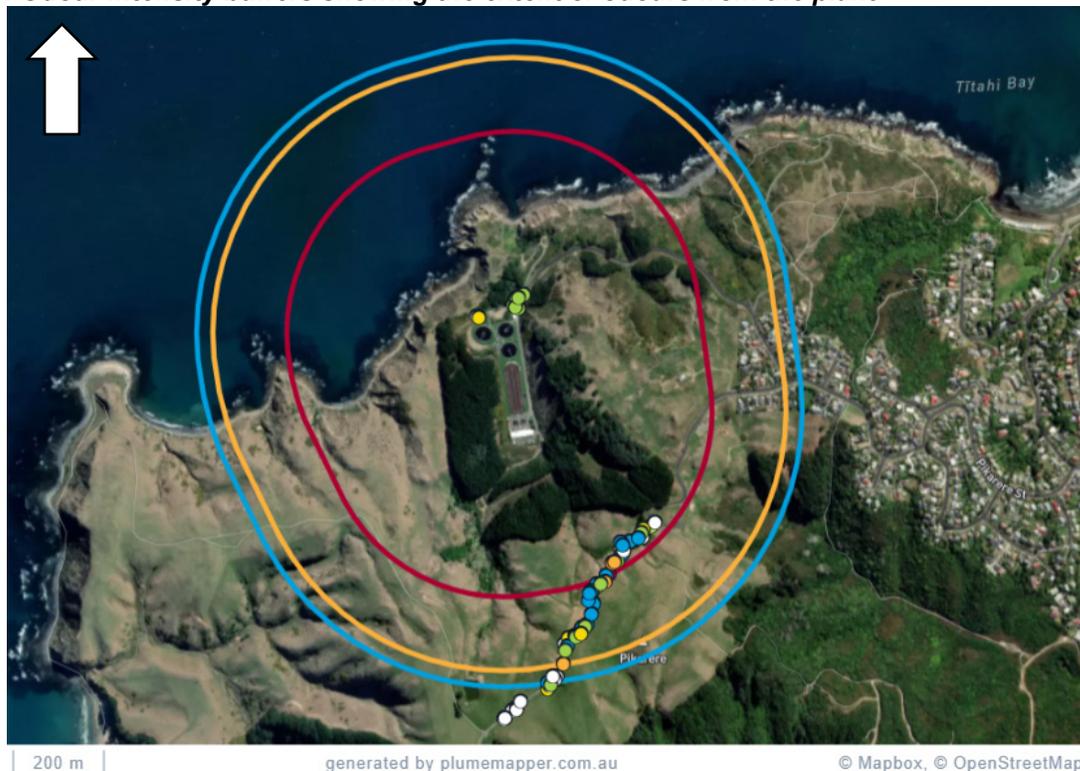
Odours related to the WWTP were detected downwind of the plant on each of the five days that surveys were undertaken. These odours were detected at various locations along Pikarere Street, however, they were most frequently observed, and at higher odour intensities, close to the Pikarere Street gate. This is most likely due to this location being directly downwind of the WWTP for most of the monitoring period. Odours observed along Pikarere St were relatively persistent during the monitoring period, with an intensity typically ranging between 'weak' and 'moderate', with occasional 'strong' odour intensities. AQCNZ considers that if these odours were observed at a receptor location, they would likely cause odour nuisance effects.

Odour Buffers

Figure 7 below shows the maximum extent to which odour associated with the WWTP could be detected for the various odour intensity classifications. The contours represent the maximum distance that odour was detected for the different odour intensities, i.e. strong, moderate etc.

The figure shows that at the location of the nearest dwellings to the south of the plant, strong odours could be expected on occasions based on the maximum distance (~600 m from the inlet works) that strong odours could be detected. AQCNZ notes that the dwellings to the east of the plant are unlikely to experience these odours due to the lack of winds blowing in this direction.

Figure 7: Odour intensity buffers showing the extent of odours from the plant



Odour Intensity Scale

○ No data ○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 1 Extremely Strong

3 Conclusion

Five days of odour surveys were undertaken between 12 and 16 February 2024. In total, 42 timed 10-minute observations and 36 instantaneous observations were undertaken, with an average of 16 surveys (9 timed and 7 instantaneous) undertaken per day.

During this period, winds primarily came from the northwest, north and northeast directions, with wind speeds ranging between 0.3 m/s and 6.5 m/s. As the majority of the surveys were undertaken during these wind conditions, odours were able to be observed along Pikarere Street. No surveys were undertaken in rainy conditions.

Observations were taken upwind and downwind of PWWTP. As the winds predominantly blew from the northwest, downwind surveys were undertaken along Pikarere Street (between 350 m and 875 m downwind of the inlet works). Odours observed along Pikarere Street were typically associated with the PWWTP. Odours were generally stronger and consistently present at the bottom of the road by the gate, becoming less strong and fleeting as you move up the road towards the houses. This is to be expected given the prevailing northwesterly winds observed during the monitoring period.

There were occasional observations of odours associated with farming activities along Pikarere Street, however, they were fleeting and generally of a 'weak' intensity.

This round of odour monitoring coincides with late summer conditions, following the previous round of odour monitoring undertaken during early/mid summer conditions. AQCNZ considers summer conditions to be more conducive to observing off-site odour from the plant, due to higher ambient temperatures, lighter northerly winds and the potential for effluent to be less diluted due to lower rainfall. This round of monitoring experienced similar ambient temperatures and wind speeds on average to the previous round and provided favourable conditions for detecting WWTP odours.

AQCNZ notes that the vent stack fan was off during the monitoring period, due to prevailing northerly winds with a low wind speed, suggesting that this is not a source of odour detected off-site. Given that the vent fan was off, it is not possible to make any further recommendations, as part of this round of odour surveys, regarding the configuration of the fan control system.

H₂S concentrations measured in the milliscreen vent generally ranged between 5 and 25 ppm. A slight increase in concentrations was observed towards the late afternoon/evening period, however this does not appear to be significant or the likely cause of more frequent odours noted by residents during this period of the day. AQCNZ understands that the milliscreen vent fan was replaced in December after the previous round of odour monitoring. The increased airflow from this source is a potential cause of odour being more prominent during this round of odour surveys compared to odour observations undertaken in December.

The results from the February survey differ from those from the July/August and December 2023 surveys as these found limited odour associated with PWWTP along Pikarere Street while this round found that odour associated with PWWTP was prominent.

AQCNZ considers this to be a result of a combination of factors, such as surveys being undertaken in the afternoon and early evening experiencing late summer warmer conditions and the potential for increased odour discharged from the milliscreen vent.

Overall, AQCNZ considers that the odours associated with PWWTP that were detected along Pikarere Street during the time of the survey were occasionally of an intensity, frequency, or duration likely to cause odour nuisance effects if detected at a residential location.

AQCNZ understands that Veolia is currently investigating, as an interim measure, spraying an odour-neutralising solution into the milliscreen vent stack to reduce the odour potential from this source. This investigation is in addition to the current programme of improvement works for the plant which includes the design and construction of odour treatment systems. This project is currently in the concept design phase.

4 Closure

Please contact the undersigned if you have any questions regarding the above assessment.

Yours sincerely,

Lydia Stevens
Lydia Stevens
Odour Technician

Peter Stacey
Peter Stacey
BSc, GradDip(Bus), CASANZ CAQP
Managing Director
Phone: 021 614 842
Email: peter@airqualityconsulting.co.nz

5 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.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where this report indicates that information has been provided to Air Quality Consulting NZ Limited by third parties, Air Quality Consulting NZ Limited has made no independent verification of this information except as expressly stated in the report.

Air Quality Consulting NZ Limited assumes no liability for any inaccuracies in or omissions to that information.

This report was prepared in March 2024 and is based on the conditions encountered and information reviewed at the time of preparation. Air Quality Consulting NZ Limited disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners