

29 January 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  
– December 2023**

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**). This study was undertaken to satisfy the requirements of resource consent (No. WGN200229 [36727]) condition 8B, which requires seven days of independent odour surveys to be undertaken within three months of implementing the plant improvements specified by condition 8A.

The plant improvements implemented by WWL prior to the start of the monitoring study included the following:

- Installation of continuous H<sub>2</sub>S monitors in the discharge from the inlet tunnel vent and multiscreen building stack.
- Installation of a new weather station.
- Configuration of the operation of the inlet tunnel vent fan so that between 05:00 hours and 23:00 hours, it automatically turns off when the weather station measures northerly winds, between 315° to 45°, that are less than the wind speed trigger included in the Odour Management Plan (OMP) that is currently set to 3 m/s as a 1-hour average.

Following the completion of the survey, condition 8B requires a monitoring report to be provided to Greater Wellington Regional Council (GWRC), along with confirmation of the next steps, if any, that will be undertaken regarding the interim odour control conditions.

This odour survey follows an earlier baseline seven-day study undertaken by AQCNZ at Porirua WWTP prior to the above improvements during July and August 2023.

The following letter report sets out the methodology followed, and the findings of a seven-day odour survey undertaken at PWWTP between 6 and 12 December 2023. The letter report will then provide recommendations on any changes to the OMP based on the assessment findings.

# 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 seven (7) 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 Victoria<sup>1</sup>.

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).

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<sup>1</sup> EPA Victoria "Odour Surveillance Method Draft" December 2019

During a period of 7 days, the odour scout mapped the extent of the odour plume over the course of a normal business day (typically 7 am – 4 pm). This was achieved by taking multiple surveys - between three and four campaigns per day consisting of up to ten 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 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 – Wednesday, 06 December 2023, 11:00 to 16:40.
- Day 2 – Thursday, 07 December 2023, 07:30 to 12:00.
- Day 3 - Friday, 08 December 2023, 08:00 to 16:30.
- Day 4 - Saturday, 09 December 2023, 07:00 to 17:03.
- Day 5 - Sunday, 10 December 2023, 07:00 to 16:45.
- Day 6 - Monday, 11 December 2023, 07:30 to 16:40.
- Day 7 - Tuesday, 12 December 2023, 09:30 to 14:30.

During the monitoring study, the prevailing winds at Porirua were from the north, northwest, northeast or south, with limited winds from the west. 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**



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.

## 2 Odour Survey Results

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

### Day 1 - Wednesday 06 December 2023

#### Meteorological Conditions

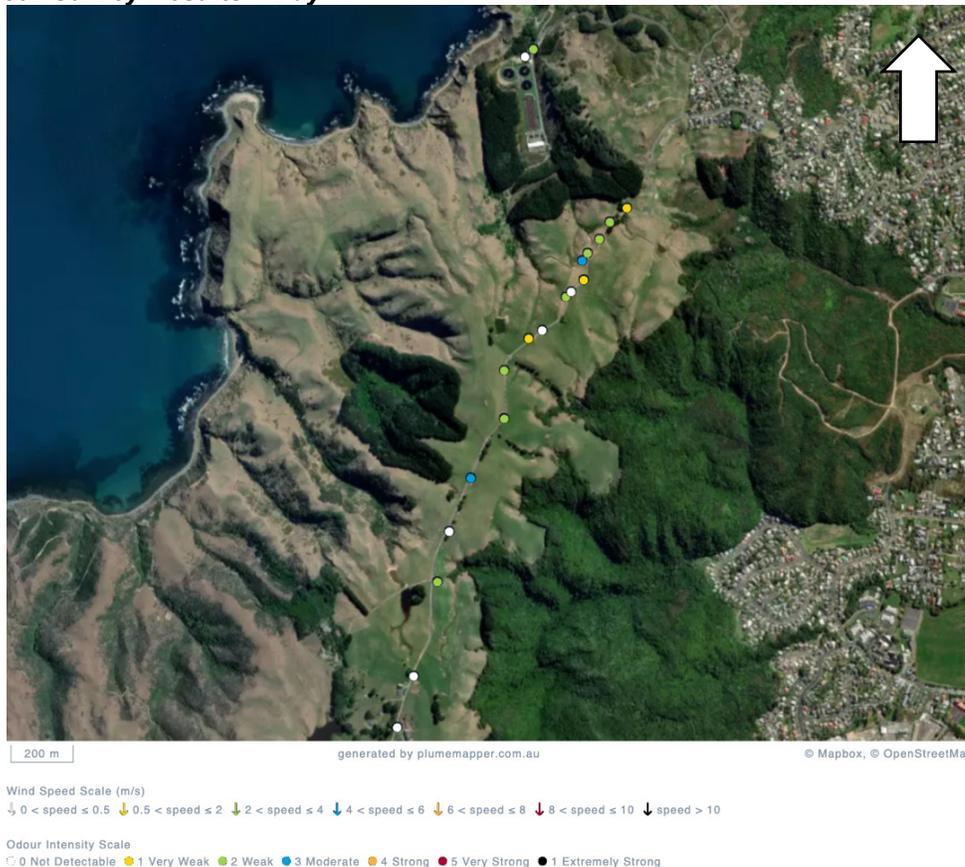
Odour observations were undertaken between 11:00 and 16:40. Winds primarily came from the northwest, and wind speeds ranged between 0.5 m/s and 5.1 m/s. It was dry throughout the day, and the ambient temperature ranged between 12°C and 20°C.

#### 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 throughout the day, with no significant odours present. Downwind odour observations were undertaken along Pikarere Street. The odours detected were of a character defined as 'grass' and 'animal/farm' at 'very weak' to 'weak' intensities for fleeting periods. General WTPP effluent odour was observed 13 times (individual sniffs) along Pikarere Street on this day. This odour also only reached a weak intensity for this character type.

**Figure 2: Odour Survey Results – Day 1**



## Day 2 - Thursday, 07 December 2023

### Meteorological Conditions

Odour observations were undertaken between 07:30 and 12:00. Throughout the monitoring period, the wind blew from the northwest with a wind speed ranging between 0.6 m/s and 2.4 m/s. The ambient temperature ranged between 14 and 21°C, and no rainfall was observed.

### 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 odours being present. Downwind odour observations were undertaken along Pikarere Street. Effluent odour was detected 49 times (individual sniffs) throughout the monitoring, 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.

**Figure 3: Odour Survey Results – Day 2**



Wind Speed Scale (m/s)

↓ 0 < speed ≤ 0.5   ↓ 0.5 < speed ≤ 2   ↓ 2 < speed ≤ 4   ↓ 4 < speed ≤ 6   ↓ 6 < speed ≤ 8   ↓ 8 < speed ≤ 10   ↓ speed > 10

Odour Intensity Scale

○ 0 Not Detectable   ● 1 Very Weak   ● 2 Weak   ● 3 Moderate   ● 4 Strong   ● 5 Very Strong   ● 1 Extremely Strong

### Day 3 - Friday, 08 December 2023

#### Meteorological Conditions

Odour observations were undertaken between 08:00 and 16:30. Throughout this day, the wind blew from the south and southwesterly wind directions, with wind speeds ranging between 0.5 m/s and 5 m/s. The ambient temperature was between 10 to 22 °C, with no rainfall observed.

#### 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 three times, one for each survey round, with no significant odours being present. Downwind odour observations were undertaken up to 25 m downwind of the plant boundary. WWTP odours at this location were irregularly detected between 12:15 and 12:31 pm for fleeting durations at a 'weak' and 'moderate' intensity.

Figure 4: Odour Survey Results – Day 3



100 m

generated by plumemapper.com.au

© Mapbox, © OpenStreetMap

Wind Speed Scale (m/s)

↓ 0 < speed ≤ 0.5   ↓ 0.5 < speed ≤ 2   ↓ 2 < speed ≤ 4   ↓ 4 < speed ≤ 6   ↓ 6 < speed ≤ 8   ↓ 8 < speed ≤ 10   ↓ speed > 10

Odour Intensity Scale

○ 0 Not Detectable   ● 1 Very Weak   ● 2 Weak   ● 3 Moderate   ● 4 Strong   ● 5 Very Strong   ● 1 Extremely Strong

## Day 4 - Saturday, 09 December 2023

### Meteorological Conditions

Odour observations were undertaken between 07:00 and 17:03. Throughout the monitoring period, the wind blew from the northwest with a wind speed ranging between 0.4 m/s and 5.6 m/s. The ambient temperature was between 10 and 19 °C, with no rainfall observed.

### 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 inlet works. Downwind odour observations were undertaken along Pikarere Street. The odours observed were described as 'grass', 'animal/farm', 'sewage' and 'effluent'. However, the odour intensity of these characters did not exceed 'weak' at any given time.

Figure 5: Odour Survey Results – Day 4



Wind Speed Scale (m/s)

↓ 0 < speed ≤ 0.5   ↓ 0.5 < speed ≤ 2   ↓ 2 < speed ≤ 4   ↓ 4 < speed ≤ 6   ↓ 6 < speed ≤ 8   ↓ 8 < speed ≤ 10   ↓ speed > 10

Odour Intensity Scale

○ 0 Not Detectable   ● 1 Very Weak   ● 2 Weak   ● 3 Moderate   ● 4 Strong   ● 5 Very Strong   ● 1 Extremely Strong

## Day 5 - Sunday, 10 December 2023

### Meteorological Conditions

Odour observations were undertaken between 07:00 and 16:45. In the early morning, winds blew from the northwest with wind speeds around 1.3 m/s. There were occasional droplets and full cloud coverage, which disappeared in the afternoon when the wind direction changed to a southeasterly with wind speeds between 1.9 m/s and 2.4 m/s. The ambient temperature ranged between 8 and 17 °C.

### 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.

An upwind odour observation was made at the start of the day when the winds blew from the northwest, with no odours present. Downwind odour observations were undertaken along Pikarere Street between 07:00 and 09:00, with no significant odours present.

In the afternoon, downwind odour observations were undertaken 200 m downwind of the WWTP. WWTP odours observed at these locations occasionally had a 'moderate' to 'strong' intensity. These odours were detected between 15:30 and 17:00. No odours associated with PWWTP were observed along Pikarere Street.

**Figure 6: Odour Survey Results – Day 5**



## Day 6 - Monday, 11 December 2023

### Meteorological Conditions

Odour observations were undertaken between 07:30 and 16:40. The wind mainly blew from the northwest, with occasional southeasterly winds in the early morning. The wind speed ranged between 0.1 m/s and 2.4 m/s. The ambient temperature ranged between 5 and 18 °C, with no rainfall observed.

### Odour Observations

Figure 7 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 three times throughout the day, with no odours being detected. Downwind odour observations were undertaken along Pikarere Street. Effluent odours associated with the WWTP were detected once along Pikarere Street 30 times (individual sniffs) fleetingly at a 'very weak' or 'weak' intensity. Other noticeable odours detected along Pikarere Street were 'weak' to 'moderate' intensity 'animal/farm' odours and 'weak' 'grass' odours.

Figure 7: Odour Survey Results – Day 6



Wind Speed Scale (m/s)

↓ 0 < speed ≤ 0.5   ↓ 0.5 < speed ≤ 2   ↓ 2 < speed ≤ 4   ↓ 4 < speed ≤ 6   ↓ 6 < speed ≤ 8   ↓ 8 < speed ≤ 10   ↓ speed > 10

Odour Intensity Scale

○ 0 Not Detectable   ● 1 Very Weak   ● 2 Weak   ● 3 Moderate   ● 4 Strong   ● 5 Very Strong   ● 1 Extremely Strong

## Day 7 - Tuesday, 12 December 2023

### Meteorological Conditions

Odour observations were undertaken between 09:30 and 14:30. The wind blew from north to northeast during the monitoring period with a wind speed between 0.7 m/s and 2.3 m/s. The ambient temperature was between 10 and 20 °C, with no rainfall during the observation period.

### Odour Observations

Figure 8 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 throughout the day, with no significant odours present. Downwind odour observations were undertaken along Pikarere Street. Effluent odour associated with the WWTP was detected only occasionally, never exceeding a 'weak' intensity. Other noticeable odours detected along Pikarere Street were 'very weak' or 'weak' intensity odours with a character described as 'grass' and 'animal/farm'.

Figure 8: Odour Survey Results – Day 7



Wind Speed Scale (m/s)

↓ 0 < speed ≤ 0.5 ↓ 0.5 < speed ≤ 2 ↓ 2 < speed ≤ 4 ↓ 4 < speed ≤ 6 ↓ 6 < speed ≤ 8 ↓ 8 < speed ≤ 10 ↓ speed > 10

Odour Intensity Scale

○ 0 Not Detectable ● 1 Very Weak ● 2 Weak ● 3 Moderate ● 4 Strong ● 5 Very Strong ● 6 Extremely Strong

### 3 Conclusion

Seven days of odour surveys were undertaken between 06 and 12 December 2023. In total, 95 timed 10-minute observations and 24 instantaneous observations were undertaken, with an average of 17 surveys (14 timed and 2 instantaneous) undertaken per day.

During this period, winds primarily came from the northwest, north and northeast directions, with wind speeds ranging between 0.1 m/s and 6 m/s. It was generally dry, with limited surveys undertaken while it was raining. The vast majority of surveys were undertaken while the wind was from the north/northwest, allowing odours along Pikarere Street to be observed.

Observations were taken upwind and downwind of PWWTP. Downwind surveys were undertaken within 200 m of the plant when winds blew from the south and along Pikarere Street (between 350 m and 875 m downwind of the inlet works) during northerly winds. Odours observed within 200 m of PWWTP had an intensity ranging between 'weak' and 'strong'. Odours observed along Pikarere Street were typically associated with farming activities. There were occasional observations of odours associated with PWWTP however, they were fleeting and generally of a 'weak' intensity.

This round of odour monitoring coincides with early summer conditions, which AQCNZ considers to be more conducive to observing off-site odour from the plant as compared to the previous round of odour monitoring undertaken during winter months. This round of monitoring experienced higher ambient temperatures on average and lower wind speeds, providing more favourable conditions for detecting WWTP odours.

The results from the December survey generally align with those from the July/August 2023 survey, which also found limited odour associated with PWWTP along Pikarere Street.

Overall, AQCNZ considers that the odours associated with PWWTP that were detected along Pikarere Street during the time of the survey were not of an intensity, frequency, or duration likely to cause odour nuisance effects.

Based on the results, there does not appear to be any reason to change the operation of the fan control system. However, AQCNZ makes the following observations/recomendations.

- The wind angle that the fan should turn off is specified by the consent to be between 315° and 45°, however, the system has been conservatively configured using a larger range of 270° and 90°. This means that the fan will be off more often than the consent requires it to be. AQCNZ recommends that the OMP is updated to reflect this more conservative configuration of the fan control system.
- The windspeed threshold for turning the fan off has been configured to be 3 m/s. However, this is based on a 10-minute average instead of an hourly average as specified by the OMP. This variation is unlikely to make a significant difference in the amount of time that the fan is operational, however, it is recommended that OMP is updated to reflect this change.

## 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**  
BSc, GradDip(Bus), CASANZ CAQP  
Managing Director  
Phone: 021 614 842  
Email: [peter@airqualityconsulting.co.nz](mailto:peter@airqualityconsulting.co.nz)

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