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Dear Joemar,

Wellington Water – Porirua Wastewater Treatment Plant - Odour Investigation Study – October 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 requested by WWL to help provide a better understanding of current off-site odours associated with the plant and to establish a baseline to assess future odour reduction improvements required by the resource consent (No. WGN200229 [36727]). AQCNZ understands the first stage of improvements is in the final stages of being implemented and that a second round of odour surveys will be required within the next three months to assess the improvement in off-site odour achieved by these changes.

The following letter report sets out the methodology followed and the findings of a seven-day odour survey undertaken at PWWTP during July and August 2023.

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 (79 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. 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[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 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 seven (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 WWTP could not be observed or locations where a significant odour was present, often observed when moving between monitoring locations.

[1] EPA Victoria "Odour Surveillance Method Draft" December 2019

Odour surveys were collected over the following days/times:

- Day 1 - Thursday 13 July 2023, 11:40 to 16:00
- Day 2 - Friday, 14 July 2023, 08:00 to 15:10
- Day 3 - Saturday, 15 July 2023, 08:00 to 15:20
- Day 4 - Monday, 28 August 2023, 09:00 to 15:00
- Day 5 - Tuesday, 29 August 2023, 07:00 to 15:30
- Day 6 - Wednesday, 30 August 2023, 07:00 to 16:00
- Day 7 - Thursday, 31 August 2023, 07:00 to 14:30

During the monitoring study, the prevailing winds at Porirua were from the north, northwest or south, with limited winds from the east or 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 - Thursday 13 July 2023

Meteorolgical conditions
Odour observations were undertaken between 11:40 and 16:00. Winds primarily came from the northwest, and wind speed ranged between 0.5 m/s and 10 m/s. It was dry throughout the day, and the ambient temperature ranged between 11°C and 15°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. No odours associated with PWWTP were observed along Pikarere Street.

Figure 2: Odour Survey Results – Day 1

Day 2 - Friday, 14 July 2023

Meteorolgical conditions

Odour observations were undertaken between 08:00 and 15:10. Throughout monitoring, the wind blew from the northwest with a wind speed ranging between 0.6 m/s and 6.8 m/s. The ambient temperature ranged between 14 and 16°C, with no rainfall 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 throughout the day, with no significant odours present. Downwind odour observations were undertaken up to 25 m downwind of the inlet works and along Pikarere Street. Sewage odours were detected 25 m downwind of the plant and were characterised as being from the inlet works. These odours had a 'strong', continuous intensity. Odours detected on Pikerere Street were described as having 'grass', 'animal/farm' and 'ocean' characters. No odours associated with PWWTP were observed along Pikarere Street.

Figure 3: Odour Survey Results – Day 2

Day 3 - Saturday, 15 July 2023

Meteorolgical conditions

Odour observations were undertaken between 08:00 and 15:20. In the early morning, the wind was blowing from the northeast, while throughout the rest of the monitoring period, the wind was blowing from the northwest with a wind speed ranging between 0.5 m/s and 6.8 m/s. The ambient temperature was between 4 to 16 °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 at the beginning of the day, with no odours being present. Downwind odour observations were undertaken along Pikarere Street. Sewage was irregularly detected between 10.40 and 15:20 for fleeting durations at a 'weak' intensity. These odour observations are shown as an insert to Figure 4**.** Other odours detected on Pikerere Street were described as having 'grass' or 'animal/farm' characters.

Figure 4: Odour Survey Results – Day 3

Day 4 - Monday, 28 August 2023

Meteorolgical conditions

Odour observations were undertaken between 09:00 and 15:00. Throughout the monitoring period, the wind blew from the southwest with a wind speed ranging between 0.6 m/s and 4.8 m/s. The ambient temperature was between 8 and 10 °C, with brief rain showers between 09:30 and 12:32, ranging from occasional droplets to light rain.

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 occurred at the beginning of the day, with sewage-type odours present within 50 m of the inlet works during periods of low wind speed (<1.5 m/s). The odour intensity ranged from ‘weak’ to ‘strong’.

Downwind odour observations were undertaken just past the plant's boundary towards the shoreline. ‘Weak’ sewage odours were detected within 50 m of the plant boundary. Grass-type odours were also briefly detected.

Figure 5: Odour Survey Results – Day 4

Day 5 - Tuesday, 29 August 2023

Meteorolgical conditions

Odour observations were undertaken between 07:00 and 15:30. The wind varied between north and northwest during the monitoring period, with the wind speed ranging between 0.6 m/s and 5.9 m/s. The ambient temperature ranged between 2 and 13 °C with no rainfall observed.

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 occurred at the start of the day, with no odours being present. Downwind odour observations were undertaken within 200 m of the intet works and along Pikarere Street. Inlet works type odours were detected within 200 m of the plant, ranging between weak (25 and 200 m from the plant) and moderate intensities closer to the plant (<25 m). Along Pikarere Street, weak animal/farm odours were detected. No odours associated with PWWTP were observed along Pikarere Street.

Figure 6: Odour Survey Results – Day 5

Day 6 - Wednesday, 30 August 2023

Meteorolgical conditions

Odour observations were undertaken between 07:00 and 16:00. The wind mainly blew from the northwest, with occasional northeasterly winds in the early morning. The wind speed ranged between 0.7 m/s and 8.6 m/s. The ambient temperature ranged between 1 and 13 °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 throughout the day, with no odours being detected. Downwind odour observations were undertaken within 200 m of the intet works and along Pikarere Street. Inlet work-type odours were detected within 200 m of the plant, ranging between weak (25 and 200 m from the plant) and moderate intensities closer to the plant (<25 m). Sewage-type odours were also detected once along Pikarere Street fleetingly at a '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

Day 7 - Thursday, 31 August 2023

Meteorolgical conditions

Odour observations were undertaken between 07:00 and 14:30. The wind blew from north to northwest during the monitoring period with a wind speed between 1.0 m/s and 8.9 m/s. The ambient temperature was between 10 and 14 °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 throughout the day, with no significant odours present. Downwind odour observations were undertaken within 200 m of the intet works and along Pikarere Street. Sewage odours were detected within 200 m of the inlet works, ranging from 'weak' to 'strong' intensities at locations closer to the plant (<25 m). Sewage odours were also detected once along Pikarere Street fleetingly with a 'weak' intensity. Other noticeable odours detected along Pikarere Street were 'weak' intensity odours with a character described as 'grass' and 'animal/farm'.

Figure 8: Odour Survey Results – Day 7

3 Conclusion

Seven days of odour observations were undertaken between 13 July and 31 August, split into two campaigns, 13 to 15 July and 28 to 31 August. In total, 136 timed 10-minute and 63 instantaneous surveys were undertaken, with an average of 28 surveys (19 timed and 9 instantaneous) undertaken per day.

During this period, winds primarily came from the northwest, north and northeast directions, with wind speeds ranging between 0.5 and 10 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. Upwind measurements were undertaken within 50 m of the plant. Downwind surveys were undertaken within 200 m of the plant and along Pikarere Street (between 350 m and 875 m downwind of the inlet works). 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 of a 'weak' intensity.

Overall, AQCNZ considers that the odours detected along Pikarere Street, associated with PWWTP, were not of an intensity, frequency or duration likely to cause odour nusiance effects. However, AQCNZ notes that this odour investigation study was undertaken during the winter months, which, due to wastewater being more dilute, lower ambient temperatures and wind conditions being more favourable at dispersing odour, there is a lower potential to experience off-site odour, when compared to summer months. The next monitoring round will likely coincide with late spring/early summer conditions, which are likely more conducive to observing off-site odour from the plant.

4 Closure

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

Yours sincerely,

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