Fulton Hogan Land Development Ltd

Milldale Stages 14 – 17
Wainui Road, Wainui

Technical assessment of discharges to air from proposed wastewater treatment plant

Report 26219
Report date 13/08/2026

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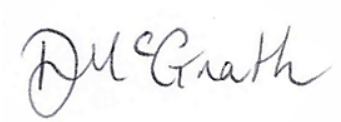

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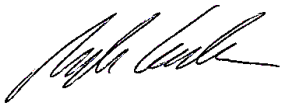

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Document History

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1	Draft	Sent for client review	16/06/2026
2	Draft	Updated based on client feedback	23/06/2026
3	Final	Updated to reflect preliminary design report and process details	13/08/2026

Statement of Qualifications and Experience

Dearbhla McGrath

I have been employed as an Air Quality Consultant at AML since April 2024. I hold a Master of Science Degree with Distinction in Environmental Engineering from Queen's University Belfast, completed in 2021.

I have four years' experience working in the air quality sector, with a focus on air quality and odour assessments that help with consent applications and ongoing compliance. My experience includes odour dispersion modelling (including CALPUFF and AERMOD), FIDOL assessments, odour surveys and the preparation of technical reports for resource consent applications including Assessments of Environmental Effects (AEE). I have supported multiple projects associated with wastewater-related odour including package wastewater treatment plants that operate within community settings.

I have completed a series of CASANZ professional development courses, most recently "Odour, An Introduction", and I regularly attend CASANZ presentations and technical sessions to maintain current knowledge of relevant guidance and good practice.

While this is not an Environment Court proceeding, we confirm that we have prepared this assessment in accordance with the applicable professional and ethical obligations of my profession and that the opinions expressed are within our area of expertise.

Nigel Goodhue

I am a Principal Air Quality Consultant at Air Matters Limited (AML). AML is a consultancy specialising in assessing the effects of activities on air quality for the protection of human health and the environment. I have been employed at AML since June 2022.

My highest qualification is a Master of Science Degree with First Class Honours from the University of Waikato which I gained in 2007. I am a member of the Clean Air Society of Australia and New Zealand (CASANZ).

I have over 10 years direct experience in assessing, managing & consenting air quality. During my employment at AML my experience has included reporting of air quality assessments for a wide range of industrial processes including the effects of odour from municipal wastewater treatment plants.

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Terms and Abbreviations

Terms & Abbreviations	Explanation
AAQG	Ambient Air Quality Guidelines (MfE)
AEE	Assessment of Environmental Effects
AML	Air Matters Ltd
AUP	Operative Auckland Unitary Plan
FIDOL	Frequency, Intensity, Duration, Offensiveness & Location A qualitative approach to evaluate the likelihood of odour giving rise to 'offensive or objectionable odour effects'
GPG	Good Practice Guide for Assessing Discharges to Air from Industry / for Atmospheric Dispersion Modelling
MfE	Ministry for the Environment (2016)
NESAQ	National Environmental Standards for Air Quality Regulations (2004)
NIWA	National Institute of Water and Atmospheric Research
RMA	Resource Management Act 1991

1. Introduction

AML has been engaged by Fulton Hogan Land Development Limited (FHLD) (herein referred to as 'the Applicant') to undertake a technical assessment of discharges to air from a proposed Wastewater Treatment Plant (WWTP) associated with the Milldale Stages 14-17 project (Milldale North). This report will be prepared to support the substantive application under the Fast-Track Approvals Act 2024 (FTAA).

Apex Water Ltd is currently engaged by the developer to design the WWTP. The application seeks approvals necessary to facilitate the staged development of the Project, including a suite of resource consents required under the FTAA framework. The substantive application is supported by a comprehensive set of technical assessments and plans addressing the environmental, servicing and infrastructure matters associated with the proposal. This report should be read alongside the Planning Report and the appended technical reports and drawings lodged in support of the whole application.

1.1 Overview of the proposed development

The site comprises approximately 231 hectares centred around Wainui Road in Wainui, Auckland. The site is located to the north of the existing and consented Milldale development, extending further north towards Upper Orewa Road.

The proposal includes provision for a small commercial area, transport infrastructure, servicing and stormwater infrastructure, subdivision, earthworks, stream works, and neighbourhood parks. To the north of the Ōrewa River/Awa, the project includes a large-scale ecological restoration area, including walking and cycling trails to enhance recreation and amenity.

The Milldale development is a 300-hectare master planned project which started in 2014 to accommodate 4,500 new dwellings. To allow for the completion of the final stages, Apex Water has been engaged to design a WWTP located on the northern side of the development, capable of servicing up to 1,425 dwellings plus one small commercial lot across a range of housing typologies and densities ('Milldale North').

A small parcel of land to the north of the subdivision has been designated by the applicant for the proposed WWTP. This parcel is located within the proposed ecological restoration area.

2. Site Location and Environmental Setting

2.1 Site Location

The site comprises approximately 231 ha of land held across various records of title at Milldale, Wainui. The site is located to the north of the existing and consented Milldale development, extending towards Upper Orewa Road as well as to the northeast and east, as outlined in red in Figure 2-1. The Silverdale residential subdivision is located approximately 500 m east of the site boundary, intercepted by the Northern motorway.

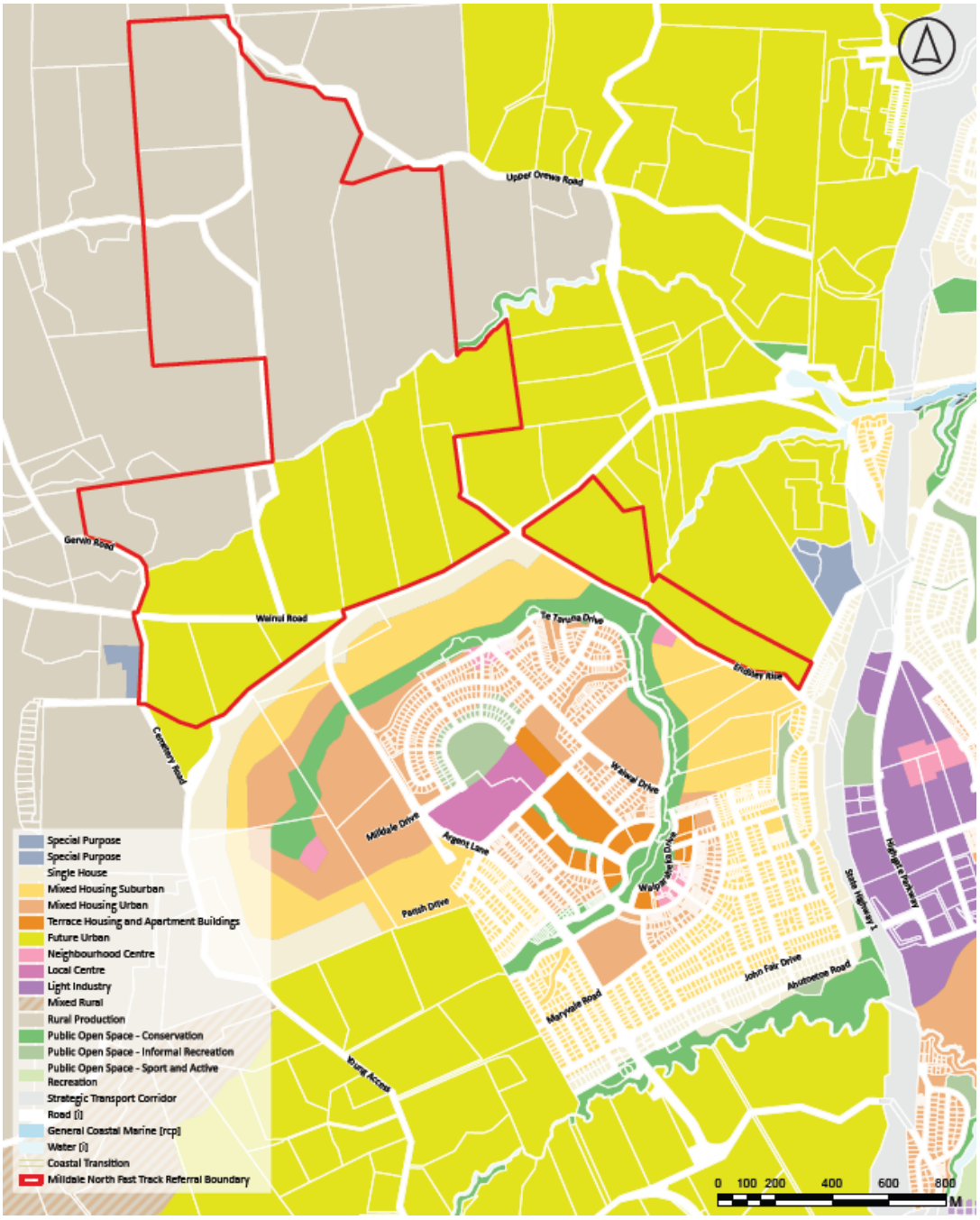


Figure 2-1: Site area and Auckland Unitary Plan (AUP) zones

There is existing water, stormwater and wastewater infrastructure surrounding the site as a result of the extensive development within previous Milldale Stages. However, the site itself is not currently serviced in terms of supply and infrastructure.

With respect to the surrounding area, the development of Milldale Stages 1 to 5 is now complete, with civil works on Stage 6 well underway. Stages 7 and 9 are currently under construction, as is the Town Centre. As at late 2024, more than 1,220 homes had been constructed in Milldale, with a further 960 currently enabled by the consented subdivision.

Within Milldale, the Ahutoetoe Primary School is now open (as are two pre-schools), and a Summerset retirement village is operating. Outside of the Milldale development, the site is surrounded by multiple rural residential properties.

2.2 Topography

The land to be developed for residential purposes is located to the south of the Ōrewa Awa and is within the Future Urban Zone under the Auckland Unitary Plan (AUP). Generally, the topography of the development area is defined by low rolling hills and pasture. The proposed WWTP site is situated within an open, low-lying basin, bordered by gently sloping terrain and areas of dense vegetation with mature trees to the west, north, and east. Freshwater features across the development area include several streams, natural wetlands, constructed ponds and artificial drains.

North of the Ōrewa Awa is existing farmland which is zoned Rural Production under the AUP. This area is proposed as the ecological restoration area and will also be proposed for the WWTP and water treatment plants. This area of the site contains undulating slopes with several streams and natural wetlands and is predominantly covered in managed pasture. Outside of the pasture, several pine plantations, exotic vegetation and gorse scrub are present. Relatively large areas of native vegetation are also present on the site, including within a Significant Ecological Area – Terrestrial Overlay in the north-west portion.

Further detail regarding the site, surrounding environment and planning framework is provided within the Planning Report and technical reports appended to the application.

2.3 Meteorology

Auckland has a subtropical climate. Spring tends to be the windiest season across the region, with strong gusts especially common in exposed coastal locations. In contrast, summer and autumn typically see the highest number of light wind days. During the cooler spring and winter months, south-westerly winds are most prevalent, while northeasterly winds are more frequent in summer[1].

Air quality effects and local meteorology are discussed further in Section 6.

[1] NIWA – The Climate and Weather of Auckland (2013)

3. Proposed WWTP location and design

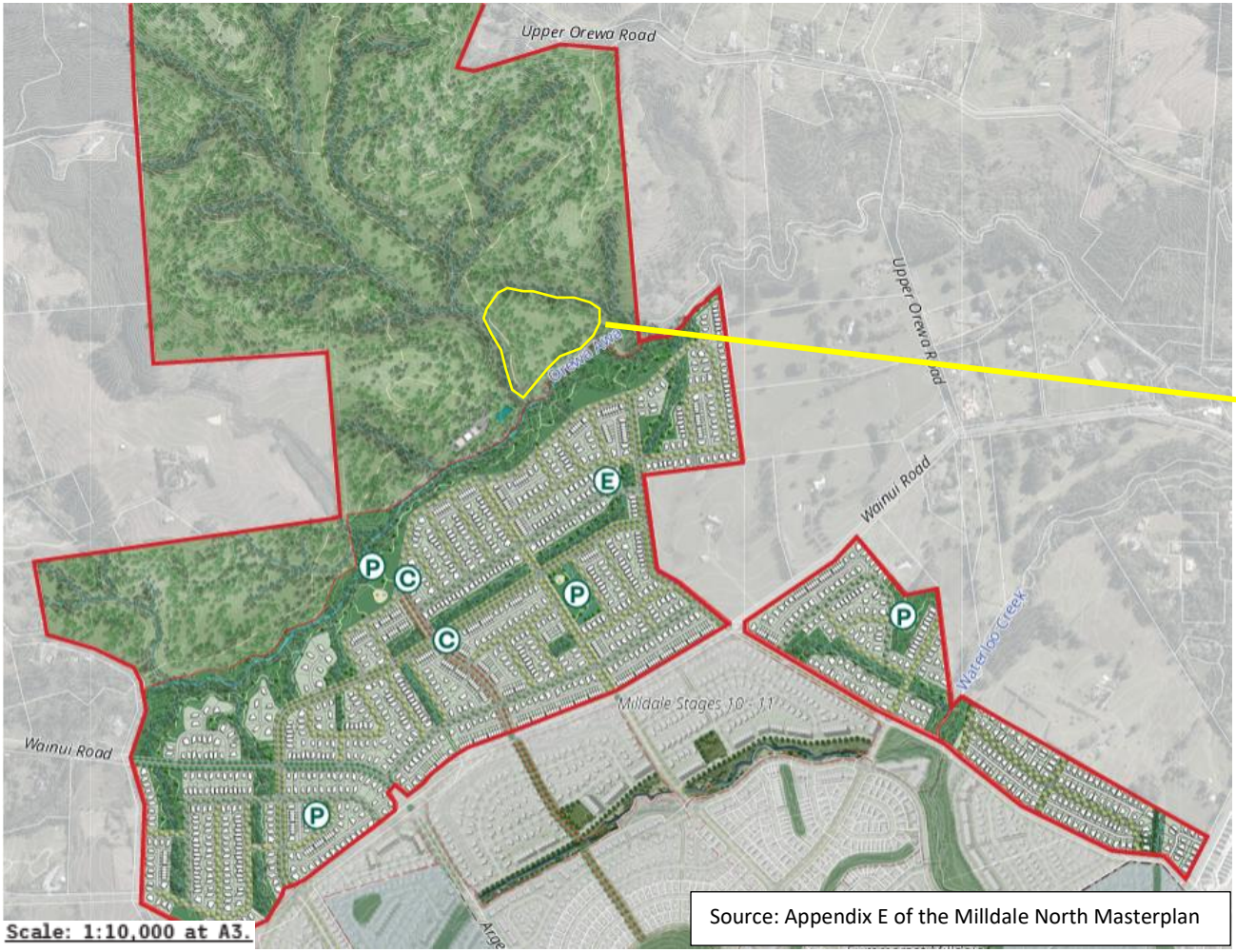
A full description of the proposal is provided in the Planning Report. Technical reports and drawings appended to the substantive application should be read in conjunction with this report.

Apex Water Ltd has been engaged to design a Wastewater Treatment Plant, capable of servicing up to 1,425 dwellings plus one small commercial lot. A need was identified for a new Water Treatment Plant (WTP) capable of meeting a peak demand of 1,300 m^3/day, and a new Wastewater Treatment Plant (WWTP) capable of treating a peak wastewater production of 780 m^3/day.

The proposed WWTP will employ a hybrid biological nutrient removal system, combining advanced processes to produce exceptionally high-quality permeate. The treatment train will include a four-stage Bardenpho activated sludge process, a Membrane Aerated Biofilm Reactor (MABR), and hollow-fibre ultrafiltration membranes. Once fully established, this system is designed to treat wastewater to an extremely high standard, producing permeate of a quality among the highest achieved by any WWTP in New Zealand[2].

Figure 3-1 below provides the provisional location and layout of the WWTP. A more detailed layout of the proposed site layout can be found in the Preliminary Design Report (Revision 3) by Apex Water Ltd.

[2] Apex Water Ltd - Preliminary Design Report - Fulton Hogan Land Development -Water and Wastewater Treatment for Consenting - August 2026 Revision 3 – 12/08/26



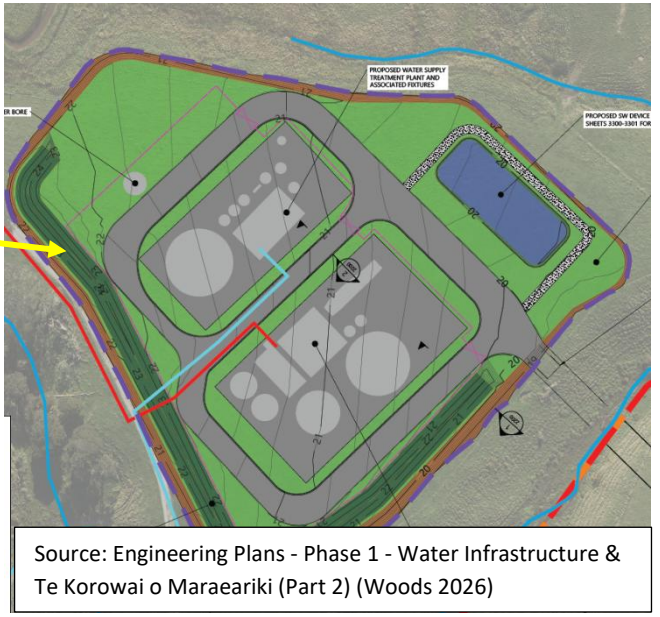


Figure 3-1: WWTP location and layout

4. Consent requirements

4.1 Auckland Unitary Plan (AUP)

Table E14.4.1 (Rule A163) of the AUP states that treatment of municipal wastewater (municipal wastewater treatment plants) is a Discretionary Activity in all air quality areas.

The proposed WWTP is designed to accept and treat municipal wastewater from a new subdivision. As such the emissions to air, including odour, is a **Discretionary** Activity.

Table E14.4.1 (Rule A48) of the AUP states that emergency generators used for the purpose of generating electricity for premises during mains power unavailability (includes operation for the purpose of generator testing and maintenance) is a Permitted Activity.

The site will include an emergency generator in accordance with Rule 48 and as such is a **Permitted** Activity.

All activities listed as **permitted** in Table E14.4.1 Activity table must also comply with the following general standards and specific standards where applicable:

E14.6.1.1 General Standards

1) The discharge must not cause, or be likely to cause, adverse effects on human health, property or ecosystems beyond the boundary of the premises where the activity takes place
2) The discharge must not cause noxious, dangerous, offensive or objectionable odour, dust, particulate, smoke or ash beyond the boundary of the premises where the activity takes place.
3) There must be no dangerous, offensive or objectionable visible emissions.
4) There must be no spray drift or overspray beyond the boundary of the premises where the activity takes place.

No other Rules in the AUP Chapter 14 Air Quality relate to the emissions to air from the operation of the WWTP.

4.2 National Environmental Standards

4.2.1 *National Environmental Standards for Air Quality Regulations 2004*

In 2004, five standards for ambient (outdoor) air quality were introduced in New Zealand under the Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and Other Toxics) Regulations 2004 (NESAQ).

The NESAQ includes specific provisions relating to a consent authorities' ability to grant resource consents for discharges to air of PM_{10} (Regulation 17) and other contaminants (Regulations 20 and 21).

Regulation 17 (PM_{10}) is not relevant to the applicant's site as it is not located in a polluted Airshed and the operation of the WWTP is not likely to generate PM_{10} emissions. Regulation 20 of the NESAQ applies to the discharge of carbon monoxide, oxides of nitrogen, and volatile organic compounds (VOCs). Regulation 20 sets

out that an application must be declined if it is likely to cause the concentration of carbon monoxide, oxides of nitrogen or volatile organic compounds in the Airshed to breach its ambient air quality standard and is likely to be a principal source of that gas in the Airshed. Regulation 21 applies to the discharge of sulphur dioxide and states that an application must be declined if it is likely to cause the concentration of sulphide dioxide in the Airshed to breach its ambient air quality standards.

The operation of the onsite emergency generator will generate carbon monoxide and oxides of nitrogen emissions. However, the ambient air quality standards will not be exceeded as a result of its operation. The discharges to air from the WWTP are expected to contain negligible concentrations of SO2 and VOCs.

Therefore, the NESAQ does not restrict the granting of this consent for discharges to air.

4.2.2 *National Environmental Standards for Greenhouse Gas Emissions from Industrial Process Heat Regulations 2023*

On 27 July 2023 National Environmental Standard for Greenhouse Gas Emissions from Industrial Process Heat ('Greenhouse NES') and the associated National Policy Statement ('Greenhouse NPS') were introduced for fossil fuel burning equipment that produces industrial process heat. The objective is to reduce emissions of Greenhouse Gases (GHG) in order to mitigate climate change and its current and future adverse effects on the environment and the wellbeing of people and communities. The Greenhouse NES outlines the activity status of a GHG emission dependent on the type of fossil fuel used and annual volume of GHG's emitted.

With regards to the proposed WWTP the only potential GHG emissions from the combustion of fossil fuel will be from a diesel-fired back-up electricity generation device. Backup heat devices are specifically excluded from the regulations (Section 10(1)b) and therefore the Greenhouse NES does not need to be considered as part of this assessment.

5. Discharges to air

5.1 Introduction

The primary discharge to air from the wastewater treatment process will be odour. WWTP odours have the potential to be generated from the decomposition of organic material (e.g. carbohydrates, fats and proteins) present in the wastewater. High levels of odour may be generated when wastewater (or sludge) becomes oxygen depleted and anaerobic (septic) conditions become present. During anaerobic conditions, highly odorous compounds such as hydrogen sulphide (H_2S) are generated.

Odour generated by processing of wastewater will be made up of a complex range of organic compounds that are able to be detected by human olfaction (sense of smell). Health effects from individual compounds can occur if in elevated concentrations (for example H_2S), however based on Air Matters experience with WWTPs, concentrations of any compounds will be low and not result in any direct potential health effects. Consequently, this assessment is limited to the effects of odour from the proposed WWTP which are described in more detail in Section 7.

Dust may also be generated during the construction of the WWTP resulting in nuisance (soiling) or health-related effects (finer dust). The level of dust generated is unlikely to be significantly different from that generated during the wider Milldale development. Furthermore, standard dust mitigations in place during the construction should limit the potential effects. As such, dust generation from the construction or on-going operation of the WWTP have not been considered in this assessment.

5.2 Odour generation and mitigation

There are a number of potential odour-generating sources from the WWTP that are summarised below along with a description of the proposed mitigation methods. Information in Table 5-1 and the flow progress diagram in Figure 5-1 has been provided in the Preliminary Design Report (Revision 3) by Apex Water Ltd.

Table 5-1: Odour-generating potential and mitigations for the proposed WWTP

Process	Potential to generate odour	Process details	Mitigation and controls
Headwork Screening (and grit removal)	High	Potential of the raw sewage and screenings in this system to release offensive odours due to anaerobic decomposition in the conveyancing network feeding the plant.	The system (including screening bins) is fully enclosed and connected to the odour extraction network. The main site odour extraction network maintains a negative pressure on the headworks system that ensures any odour is captured and transferred to the odour control unit for treatment prior to discharge. Uncontrolled odour emission should be negligible during normal operations. Overloading of the screens and unplanned outages, which increase the release of odour, will be managed by having a second set of screens on standby.
Influent Balance Tank	High	Receives raw sewage therefore tank level is constantly changing	The Balance Tank will be covered and the air from the headspace of this tank will be ducted to a carbon scrubber for odour treatment before being released to the environment. Uncontrolled odour emission should be negligible during normal operations.
Pre-Anoxic Tank (with MABR Modules)	Low	Raw screened sewage is fed into this tank	Continuously recycle flow from the aeration tank, providing large quantities of nitrate-rich water, and preventing anaerobic conditions from developing. The Oxidation- Reduction potential of the contents of this tank are continuously monitored which allows the contents to be monitored to ensure the generation of anaerobic conditions do not occur.

Process	Potential to generate odour	Process details	Mitigation and controls
Aeration (aerobic) Tank	Moderate	Anaerobic conditions from overloading or aeration equipment failure can generate offensive odour. Not inherently odorous provided that aerobic conditions are maintained.	The aeration tanks are fitted with fine bubble diffusers to efficiently transfer oxygen from the air into the water. By maintaining a positive level of dissolved oxygen in the aeration tank, odour emissions are minimised meaning that this tank does not need to be covered. Blowers, which supply air, will have a backup emergency power supply. Standby blowers available onsite.
Post-Anoxic Tank	Low	Anaerobic conditions from overloading or aeration equipment failure can generate offensive odour.	Continuous supply of nitrate to this anoxic tank, combined with its very short hydraulic residence times prevents anaerobic conditions from developing.
MBR Tank	Low	Anaerobic conditions from overloading or aeration equipment failure can generate elevated odour.	The membranes in these tanks are continuously cleaned by scouring with air. The contents of this tank have already had almost all dissolved contaminants (e.g. organic load and nutrients) removed by previous steps in the process. Therefore, the membrane tanks have a high concentration of dissolved oxygen in them. These factors combine to mitigate the risk of the membrane tanks generating offensive odours.
UV Disinfection	Low	Positive dissolved oxygen concentrations and low organic content at this point in the process as most remaining bacteria or viruses are deactivated through exposure to ultraviolet light	The process is located in an enclosed building.
Permeate Storage Tank	Low	Stores fully treated, disinfected effluent prior to discharge.	High water clarity and elevated dissolved oxygen concentrations eliminate potential for offensive odours.

Process	Potential to generate odour	Process details	Mitigation and controls
Waste Activated Sludge (WAS) Dewatering and Storage	High	Contains sludge which is transferred to dedicated storage tank where it thickens prior to mechanical dewatering. Sludge has a high risk of releasing elevated odour.	The WAS tanks are fully enclosed and connected to the odour extraction and treatment network. The WAS is aerated to maintain conditions which mitigate the formation of offensive odours. The sludge dewatering plant is fully enclosed and connected directly to the odour removal and treatment system. It is also housed in a building separately connected to the odour extraction and treatment network.
UV Disinfection	Low	Positive dissolved oxygen concentrations and low organic content at this point in the process.	The process is located in an enclosed building.
Discharge to wetland	Low	The wastewater will have low odour potential (i.e. positive dissolved oxygen concentrations and low organic content) and be distributed into the ground quickly.	N/A

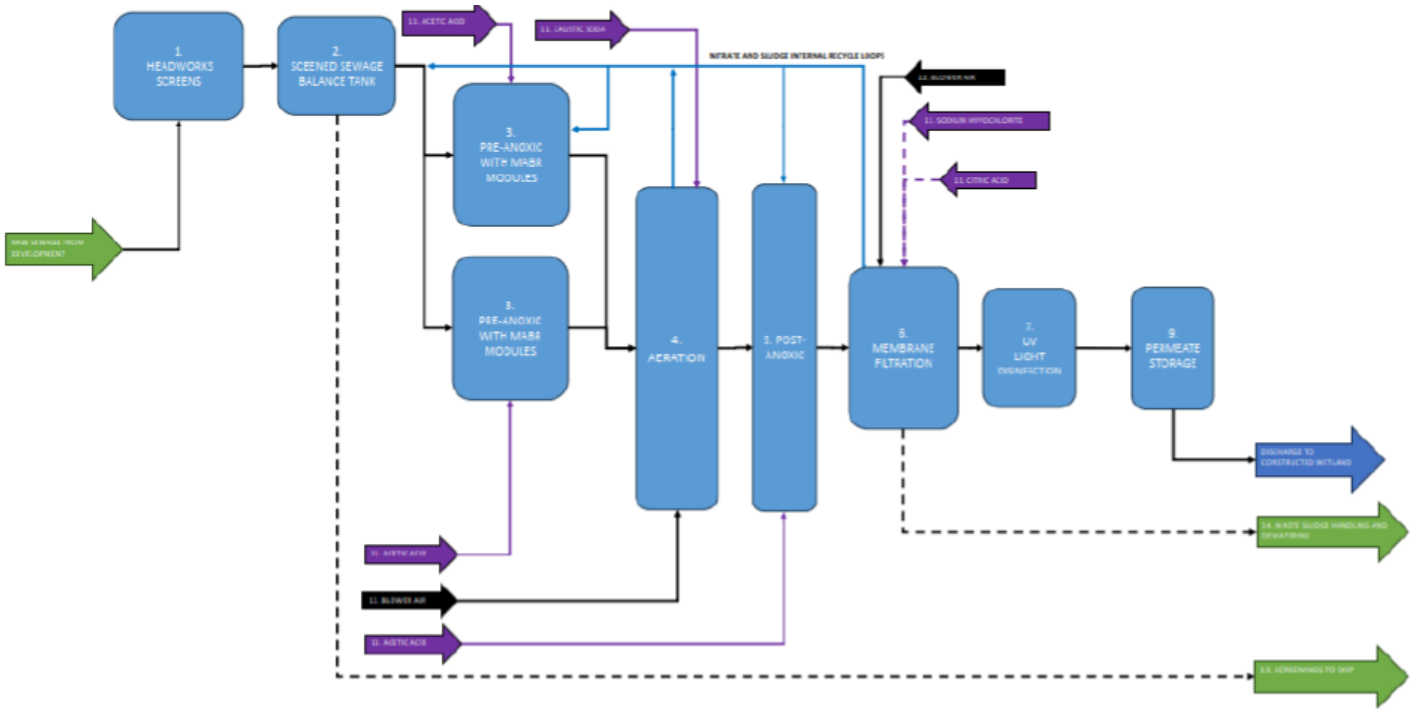


Figure 5-1: Proposed WWTP process flow diagram

5.3 Mitigation summary

Mitigations employed to minimise the release of odour at the proposed WWTP are described in Table 5-1 and in summary include: ensuring aerobic/anoxic conditions are maintained through the process; process monitoring of key chemical/biological variables including oxygen levels; redundancy of key equipment on site; robust equipment maintenance and, extraction and treatment of potentially odorous air through the odour treatment system.

5.4 Odour Control Unit

The formation of offensive odours within the wastewater network feeding into the treatment plant cannot be fully controlled, necessitating the installation of infrastructure designed to capture and treat these potential odours. An odour control system is employed to eliminate or neutralise offensive odours and other contaminants extracted from the facility. Air collected from enclosed spaces, such as those housing equipment or liquids with the potential to generate offensive odours will be directed to the odour control system as outlined in Table 5-1. These enclosed spaces are maintained under negative pressure, ensuring that any fugitive odours are extracted and transported to the odour control unit.

5.5 Carbon absorption beds

Milldale North WWTP will have a carbon scrubber which uses an activated carbon pallet bed. Odour-causing compounds are adsorbed onto the activated carbon pallets and thereby removed from the air stream. The carbon pallets can also be doped with sodium hydroxide, which significantly increases the ability of the carbon to remove and neutralise acidic gasses, such as hydrogen sulphide from sewage and sludge.

The volume of carbon will be designed to ensure that the airflow velocity through the bed is minimised to maximise odour absorption. Given the sensitivity of the receiving environment, it should be designed to ensure as high removal rates as practical. As moisture can interfere with absorption preheating of the extracted air flow will occur to reduce humidity levels.

The carbon media will become saturated overtime. Consequently, the media bed will require periodic changes prior to reaching saturation. The WWTP operator will undertake regular testing of the bed saturation.

5.6 Acetic Acid tank

AML carried out an odour survey at Meremere WWTP for Watercare in the Waikato District. The findings highlighted that the Acetic Acid tank was a consistent source of low intensity odour at a distance of up to 45 m. AML also carried out an odour survey at Karaka WWTP which is currently serving the Karaka North Village development. It is of similar design and layout as the WWTP proposed for this assessment. No odour was detected for 85% of the survey. Odour from the acetic tanks on site was detected 6.7% of the time out to approximately 30 m from the site boundary and the intensity was described as very weak to weak. Further detail on the odour surveys is provided in Section 7.2.2 and Appendix A.

For the Milldale North WWTP, Apex Water is proposing to direct the acetic acid tank overflow through a lute pot (a water seal) and place a carbon filter on the vent to remove any generated odours.

6. Air quality effects on the existing environment

As in all areas of New Zealand the specific prevailing and strong wind direction in any locality is determined largely by local terrain. As noted in Section 2.2, the terrain of the site and surrounding areas is generally flat with gentle inclines east and west of the site. Air quality effects, particularly odour, can be exacerbated during certain meteorological conditions. In order to assess the potential air quality effects, it is important to understand local meteorology.

For this assessment, Air Matters obtained computer simulated data from MetService for a location near Dairy Flat approximately 6 km south of the Milldale North development (latitude 36.65669, longitude 174.64411). This data covered a three-year period (2022 – 2024). The MetService model combines historical observations into national model predications.

Figure 6-1 (A) below displays a wind rose of this data, which demonstrates the following characteristics:

- The most predominant winds are from the southwest 23.2% of the time, followed by the west (19.4%) and northeast (14.9%).
- The strongest winds (≥ 5 m/s) occur from the southwest (6%) followed by the northeast (5.5%).
- The lightest winds (0.5 – 3 m/s) occur from the southwest (9.9%) and west (8.6%).
- Calm winds (<0.5 m/s) were reported < 0.5% of the time.
- These predominant wind directions are consistent with previous wind patterns reported for northern regions of Auckland (NIWA, 2013).

To confirm the suitability of the computer simulated data, they were compared to observed data from a meteorological station located on the Whangaparāoa peninsula (latitude -36.6026842, longitude 174.834581625), approximately 18 km northeast of the site. This dataset was also provided by MetService and covers two full years (2020-2021) and is displayed in Figure 6-1 (B).

The similarity in dominant wind directions and speed distributions indicates that the modelled dataset is suitably representative for use in this assessment. The stronger wind speeds in the Whangaparāoa observations are reflective of the exposed coastal location of the meteorological station positioned on the peninsula. Based on this review Air Matters considers the Dairy Flat meteorological data appropriate for use in this assessment.

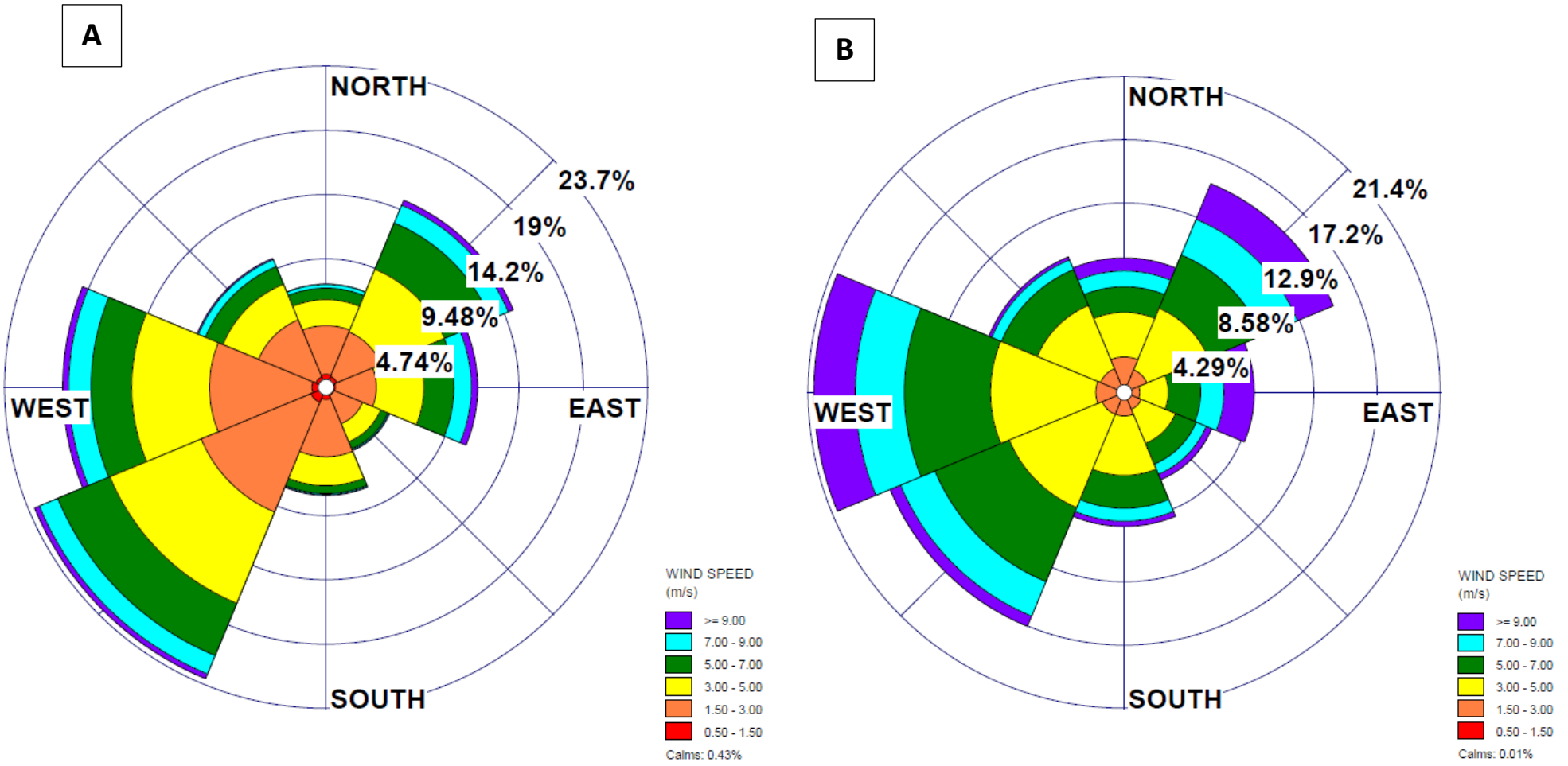


Figure 6-1: A) Wind rose for the site area in Dairy Flat using computer simulated data (2022 – 2024) and (B) Wind rose for Whangaparāoa Peninsula using measured data (2020 – 2021)

Low wind speeds can result in reduced dispersion and exacerbate the effects of odour. The WWTP will be located in a proposed ecological reserve to the north of the subdivision. The surrounding rolling hills have the potential to create air drainage ('down valley flows') during evening periods on calm nights. Due to the limited scale of the valley (height and fetch) these drainage winds are expected to be very limited and the overarching regional winds are likely to be the dominant influence.

6.1 Background Air Quality

To understand the existing air quality in the area surrounding the Milldale North WWTP, Air Matters has completed a desktop study using available information and supplemented this with a site visit to review surrounding land use activities.

With the exception of the already consented Milldale WWTP and proposed Delamore WWTP which is awaiting a consent decision, there are no other known consented air discharges within a two km radius of the proposed WWTP site. Cumulative effects from both these WWWTP have been conservatively assessed as part of the existing consented environment in Section 6.1.1 below.

Service stations and fast-food restaurants are located within 1 km of the proposed WWTP within the Silverdale area. Given the separation distances, emissions from these sites are unlikely to impact on the same areas as the proposed WWTP.

When construction of the initial development to the south of the WWTP is underway (south of the Ōrewa Awa), large scale civil works and construction of residential houses is expected. These activities are likely to generate elevated levels of dust emissions, but limited potential for odour.

Existing surrounding land use, outside of the project area (including the ecological reserve), to the north, east and southwest of the development is rural. Rural activities include a dairy farm and horse stables. Typical rural odours are likely common but intermittent including stock, silage, burn-offs and fertiliser spreading.

Wainui Valley mushroom farm, located at 911 Weraimui Road, cultivates, harvests and sells fresh mushrooms and products. The farm has potential to cause odour particularly from anaerobic conditions during composting which can produce offensive odours (rotten, decay and sulphur smells)[3]. Separation distances (discussed further in Section 7.2.1) are used to manage the effects of unintended or accidental discharge of odour from sites such as mushroom farms to offsite receptors e.g. residential dwellings. Standard industry separation distances recommended a separation distance of 500 – 1,000 m for mushroom farms using on-site blended soils or compost (Western Australia EPA 2005) and 1,000 m from active composting areas producing >200 tonnes/year (South Australia EPA 2023).

The mushroom farm is located over 2,000 m from the closest boundary of proposed Milldale North development (Stage 14A) which is considered an appropriate distance to mitigate any significant

[3] The Pennsylvania State University (2008) College of Agricultural Sciences - *Mushroom Substrate Preparation Odor-Management Plan*

additive effects of odour from the proposed WWTP. While light northerly winds could potentially carry odours toward the new development, these conditions are highly infrequent, occurring just 4.6% of the year (equivalent to roughly 17 days). Consequently, the risk of cumulative odour impact is considered low.

In summary the area surrounding the site is expected to have good air quality, characterised by rural odours and possibly occasional dust from construction of the residential development at times. Given the expansion of the wider Milldale area into urban areas, it is likely that odour associated with rural activities will decrease as more residential development occurs.

6.1.1 *Cumulative odour effects*

Consideration has been given to the potential cumulative odour effects of the proposed Milldale North WWTP in conjunction with two nearby WWTPs:

- The consented but currently non-operational Milldale WWTP located on Lysnar Road approximately 1.3 km to the southeast (Figure 6-2 below). This WWTP is associated with the original Milldale subdivision which will treat wastewater from up to 1,200 residential houses.
- The proposed Delmore WWTP currently undergoing the consent process (1.4 km to the northeast of Milldale North). The council decision date for the Delmore WWTP is currently 12 August 2026. While the Delmore WWTP consent has not yet been formally granted, it has been conservatively assessed as part of the consented environment for the purposes of this assessment.

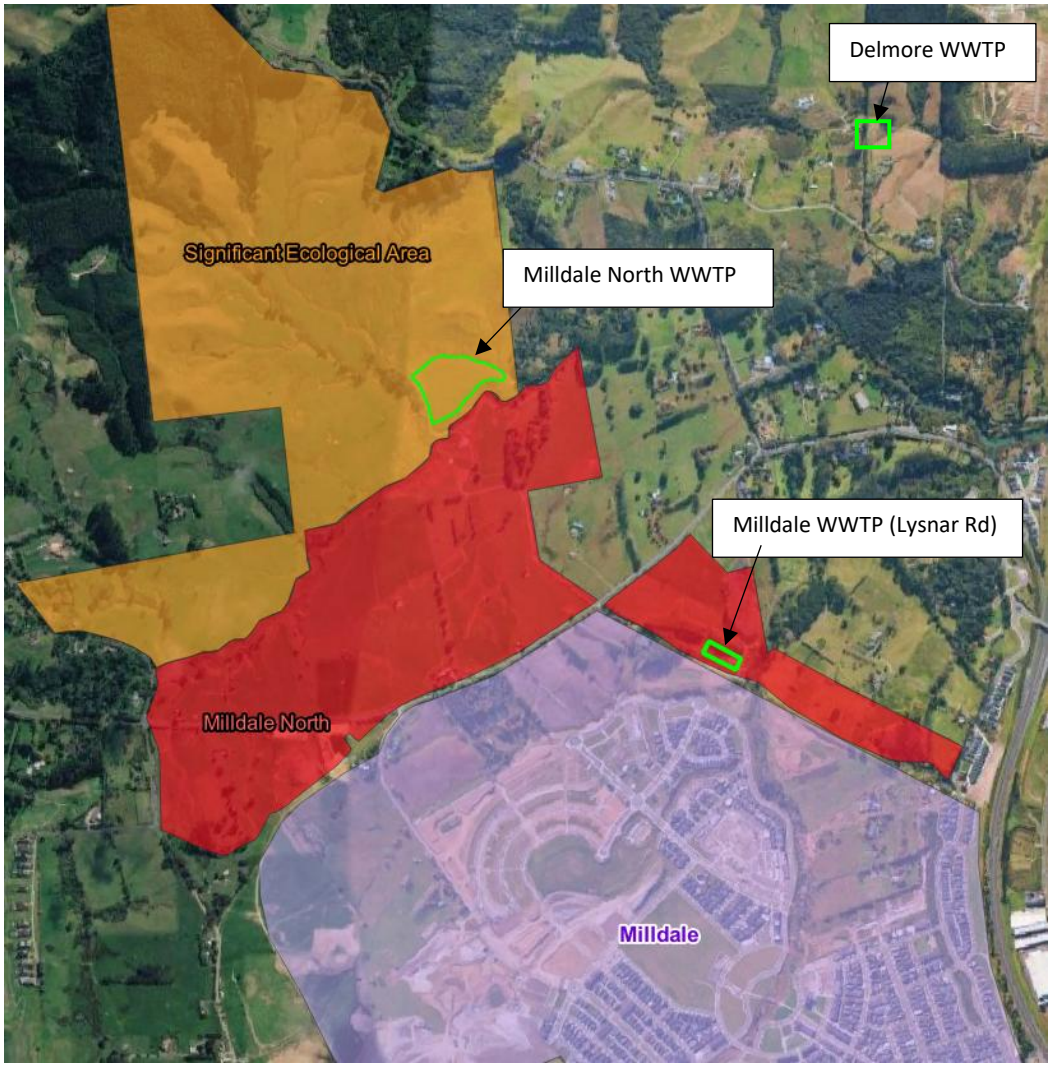


Figure 6-2: Milldale North and Milldale (Lysnar Road) WWTPs

As noted in Section 2.1, a portion of the proposed Milldale North subdivision extends to the northeast and east of the existing Milldale development. Consequently, certain proposed residential dwellings within this Milldale North subdivision will be situated in closer physical proximity to the already consented Milldale WWTP located on Lysnar Road (not currently operational). For the purposes of this assessment, these specific receptors are evaluated solely in relation to the potential effects of the proposed Milldale North WWTP. As these dwellings were not part of the earlier development plans when the existing WWTP was consented, they were not included in the Assessment of Environmental Effects for Milldale subdivision (Air Matters report 24464).

Due to the close proximity of the three WWTPs and associated residential subdivisions, a high standard of odour mitigation is required. It is expected that some sensitive receptors in the Milldale North development and Milldale development will be equal distances from the two or more of the WWTPs. Due to the wind directions and separations distances, no individual receptors are expected to be impacted by an odour generated from all three WWTPs.

In addition, it is noted that an increase in concentration, i.e. the operation of all three WWTPs simultaneously does not necessarily mean an increase in the odour intensity at receptor locations. This is due to the fact that the perception of the intensity of odour in relation to the odour concentration is not linear. If the concentration of an odour, such as H_2S, increases ten-fold, the perceived increase in intensity is expected to be much smaller, i.e. a two-fold increase[4]. The staging of the Milldale and Milldale North WWTPs is further addressed within the Planning Report.

6.2 Sensitives Activities (receptors)

When assessing air discharges, the sensitivity of the environment must be taken into account and should be considered as part of any odour assessment. When assessing air discharges, sensitivity is based on characteristics of the land use, including the time of day and the reason people are at the particular location. Other factors that may determine whether an offensive or objectionable effect from an odour emission is likely to occur are the presence of background odours (Section 6.1 above), aspects influencing perception, and the mental and physical state of the affected person.

Ministry for the Environment (MfE) (2016) guideline recommends the use of district planning maps as these zones are based on controlling adverse effects on amenity, which aligns with odour effects.

Typical activities that have a high sensitivity to odours include (MfE, 2016):

- Residential properties (including rural residential);
- Hospitals, schools, childcare facilities, rest homes and marae;
- Public outdoor locations (e.g. parks, reserves, sports fields, beaches).
- Tourist, cultural, conservation
- Some commercial and retail businesses

Figure 6-3 and Table 6-1 illustrate the identified sensitive receptors surrounding the WWTP. This is based on zoning from the Auckland Unitary Plan along with specific high-sensitivity activities within low sensitive zones (dwellings in rural zoned areas) within close proximity of the WWTP.

Receptors located within 200 m of the WWTP are highlighted in red. The importance of this is discussed further in Section 7.2.1.

Table 6-1: Receptors sensitive to potential odour effects surrounding the WWTP

Receptor ID	Address	Description /Zoning	Approximate distance* and direction from proposed WWTP
Existing Receptors (not part of Milldale North development)			
E1	163 Upper Orewa Road	Residential Dwelling in Rural Production Zone	585 m North

[4] BOPRC (2012) A review of odour properties of H2S - Odour Threshold Investigation.

Receptor ID	Address	Description /Zoning	Approximate distance* and direction from proposed WWTP
E2	159 Upper Orewa Road	Residential Dwelling in Rural Production Zone	540 m North
E3	117 Upper Orewa Road	Residential Dwelling in Rural Production Zone	515 m Northeast
E4	105A Upper Orewa Road	Residential Dwelling in Rural Production Zone	600 m Northeast
E5	85 Upper Orewa Road	Residential Dwelling in Rural Production Zone	700 m Northeast
E6	37 Upper Orewa Road	Residential Dwelling in Future Urban Zone	525 m East
E7	29 Upper Orewa Road	Residential Dwelling in Future Urban Zone	460 m East
E8	406 Wainui Road	Residential Dwelling in Future Urban Zone	680 m Southeast
E9	Fantails Childcare 411 Wainui Road	Childcare in Future Urban Zone	725 m Southeast
E10	427 Wainui Road	Residential Dwelling in Future Urban Zone	760 m Southeast
E11	440 Wainui Road	Residential Dwelling in Future Urban Zone	520 m Southeast
E12	462 Wainui Road	Residential Dwelling in Future Urban Zone	450 m Southeast
E13	64 Gervin Road	Residential Dwelling in Rural Production Zone	750 m Southeast
E14	168A Gervin Road	Residential Dwelling in Rural Production Zone	1 km, West
E15	166 Gervin Road	Residential Dwelling in Rural Production Zone	1.2 km Northwest
E16	171 Gervin Road	Residential Dwelling in Rural Production Zone	1.2 km Northwest
E17	186 Gervin Road	Residential Dwelling in Rural Production Zone	930 m Northwest
Proposed receptors (within the Milldale North development)			
R14_A	Milldale North	Currently Future Urban Zone (presumed to be	**180 m Southeast**
R14_B			**140 m South**
R14_E			280 m Southwest

Receptor ID	Address	Description /Zoning	Approximate distance* and direction from proposed WWTP
R14_H		rezoned Residential for proposed development)	600 m Southwest
R14_C&F			470 m South
R14_D&G			610 m Southeast
R16_B			725 m Southeast

E = Existing receptors

R14 = Milldale North proposed receptors for Stage 14

*Distance taken from WWTP border (indicative) to existing and proposed receptors

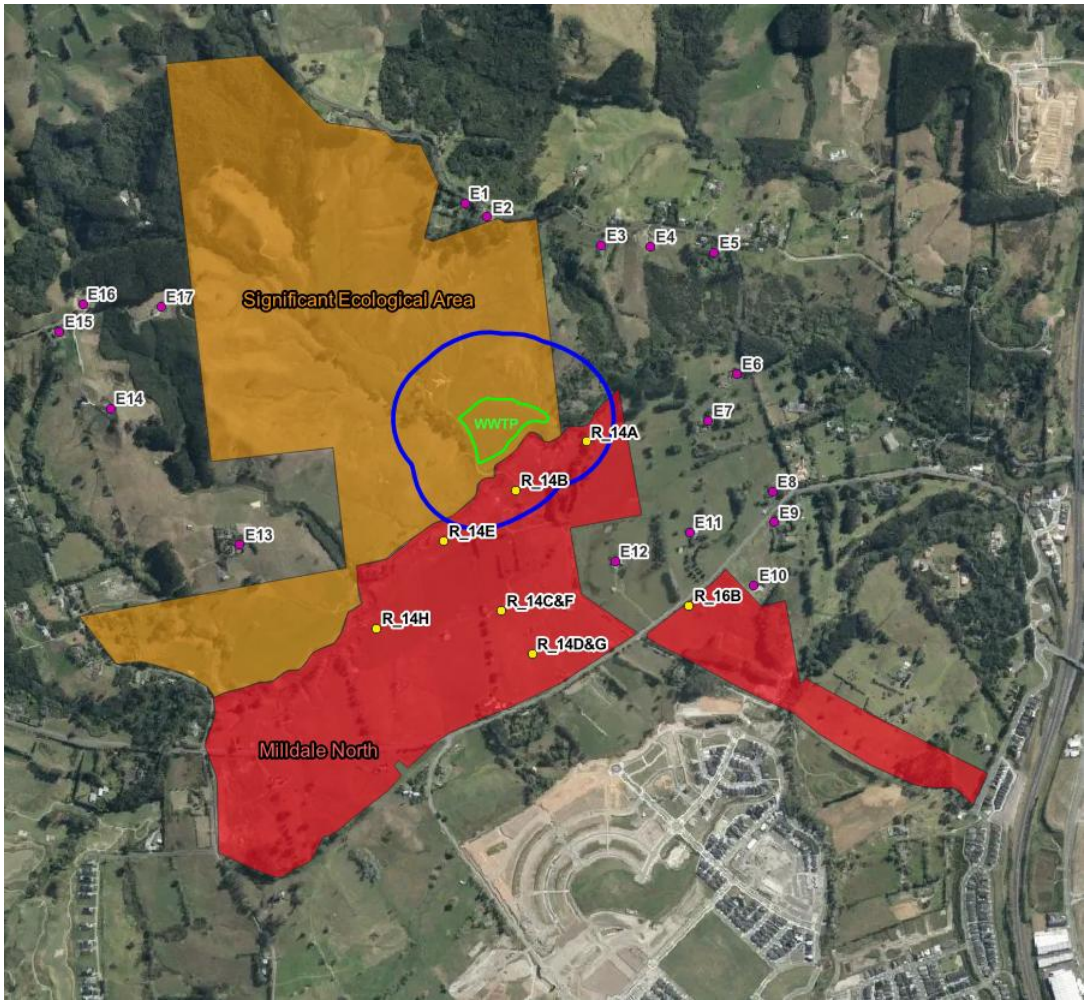


Figure 6-3: Sensitive receptor locations relative to the WWTP boundary (outlined in green) and the 200 m buffer (outlined in blue)

Receptors R14_A and R14_B have been identified as a Sensitive Receptors located within 200 m of the proposed WWTP site. This subdivision is of residential nature and is also considered sensitive to the effects of odour in accordance with the MfE-Industry GPG (2016).

7. Assessment of Effects

7.1 Potential effects of odour

Odour is perceived by our brains in response to chemicals present in the air we breathe. Humans have a sensitive sense of smell and can detect odour even when chemicals are present in very, very low concentrations. Given that odour is a human perception, it is extremely difficult to measure an odour using a chemical, mechanical or electronic apparatus as is possible for other nuisance effects such as noise and light. At present, assessment by human nose is the most reliable method for determining an odour (MfE, 2016). In the context of undertaking an assessment, odour can be described in two ways:

- Acute - high-intensity and/or highly unpleasant odours occurring infrequently or for short periods (a few minutes to an hour);
- Chronic - low-intensity and/or moderately unpleasant odours occurring frequently or continuously over a long period.

The concept of acute and chronic odour is discussed throughout this assessment.

People have reported effects of odour that include nausea, headaches, retching, difficulty breathing, frustration, annoyance, depression, stress, tearfulness, reduced appetite, being woken in the night, and embarrassment. All of these can contribute to a reduced quality of life for the individuals who are exposed to the odour. People can develop physiological effects from odour even when their exposure is much lower than that typically required to cause direct health effects. This effect is sometimes termed 'odour worry' and is due to effects brought on by stress or the perception that if there is a smell it must be doing physical harm (MfE, 2016).

7.2 Screening level assessment

7.2.1 *Separation distance*

The initial screening assessment is based on the separation distance between sensitive receptors and the proposed WWTP. By having a suitable separation distance, odour emissions can be dispersed and diluted to such an extent that their effects at sensitive locations are minimised to an acceptable level.

Separation distance guidelines are not intended to be used as a pass/fail test, rather as a trigger for more detailed assessment for a particular site. MfE (2016) notes that relevant separation distances should be considered when assessing odorous discharges to air to address unintended or accidental releases, and/or effects that cannot be internalised even with adoption of the best practicable option. Site specific factors which may influence discharge rates and how they are dispersed, for example terrain, are not taken into account in separation distances.

Environment Protection Authority Victoria publishes a 'recommended separation distances for industrial residual air emissions' (EPA Victoria, 2024). In New Zealand these guidelines have been extensively used and are accepted as appropriate separation distances.

Environment Protection Authority Victoria publishes a 'recommended separation distances for industrial residual air emissions' (EPA Victoria, 2024). In New Zealand these guidelines have been extensively used and are accepted as appropriate separation distances.

In accordance with the EPA Victoria (2024) guidelines, a separation distance of 160 m from the WWTP to sensitive receptors would be applicable in this instance based on a mechanical/biological wastewater plant serving a population of 4,275 residents[5]. To provide a buffer for the proposed WWTP, a screening level separation distance of 200 m has been adopted.

Separation distances have been calculated based on the distance to a neighbouring dwelling (as opposed to the property boundary). This is referred to as Method 2 'the rural method' in EPA Victoria (2013) and is appropriate for this assessment where some properties are on rural / lifestyle blocks. The extent of the 200 m buffer is detailed in Figure 6-1 above (blue outline).

Taking into account the location of sensitive receptors as described in Table 6-1, Sensitive Receptor R_14 A & B are within 200 m of the proposed WWTP (highlighted in red in Table 6-1).

- **Location 14 _A** represents a number of potential dwellings as part of Milldale North development (Stage 14A). The total number of dwellings represented by Receptor 14_A is not currently defined but based on the preliminary design is estimated to be 100 houses, 20 of which are with the 200 m separation area.
- **Location 14 _B** also represents a number of potential dwellings as part of Milldale North developments (Stage 14B). The total number of dwellings represented by Receptor 14_B (not currently defined) is approximately 150 houses, 20 of which are with the 200 m separation area.

7.2.2 *Comparable WWTPs*

APEX have designed and commissioned multiple WWTP of similar design and capacity as that proposed for Milldale. AML visited the Meremere WWTP (commissioned in 2022) which receives and treats municipal wastewater from the township of Meremere. Air Matters undertook an odour survey at the Meremere WWTP on 16 January 2025 with the aim of the survey to ascertain the potential for odour to be generated. The Meremere WWTP does not include the capture and treatment of odour laden air from the inlet screening/storage or WAS dewatering/storage.

The survey findings (Appendix A) concluded that odour associated with the inlet screening/WAS and acidic acid storage was detectable at a distance of 45 m from the WWTP. The intensity of the odour at 45 m was described as 'weak' and the frequency was intermittent (in accordance with the MfE 2016 guidance).

AML also visited Karaka North Village Water & Wastewater Treatment Plant on May 1 2026, to characterise the odour, its sources and the intensity at various downwind locations from the WWTP.

[5] Based on 1,425 dwellings with an average occupancy of three persons.

The WWTP is currently operational, capable of supporting 400 neighbouring properties connected to the wastewater network, however is not yet operating at full capacity.

Similar to the proposed WWTP for Milldale North, the Karaka wastewater treatment process involves raw sewage screening, feed balancing in an anoxic stage, an aerobic stage, a second anoxic stage, MBR filtration and UV disinfection. An odour control unit using carbon scrubber technology is also installed.

Odour scouting and a survey at a downwind location (approximately 30 m from the site boundary) was carried out. No odour was detected for 85% of the survey. Odour from the anoxic tank (characterised as acetic acid to provide a carbon source for nitrogen removal) was detected 6.7% of the time out to approximately 30 m from the site boundary. The intensity was described as very weak to weak and the frequency was intermittent.

A copy of the odour survey reports can be found in Appendix A.

Based on the results from both surveys, it is recommended that for the proposed Milldale WWTP:

- The inlet screening/storage and WAS dewatering/solids storage should include active capture and treatment of air to minimise the release of odour (as is currently proposed - refer Section 5.2);
- Mitigations should be put in place to minimise the generation of odour from the acetic acid tank (as is currently proposed - refer Section 5.3 – 5.6).

7.3 FIDOL Assessment

In New Zealand a recognised qualitative approach to evaluate the likelihood of odour giving rise to 'offensive or objectionable odour effects' is based on an evaluation of the FIDOL factors. The FIDOL factors are described in the MfE GPG-Odour (2016) and in summary are:

Table 7-1: FIDOL assessment factors (MfE, 2016)

Factor	Description
Frequency	How often an individual is exposed to the odour
Intensity	The strength of the odour
Duration	The length of exposure
Offensiveness	The character relates to the 'hedonic tone' of the odour, which may be pleasant, neutral or unpleasant
Location	The type of land use and nature of human activities in the vicinity of an odour source

These factors have been applied to the potential odour emissions from the proposed WWTP and discussed in the section below. As noted above, locations within 200 m buffer are the primary focus of the FIDOL assessment, however other locations outside of this zone are also discussed where relevant.

Frequency relates to how often odours will be experienced at a receptor. The frequency at which odour could be detected at a receptor will be a combination of the occurrence of the odour emission and certain meteorological conditions, such as wind direction and speed.

Worst-case dispersion conditions for odour emitted from any WWTP typically occur during low wind speed (<1.5 m/s) and highly stable atmospheric conditions. A threshold of 1.5 meters per second (~5 km/h) is often employed, however given the potential underestimate of calmer periods from the computer simulated meteorology of Dairy Flat and the influence of Whangaparāoa observed winds, Air Matters considers an increased threshold (3 m/s) is more appropriate for this assessment to define 'low wind speeds'.

Based on the meteorological data presented in Section 6, light winds (≤3 m/s) capable of transporting odour towards a receptor, account for approximately 44.6% of all winds (equivalent to approximately 163 days in a year). A wind frequency analysis is provided in the table below along with the identification of the higher risk sensitive receptors located within 200 m of the proposed WWTP.

Wind frequency analysis (Dairy Flat computer simulated data)

Direction	% of time (all wind speeds)	% of time (low wind speeds <3 m/s)	Sensitive Receptors in downwind direction within 200m
N	7.6%	4.6%	R14_B
NE	14.9%	4.4%	-
E	11.2%	3.7%	-
SE	5.1%	2.9%	-
S	8.0%	5.1%	-
SW	23.2%	9.9%	-
W	19.4%	8.6%	R14_A
NW	10.3%	5.4%	R14_A & R14_B
TOTAL	99.6%	44.6	-

Frequency

Receptor 14_A is located to the southeast of the WWTP therefore winds from the west and north-west have the potential to result in odorous emissions from the proposed WWTP being dispersed onto residential dwellings at this location.

Receptor 14_B is located to the south of the WWTP therefore winds from the north and north-west have the potential to result in odorous emissions from the proposed WWTP being dispersed here.

The maximum percentage of time wind could carry odour from the WWTP towards an individual dwelling at Receptor R14_A is 19.4% (all wind conditions) and 8.6% (low wind speeds). R_14A represents a number of dwellings (~20) as discussed in Section 7.2.1 and therefore these percentages are based on the maximum frequency that any individual dwelling may experience an odour and not the cumulative[6] effects of all wind directions towards R14_A.

The maximum percentage of time wind could carry odour from the WWTP towards an individual dwelling at Receptor R14_B is 10.3% (all wind conditions) and 5.4% (low wind speeds). These percentages are also based on the maximum frequency that any individual dwelling may experience an odour and not the cumulative[7] effects of all wind directions towards R14_B.

Based on the design of the replacement WWTP, odours that would be capable of being offensive at the boundary are not expected to be emitted under normal operations. Potentially higher odour emitting events will be limited to infrequent upset and abnormal operations (acute events) which are discussed in more detail in the following sections 'Intensity' and 'Duration'. To support this, the odour survey carried out at the equivalent Meremere only identified wastewater odours at a maximum distance of 45 m from the WWTP relating to the inlet screening/WAS storage which is proposed to be fully mitigated via air extraction and treatment at the Milldale North development. The odour survey at Karaka only detected weak to very weak odours from the anoxic tank (acetic acid) which were intermittent in nature. No wastewater odours were detected.

The expected absence of chronic odour and rare occurrence of acute odour generating events at the WWTP will limit the potential for offsite odour at Sensitive Receptors. Frequency of any odour events, will be further limited by wind conditions towards high-risk sensitive locations as discussed above (which occur for a combined maximum of 18.9% of the time).

Intensity

The intensity of odour at sensitive receptors depends on emission strength (concentration) at the source and the separation distance between the source and receptors. Odour associated with the operation of a WWTP can have a strong intensity. For the proposed WWTP under normal operations it is expected that odour would have no discernible intensity at the identified sensitive receptors based on the small scale of the plant and the extensive mitigation methods deployed.

Abnormal acute discharges, if to occur, would be a cause of increased odour intensity, for example if wastewater were to turn anaerobic following WWTP failure. Abnormal discharges that result in unacceptable odours, are not expected to occur based on the mitigations in place as described in Section 5.

The odour survey carried out at the Meremere WWTP (Appendix A) only identified weak wastewater odours out to 45 m from the WWTP relating to the inlet screening/WAS storage which is proposed to be fully mitigated via air extraction and treatment at the Milldale development. The odour survey from the Karaka WWTP did not detect any wastewater odours.

The proposed WWTP has the potential to create elevated intensity odours under abnormal conditions, however these are not expected to occur based on the employed mitigations.

[6] When taking into account all wind directions that may blow towards any receptor at location R14_A the cumulative percentage increases to 29.7% (all wind speeds) and 14% (low wind speeds).

[7] When taking into account all wind directions that may blow towards any receptor at location R14_B the cumulative percentage increases to 17.9% (all wind speeds) and 10% (low wind speeds).

Duration	The duration that a receptor may be exposed to odour depends on the amount of time the wind blows in a specific direction, along with the duration that the odorous activity occurs. Duration of wind is covered above and, in summary, acute or chronic odour from the WWTP activities could affect high risk sensitive receptors for up to 18.9% of the time. WWTPs may have extended and more consistent elevated odour during plant failures and emergency situations. During these upset or unanticipated events, the increased odour may last for periods of hours to days. However, based on the mitigations employed including the ability to stop receiving wastewater (refer Section 5) the duration of any upset or abnormal conditions will be very low. The duration of rare odour-generating events during upset or abnormal conditions has the potential to last for periods of hours to days. Duration of the effects on nearby sensitive receptors will be further limited by the wind direction.
Offensiveness	As described in Section 5.1, odour associated with the processing of wastewater has an elevated potential to be offensive at sensitive locations.
Location	Location is possibly the most important of the factors, due to the fact that even if odours are generated there is little potential for effect if there are no sensitive receptors located downwind of the source. The proposed sensitive receptors located within proximity of the WWTP that may be affected by odours (if present) are R14_A & B, representing a combined 40 dwellings within 200 m of the WWTP. The location in relation to sensitive receptors to all other directions is suitable.
Summary	Taking into account the Offensiveness and Location, Air Matters considers that odours from the WWTP have the potential to result in offensive or objectionable effects at sensitive locations R14_A & B. This conclusion is based on the characteristics of typical WWTP odours and the reduced separation distance to residential dwellings to the east through south. The frequency, intensity and duration of emitted odour is expected to be very low based on the design of the proposed WWTP and employed mitigation measures. Based on this, the potential odour experienced at any sensitive receptors is considered to be acceptable. The WWTP design will incorporate best practical options (BPO) for minimising the generation of acute high intensity odour events. A focus on meeting BPO should continue throughout the detailed WWTP design phases.

8. Conclusion

The proposed WWTP is intended to service up to 1,425 residential dwellings as part of the Milldale North development. The WWTP is designed to accept raw effluent from a residential subdivision and treat it to a high standard before being discharged.

The proposed WWTP is based on a 4-stage Bardenpho (with membrane aerated biofilm reactor) treatment principle and includes primary, secondary and tertiary treatment stages. Mitigations to minimise odour will include ensuring aerobic/anoxic conditions are maintained, process monitoring of key chemical/biological variables including oxygen levels, redundancy of key equipment on site, robust equipment maintenance and, extraction and treatment of potentially odorous air through the odour treatment system. Based on the proposed mitigations the treatment plant is considered to meet the best practical option for eliminating and minimising odour.

A screening level assessment that considered the appropriate separation distances and the type of surrounding land use was undertaken. This assessment identified two representative sensitive receptors to the south and southeast of the WWTP that could be affected by odours if they cannot be effectively controlled at their source. These identified receptors are in Stages 14A and 14B of the proposed Milldale North residential development representing approximately 40 dwellings within the 200 m of the WWTP location.

A detailed FIDOL assessment, in accordance with the MfE GPG-Odour, was undertaken focusing on the identified sensitive receptors within 200 m of the WWTP location. In summary, it was identified that during times of odour generation these receptors could experience an elevated exposure to odour due to their position to the prevailing wind direction and small separation distance. However based on the modern plant design and odour mitigations employed, the generation of odour from the WWTP, beyond the site boundary, is not expected to occur. This is supported, subject to the proposed mitigations, by odour surveys of the Meremere and Karaka WWTPs.

During abnormal or upset conditions WWTPs can generate elevated acute odour. Based on the design of the plant including the employed redundancies these chronic higher-intensity odours are not expected to occur.

Based on this assessment and the design of the WWTP, the potential effects on amenity values on the surrounding land use are considered to be acceptable and remain less than minor for the duration of the consent. Section 9 outlines a set of recommended consent conditions to ensure any effects can continue to be controlled to an acceptable level.

9. Recommended Consent Conditions

Limit Conditions: Air Discharges

1. All processes associated with the wastewater treatment plant (WWTP) must be operated, maintained, supervised, monitored and controlled in accordance with the Air Quality Management Plan certified in accordance with Condition [X] to ensure that all emissions authorised by this consent are maintained at the minimum practicable level.
2. Discharges of contaminants into air from the WWTP must not cause:
   a) Odours that are noxious, dangerous, offensive or objectionable effect beyond the boundary of the Site, in the opinion of an enforcement officer.
   b) Visible emissions (other than water vapour/steam or heat haze) that cause a dangerous, offensive or objectionable effect, in the opinion of an enforcement officer.

Advice Note: Air discharge limits

Condition 2 is to be assessed by suitably trained council enforcement officers in accordance with the procedures outlined in the Good Practice Guides for Odour (Ministry for the Environment, 2016), including consideration of the FIDOL factors (frequency, intensity, duration, offensiveness and location) for amenity effects (dust, odour and visible emissions).

Process Conditions

3. Within one month of the WWTP commencing treatment, the Consent Holder must provide to the Council a report from an appropriately qualified person, which verifies that the design and installation of the wastewater treatment plant and odour control system (including the odour extraction and treatment system) is in accordance with Conditions 1, 2 and 4.
4. Air discharges from the solids screening and storage and sludge dewatering and storage must be extracted to an emission control system (including an activated carbon scrubber) and discharged from a stack at least 3 m above ground level or the apex height of the nearest building within 20 meters, without obstruction of the vertical discharge of air.

Monitoring and Reporting conditions

5. Within 3 months of exercising this resource consent, The consent holder shall:

a) Operate and maintain a weather station on the site to measure and record the air temperature, wind direction and wind velocity on a continuous basis (at no less than 10-minute intervals). The weather data shall be retained for at least the duration of the resource consent.
b) Weather data of any period shall be provided to Auckland Council within 5 days of a request.
c) The weather station shall be located on the site in a location which, as far as is practicable, is unaffected by surrounding structures or vegetation or other features for the purpose of ensuring the most accurate measurements as practicable on the site.

d) The weather station shall be installed and operated in accordance with AS/NZS 3580.14:2014 (Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications).

6. The Council must be notified as soon as practicable in the event of any significant discharge to air, which results or has the potential to result in a breach of air quality conditions or adverse effects on the environment. The following information must be supplied:
   a) Details of the nature of the discharge including any wind conditions as recorded under condition 10 during the incident timeframe
   b) An explanation of the cause of the incident
   c) Details of remediation action taken.

Advice Note: Significant discharges

Significant discharges to be notified to council in accordance with this condition include abnormal discharges arising from unexpected failures of the WWTP (including emission control systems). An email to ***monitoring@aucklandcouncil.govt.nz*** *should be sent detailing the nature of the issue and what contingency measures are to be implemented to minimise potential air quality effects.*

7. All air quality complaints that are received must be recorded and notified to the council on request. The recorded complaint details must include:

a) The date, time, location and nature of the complaint.
b) The name, phone number and address of the complainant, unless the complainant elects not to supply these details.
c) Weather conditions, including wind speed and direction, at time of the complaint.
d) Any remedial actions undertaken.

Air Quality Management Plan

8. Prior to the commissioning of the WWTP, an Air Quality Management Plan (AQMP) must be submitted to the Council for certification, to confirm that the activities undertaken in accordance with the AQMP will achieve the objectives of the plan and compliance with the relevant consent conditions. Any subsequent review of the AQMP must also be submitted to the council for certification. The consent holder must meet the costs of the production, certification, monitoring and review of the AQMP. The purpose of the AQMP is to document the monitoring, management and operational procedures, methodologies and contingency plans required to comply with the conditions of this consent. The AQMP may be a sub-section of a wider Environmental Management Plan, and must incorporate a series of monitoring, management and operational procedures, methodologies and contingency plans, and together shall accurately record all information required to comply with the conditions of this consent. The AQMP must include the following:

a) Identification of all point sources for discharges of contaminants into air, including a map and schematic diagram showing the location of each source;
b) Procedures to minimise discharges of contaminants into air (including odour), including details of the inspection, maintenance, monitoring and contingency procedures in place for the wastewater treatment plant.

c) The operating parameters of odour control equipment and the frequency and scope of the regular checks to be performed on emissions control equipment; including testing of the carbon bed saturation;
d) Procedures for the monitoring of odour, including details of inspection procedures, recording requirements and contingency measures;
e) The identification of staff responsibilities;
f) The procedures for the receipt, recording and handling of air quality complaints received.

9. The AQMP must be reviewed on an annual basis and any subsequent changes to the certified AQMP must be submitted to the council for certification prior to implementation. The council will advise the Consent Holder in writing if any aspects of the AQMP are considered to be inconsistent with achieving the provisions of this consent.

Advice Note: Air Quality Management Plan

The council acknowledges that the Air Quality Management Plan is intended to provide flexibility both for the consent holder and the council for the management of the air discharges. Accordingly, the Air Quality Management Plan may need to be reviewed over time. Any reviews should be in accordance with the stated objectives of the management plan and limited to the scope of this consent.

Certification of the Air Quality Management Plan by the council relates only to those aspects of the management plan that are relevant under the RMA. The certification does not amount to an approval or acceptance of suitability by the council of any elements of the management plan that relate to other legislation, for example, but not limited to, the Building Act 2004 or the Health and Safety at Work Act 2015.

10. References

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Appendix A Odour Surveys

Meremere

Wastewater Treatment Plant

Odour survey – **16 January 2024**

Report 24464
Survey Date 16/1/2025
Report date 17/01/2025

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PO Box 96 256, Balmoral 1342, Auckland, NZ
airmatters.co.nz

1. Introduction

Air Matters Ltd carried out an odour survey in the area surrounding Meremere Waste Water Treatment Plant (the Plant) on 16 January 2025. The focus of the survey was to characterise the odour, its sources and the intensity at various downwind locations from the Plant. Below is a summary of the surveyor who undertook the field assessment and the timing and environmental conditions at the time of the survey.

Surveyor Information	
Name:	Nigel Goodhue
Company:	Air Matters Limited

Summary of Conditions	**16 January 2025**
Survey Time Period	15:25 – 16:15
Temperature	24^{0}C (average)
Wind conditions (average over survey)	Light to moderate north/north-easterly (1–3.6 m/s)
Weather conditions	Clear day (full sun)
Plant design	The WWTP follows the same principals as that proposed for the Delmore development, being primary screening, secondary treatment based on the Bardenpho process including membrane filtration and tertiary treatment via UV disinfection. WAS is stored onsite in two tanks and removed from site via tanker. The surveyed WWTP does not employ any active odour extraction and treatment.
Site activities	The Plant was operational with the secondary and tertiary treatment phase continuously running. The inlet screens were operating intermittently.
Survey locations (refer Map)	• **A**: Full (10-min) survey downwind in 1 location (~45 meters from Plant); • **B**: 1 x downwind scouting check (45-140 m downwind); • **C**: 4 x (5-min) survey downwind of acetic acid tank at various distances (6,12, 33, 45m); • **D**: 1 x upwind check;

Summary of Conditions	16 January 2025
	• **E-G**: 3 x 5-minute surveys immediately downwind of the different stages off the Plant (membrane filtration | tertiary treatment | inlet screens and solids storage and WAS tanks);

The detail of the survey and outcome are presented in the subsequent sections.

2. Survey Results

16 January 2025

Location Map

Survey locations **A** Average wind direction Odour Generating area

2.1 Results

The table below outlines the results of the survey in terms of the odour character and intensity (DW = downwind).

Location	Distance from nearest odour generating source (m)	Odour detected? (% of time)	Character of detected odour	Intensity
A (DW of Plant – south end)	45	Yes (18%)	Sewage	weak
B (DW odour scouting)	45-140	No	-	-
C (DW of Plant – north end)	6-45m (at 4 locations)	Yes @6m = 100% @12m = 75% @33m = 40% @45m = 40%	Vinegar (acetic acid)	@6m = distinct @12m = weak/distinct @33m = weak @45m = weak
D (Upwind)	Upwind	No	-	-
E (DW of Membrane filtration)	10	No	-	-
F (DW of tertiary treatment)	10	Yes (33%)	Sewage	Weak
G (DW of inlet screens/WAS tanks)	5	Yes (90%)	Sewage	Weak/distinct

2.2 Key results

- An odour consistent with sewage was detected at location A, ~45 meters downwind of the treatment plant. Based on wind direction and the survey undertaken in closer proximity to the Plant (Locations E-G) the observed odour is expected to be generated from the primary treatment stage (wastewater screening) and WAS storage.
- The scouting odour survey along the pond track (Location B) did not detect any odour. Due to the location of the pond and the wind direction, downwind surveys between 40- 140m, were not possible on the day of the survey.
- Survey location on the north side detected a vinegar odour, which was related to the acetic acid storage tanks. Intensity and frequency of odour was surveyed at various distances downwind and reduced with distance but was still detected ~45 meters downwind of the acetic acid tank.
- A survey of the Plant immediately downwind (5-10m) detected:
    - an intermittent weak earthy sewage odour downwind of the aeration/anoxic tanks (Location F); and
    - a consistent weak to distinct sewage odour was observed at the inlet screening (Location G) and consistent with the downwind survey at Location A.
- An upwind check was completed (Location D) following the downwind survey and no odour was present at this upwind location, establishing that all detected odour during the survey was from the subject site.

3. Methodology

The odour survey is carried out as per the process described in Appendix 3 of the *Good Practice Guide for Assessing and Managing Odour, Ministry for the Environment, 2016,* which is based on the German Standard VDI 3882.

A summary of important descriptors used in this assessment are included in Figure 2 below.

The surveyor had their noses calibrated to the screening procedure for panellists detailed as per AS/NZS 4323.3:2001, Section 9.7.2. The surveyor fell outside of the standard detection range for individual threshold however meet the standard for standard deviation.

Figure 3-1: Summary of odour survey descriptor notes used in this assessment

Odour Description Notes

Note 1: Observation Point Sensitivity
1. Remote (no housing, commercial/industrial premises, or public area within 500m of obs point)
2. Low sensitivity (no housing, commercial/industrial premises, or public area within 100m of obs point)
3. Moderate sensitivity (housing, commercial/industrial premises, or public area within 100m of obs point
4. High sensitivity (housing, commercial/industrial premises, or public area within area of obs point)
5. Extra sensitive (complaints arising from residents, business, and users of public areas within the area of obs point)

Note 2: Wind Strength	
0. Calm	Smoke rises straight up
1. Light air	Smoke drifts
2. Light Breeze	Wind felt on face; leaves rustle
3. Gentle breeze	Flags flap: twigs move all the time
4. Moderate breeze	Papers blow: small branches move
5. Fresh breeze	Small trees sway
6. Strong breeze	Large branches move, wind whistles
7. Near gale	Whole trees sway

Note 3: Weather Conditions	
Precipitation	Temperature
1. Dry	1. Cold
2. Rained recently	2. Cool
3. Drizzle	3. Warm
4. Raining	4. Hot
5. Foggy	

Note 4: Scale of intensity	Note 5: General Hedonic Tone
6. Extremely strong	-4 Extremely unpleasant
5. Very strong	-3
4. Strong	-2
3. Distinct	-1
2. Weak	0 Neutral
1. Very weak odour	1
0. No odour	2
	3
	4 Extremely pleasant

Note 6: Odour character descriptions

Code	Descriptor	Code	Descriptor	Code	Descriptor	Code	Descriptor	Code	Descriptor
1	Fragrant	6	Coffee-like	11	Bark-like	16	Garlic, onion	21	Like blood, raw meat
2	Perfumy	7	Spicy	12	Woody, resinous	17	Cooked vegetables	22	Rubbish
3	Sweet	8	Meaty (cooked)	13	Medicinal	18	Chemical	23	Compost
4	Fruity	9	Sea/marine	14	Burnt, smokey	19	Etherish, anaesthetic	24	Silage
5	Bakery (fresh bread)	10	Herbal, green, cut grass	15	Soapy	20	Sour, acrid, vinegar	25	Sickening
Code	Descriptor	Code	Descriptor	Code	Descriptor				
26	Musty, earthy, mouldy	31	Like gasoline, solvent	36	Sulphur smelling				
27	Sharp, pungent, acid	32	Fishy	37	Dead animal				
28	Metallic	33	Putrid, foul, decayed	38	Faecal (like manure)				
29	Tar-like	34	Paint-like	39	Sewer odour				
30	Oily, fatty	35	Rancid	40	Other - describe				

Note 7: Cloud cover			
0	Clear sky	5	
1	Sunny	6	Mostly cloudy
2	Mostly sunny	7	Considerable cloudiness
3		8	Overcast
4	Half the sky covered in cloud	F	Fog/mist

4. Limitations

These odour surveys were carried out on a single day of operations with weather conditions as found on the day. These odour surveys provide a snapshot of the environment on this day and results do not assume that this will be consistent through time.

Karaka
Wastewater Treatment Plant

28 Karaka Village Parade

Odour survey – 1 May 2026

Survey Date 01/05/2026

587B Mount Eden Rd, Mount Eden, Auckland 1024
PO Box 96 256, Balmoral 1342, Auckland, NZ
airmatters.co.nz

1. Introduction

Air Matters Ltd carried out an odour survey in the area surrounding Karaka Waste Water Treatment Plant (WWTP) on 1 May 2026. The focus of the survey was to characterise the odour, its sources and the intensity at various downwind locations from the WWTP. Below is a summary of the surveyor who undertook the field assessment and the timing and environmental conditions at the time of the survey.

Surveyor Information	
Name:	Dearbhla McGrath
Company:	Air Matters Limited

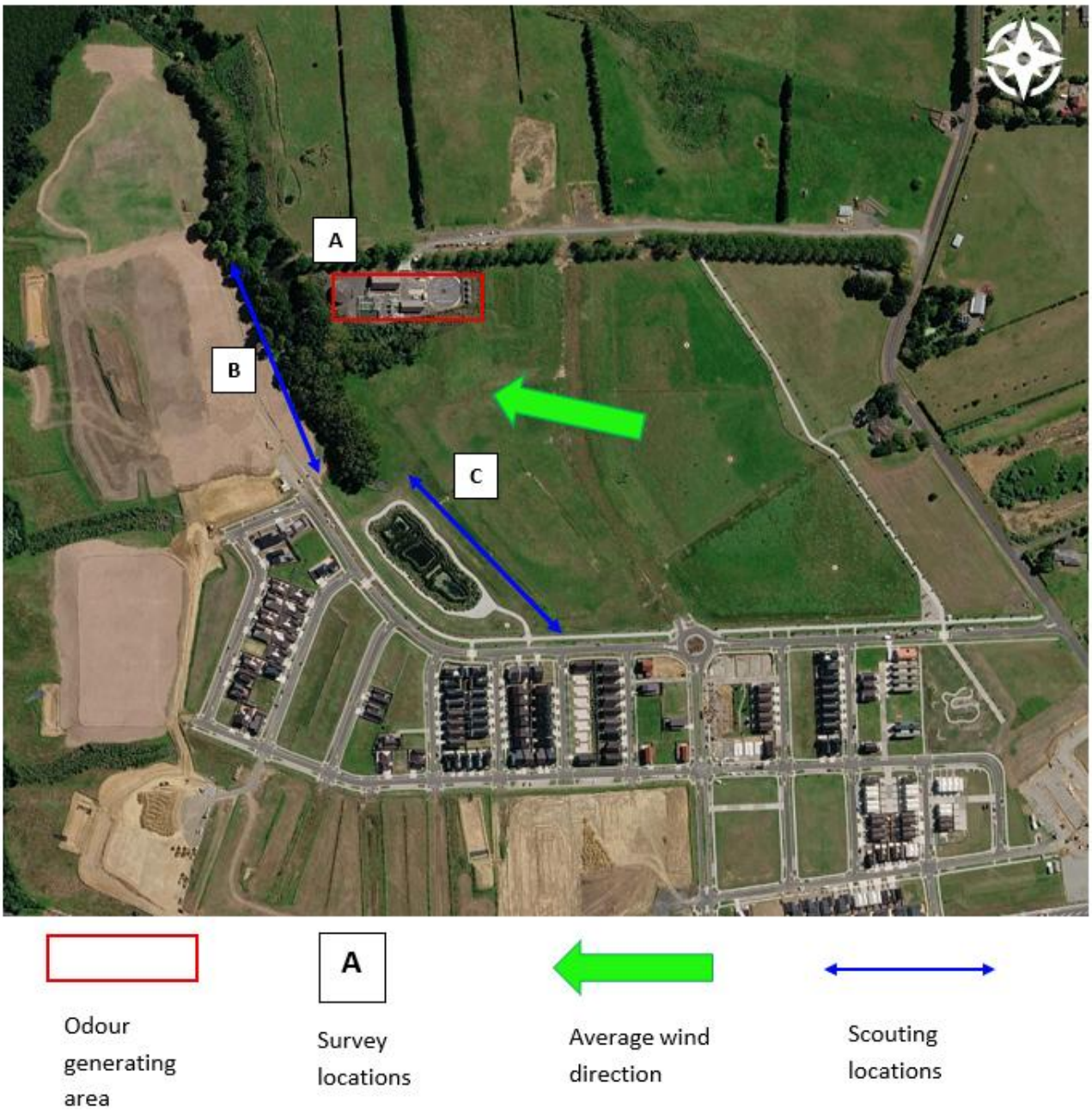
Summary of Conditions	1 May 2026
Survey Time Period	10:30 – 11:30
Temperature	16 ˚C (average)
Wind conditions (average over survey)	Light to moderate east / east southeast (1.3 - 1.6 m/s)
Weather conditions	Clear day (full sun)
Plant design	The WWTP follows the same principals as that proposed for the Delmore, Meremere and Milldale developments. This includes a primary screening, secondary treatment including membrane filtration and tertiary treatment via UV disinfection. Waste Activated Sludge (WAS) is stored onsite and removed from site via tanker. Odour control is provided via carbon scrubbers treating extracted air from the preliminary screening area.
Site activities	The Plant was operational with the secondary and tertiary treatment phase continuously running. The inlet screens operate intermittently and were not running at the time of the odour survey.
Survey locations (refer Map)	• **A**: Full (10-min) survey downwind in one location (~30 meters from WWTP site); • **B**: 1 x downwind scouting check (~ 90 – 170 m downwind); • **C**: 1 x upwind scouting check (~ 160 -280 m downwind);

On the monitoring day, local airflow was dominated by an East-South-East (ESE) wind, placing survey locations A and B directly downwind of the WWTP while Location C remained upwind.

Under typical regional conditions where south-westerly or northeasterly winds prevail, the relative positioning shifts significantly. During south-westerly winds, Location B and C are located upwind of the plant, whereas during northeasterly winds, these same locations are downwind of any potential odour emissions.

The detail of the survey and outcome are presented in the subsequent sections.

2. Survey results



3. Results

Location	Distance from nearest odour generating source (m)	Frequency % of time detected	Character of detected odour	Intensity of odour
A (Downwind of WWTP)	30	15%	Sour, acrid, vinegar (acetic acid)	Very weak – 3.3% Weak - 3.3%
			'Perfumy' (weed killer)	Very weak – 8.3%
B (DW odour scouting)	90 – 170	Not detected	-	-
C (Upwind odour scouting)	160 – 280	Not detected	-	-

3.1 Key results

An odour consistent with acetic acid (sour, acrid, vinegar) and a perfumy (weed killer) character was detected at location A, ~30 meters downwind of the treatment plant, for 15% of the total survey time.

Downwind intensity at Location A remained low overall, with acetic acid odour recorded at very weak to weak intensities and perfumy odours recorded strictly at a very weak intensity. No distinct or strong odours were observed. Importantly, no wastewater type odours were observed.

The scouting odour survey along the downwind path (Location B, 90 -170 m distance) and the upwind scouting check (Location C, 160 - 280 m distance) detected no odour.