Raglan Wastewater Treatment Plant

Technical Odour Assessment

Prepared for Watercare Services Ltd
Prepared by Beca Limited

3 April 2025

Contents

Revision History

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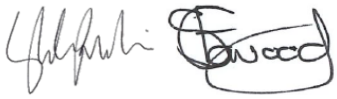
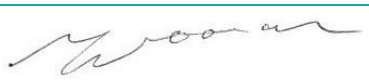
Prepared by	Nicole Rubio and Suzanne Cawood		3 April 2025
Reviewed by	Mathew Noonan		3 April 2025
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on behalf of	Beca Limited		

Executive Summary

Overview

The Waikato District Council (WDC) operates the Raglan Wastewater Treatment Plant (WWTP), located on Wainui Road, Raglan, Waikato. WDC is upgrading the existing plant. The upgrade will include the installation of a new membrane aerated bioreactor (MABR) / membrane bioreactor (MBR) plant. The treated wastewater from the WWTP will be discharged from a new outfall headwall located within the Wainui Reserve.

WDC has commissioned Beca Ltd (Beca) to undertake an assessment of the effects of the discharges to air in support of the application for a new resource consent. The primary air quality concern is the potential for odour nuisance effects.

Emissions to Air

The primary sources of odour from the are expected to be the MABR/MBR plant and the inlet works. The aeration ponds will be retained but only used to treat incoming wastewater as a contingency when flows exceed the capacity of the MABR/MBR. Therefore, for most the time it is expected to be a minimal source of odour. The existing anaerobic ponds have been decommissioned and will therefore no longer be a source of odour. Overall, it is expected that the odour emitted from upgraded plant will be lower than what is emitted from the existing plant configuration (due to changes in the processes).

The treated wastewater discharged from the outfall headwall located within the Wainui Reserve will be highly treated with a low nutrient content and positive dissolved oxygen level. The treated wastewater is expected to have a low odour potential. The odour potential will be lower than the treated wastewater currently discharged from the WWTP.

Assessment of Effects

The potential air quality effects of discharges from the upgraded WWTP and outfall were assessed against the FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) factors. An important consideration was the separation distance between sources of odour at the WWTP and nearby sensitive receptors. The closest residential dwelling is approximately 220m away from the proposed WWTP (the existing aeration ponds were the closest treatment process to any dwelling). The separation distance is greater than the 210m recommended by the Victoria Environment Protection Authority (Vic EPA) for the protection of air quality amenity at sensitive receptors. The topography of the site would also help channel any emitted odour away from sensitive receptors.

No odour complaints have been received by WDC over the past five years. The complaint record suggests that the existing level of odour discharged from the site is acceptable. Lower site emissions are expected once the proposed upgrades are implemented, therefore the offsite effect of any odour is also expected to be lower than what currently occurs.

The proposed outfall is located approximately 390m from the nearest sensitive receptor. Emissions from the outfall are therefore very unlikely to have any effect on residents.

Overall it is concluded that emissions from the upgraded WWTP and outfall would not have an adverse odour effects or be considered offensive or objectionable provided that the proposed mitigation measures are implemented and maintained.

1 Introduction

1.1 Overview

The Raglan/Whāingaroa wastewater treatment plant (WWTP) is located on Wainui Road in Raglan, Waikato District. The WWTP receives wastewater from the Raglan/Whāingaroa township and surrounds as well as wastewater from the Whānga Coast reticulation system. The site is operated by Watercare Services Limited (Watercare) on behalf of the Waikato District Council (WDC) under a long-term contractual arrangement on behalf of the Waikato District ratepayers.

The WWTP is currently being upgraded. The upgrade will include the installation of a new membrane aerated bioreactor (MABR) / membrane bioreactor (MBR) plant. Treated wastewater from the WWTP is also proposed to be discharged to a new location, to a gully located within the Wainui Reserve. The existing outfall will be retained for contingency discharge purposes.

Watercare has commissioned Beca Ltd (Beca) to undertake an assessment of the effects of the discharges to air in support of the application for a new resource consent. The primary air quality concern at the WWTP is the potential for odour nuisance effects.

1.2 Purpose of the Report

This report is intended to accompany an application for a consent application for air discharges from the Raglan WWTP. This report describes the proposed activities and the environmental effects of the discharges and includes:

- A description of the WWTP;
- A summary of the proposed operations at the WWTP, where they relate to discharges of contaminants to air;
- A description of the nature of the discharges to air;
- An assessment of the receiving environment in terms of potential influences on the environmental effects of the discharges to air from the site;
- A description of the methodology used to carry out the assessment;
- A summary of the results of the assessment of effects on air quality; and
- A summary of conclusions and findings of the investigation.

1.3 Limitations

This report has been prepared by Beca for Watercare. Beca has relied upon the information provided by WDC in completing this document. Unless otherwise stated, Beca has not sought to independently verify the information provided. This document is, therefore, based upon the accuracy and completeness of the information provided and Beca cannot be held responsible for any misrepresentations, incompleteness, or inaccuracies provided within that information. Should any new or additional information become available, this report will need to be reviewed accordingly.

1.4 Assessment Guidance

This technical assessment been prepared in accordance with the guidance provided by the Ministry for the Environment's "*Good Practice Guide for Assessing Discharges to Air from Industry*", 2016 (GPG Industry) and "*Good Practice Guide for Assessing and Managing Odour*", 2016 (GPG Odour).

2 Description of the Activities and Discharge to Air

2.1 Existing WWTP Operations

The layout of the existing Raglan WWTP is shown in Figure 2-1. The WWTP currently incorporates the following treatment processes:

- Inlet works (with screens);
- Four aerated treatment ponds (mechanically aerated);
- Day holding pond for the treated wastewater;
- Two roadside holding ponds (a treated wastewater holding pond (western pond), and a sludge storage holding pond (eastern pond));
- Tertiary ultraviolet (UV) treatment facility;
- Outfall pump station; and
- Whāingaroa Harbour outfall.

Wastewater is received at the inlet works (screen) which removes the large solids, and some of the biological oxygen demand (BOD) of the wastewater. The extracted screening material is washed and stored in bins before being transported off site for disposal.

The wastewater is piped to either of the primary aerated treatment ponds (identified as pond A and pond D in Figure 2-1), where additional treatment of the wastewater occurs. From these ponds the wastewater flows to secondary aerated ponds (identified as pond B and pond C in Figure 2-1).

Ponds A, B, C and D are fitted with ‘AquaMats’. The AquaMats provide additional surface area on which biomass can grow, increasing the rate treatment. The ponds are all aerated from bottom deployed air diffusers.

After passing through the aeration ponds, the treated wastewater then flows under gravity to the day holding pond where it is held until it is discharged to the marine outfall. If the holding capacity of the day holding pond is exceeded, the treated wastewater is then transferred to the roadside holding ponds.

From the day pond, the treated wastewater is pumped via an enclosed inline tertiary UV treatment facility to the Whāingaroa Harbour outfall. The site pump station and UV treatment facility are located at the northern end of the site.

The WWTP had previously incorporated two anaerobic treatment ponds but these ponds have now been decommissioned.

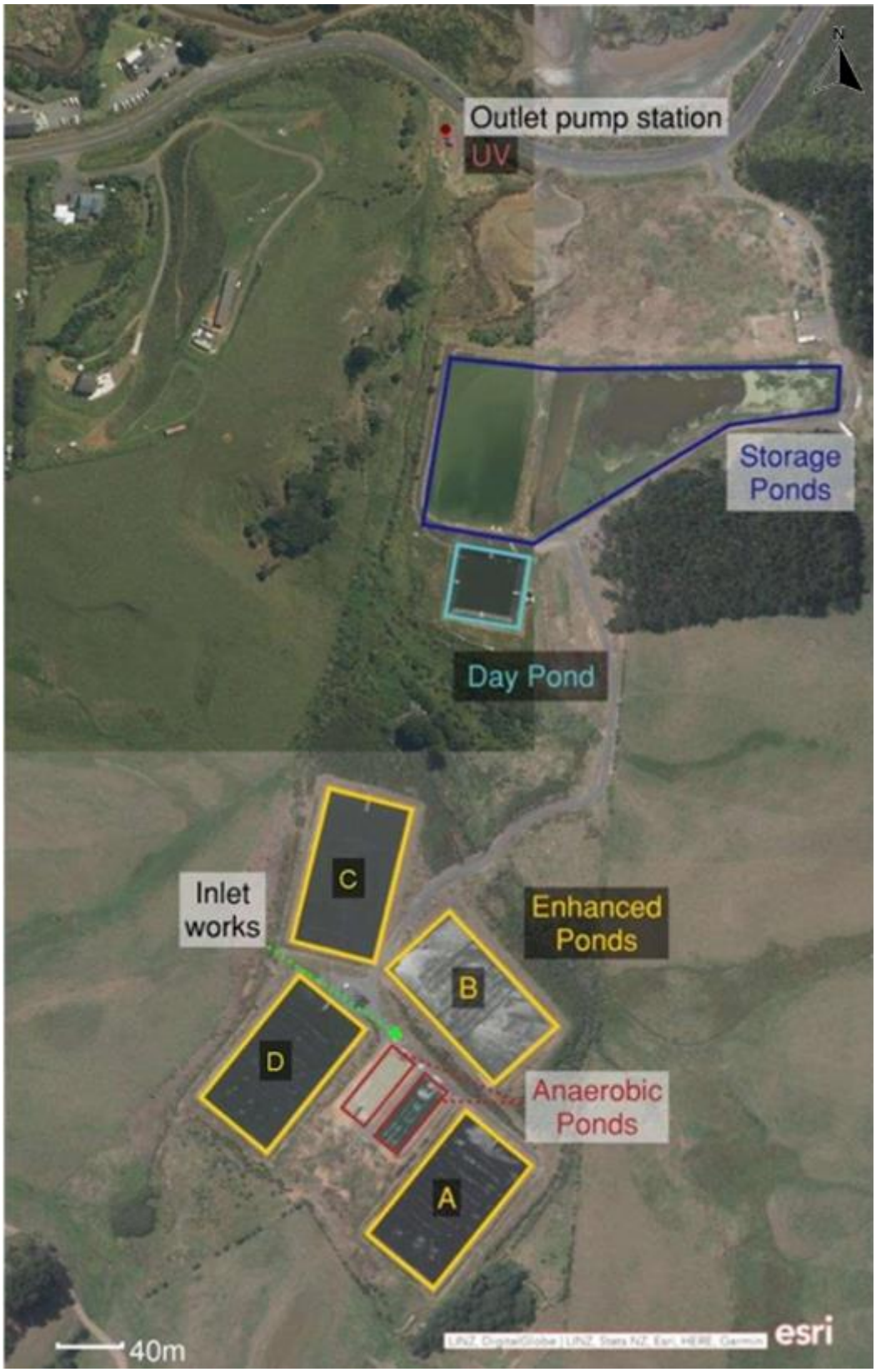

Figure 2-1. Current layout of the Raglan WWTP.

2.2 Proposed upgrades to the WWTP

2.2.1 Overview of the proposed WWTP

The WWTP is currently being upgraded. A schematic of the proposed plant is provided in Figure 2-2. The upgraded plant will incorporate a MABR/MBR treatment system, pump station and UV disinfection treatment plant. The new pump station and UV treatment unit will be installed alongside the existing day pond as shown in Figure 2-3. The existing aerated treatment ponds (ponds A to D) will be retained; however, the anaerobic ponds have been decommissioned as part of the proposed upgrades.

Treated wastewater from the WWTP will be discharged via an outfall headwall to a gully located within the Wainui Reserve.

The upgrade will increase the capacity of the WWTP to accommodate future growth, and significantly improve the quality of the treated wastewater.

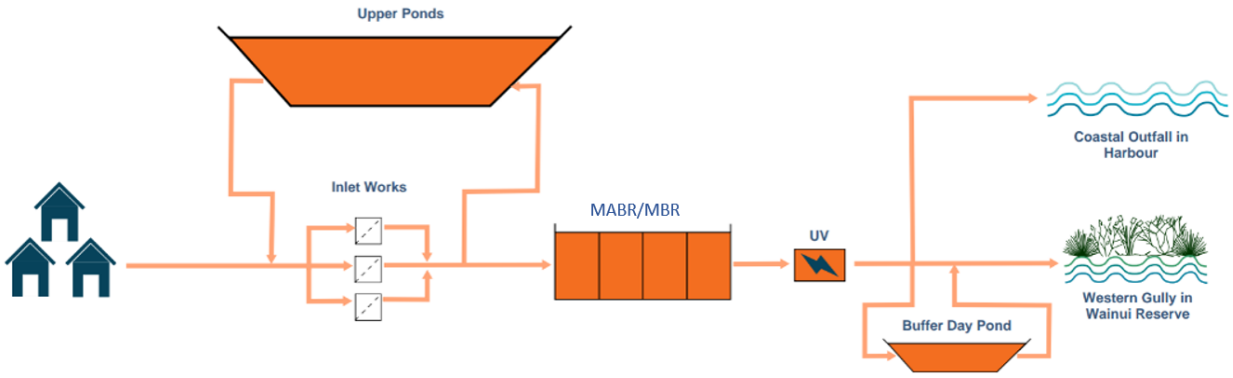

Figure 2-2. Flow diagram of the new WWTP

2.2.2 Proposed Inlet Works

There will be a new inlet works installed at the site. The inlet works will be enclosed.

2.2.3 Proposed MABR/MBR

The proposed MABR/MBR plant will be installed between the treatment ponds A and pond D (as shown in Figure 2-3). This area previously accommodated the anaerobic ponds.

The MABR/MBR plant will receive wastewater from the inlet works. The MABR uses a gas transfer membrane onto which a nitrifying and denitrifying biofilm can develop. Oxygen diffuses directly into the nitrifying biofilm which facilitates oxygen transfer and is subsequently consumed prior to reaching the outer denitrifying biofilm. The incoming wastewater then flows into the MBR. The MBR unit will separate the suspended biomass (sludge) from the permeate (treated wastewater). The permeate will then be disinfected by ultra-violet (UV) light before being pumped to the proposed outfall headwall in the Wainui Reserve. The MABR/MBR plant provides a very high level of treatment of the wastewater.

Waste activated sludge (WAS) generated from the MBR process will be pumped to the existing aerated treatment ponds B and C. The accumulated sludge will periodically be extracted from the ponds and transported off site for disposal. The desludging of the ponds is expected to occur every couple of years.

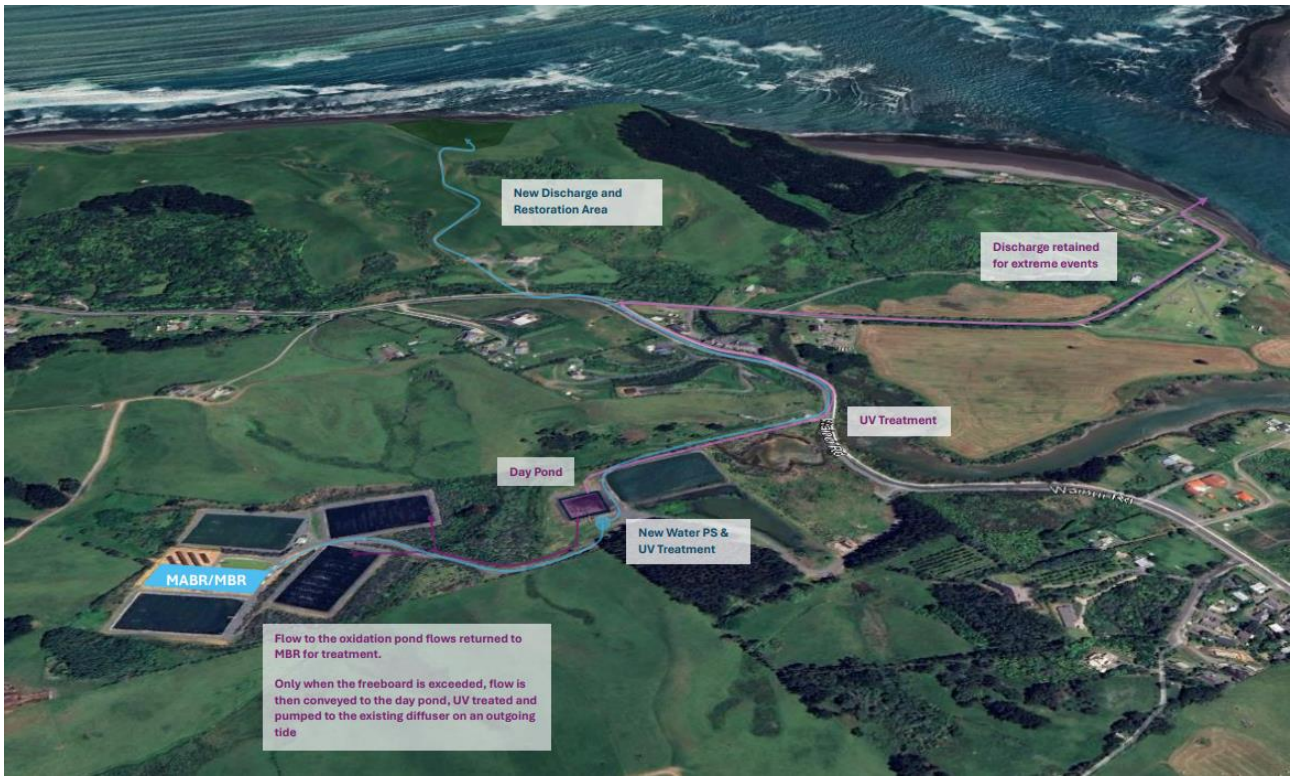

Figure 2-3. Location of the proposed MABR/MBR, pump station and UV treatment, and outfall location.

2.2.4 Proposed Discharge Location

The treated wastewater from the WWTP will be pumped to a headwall located at the top of the western gully in the Wainui Reserve as shown in Figure 2-4. The proposed outfall is located approximately 1km to the west of the WWTP. The treated wastewater will first pass through a naturized rock channel before being discharged to land. The location and design of the outfall has yet to be finalised. Figure 2-4 and Figure 2-5 show the outfall's indicative design.

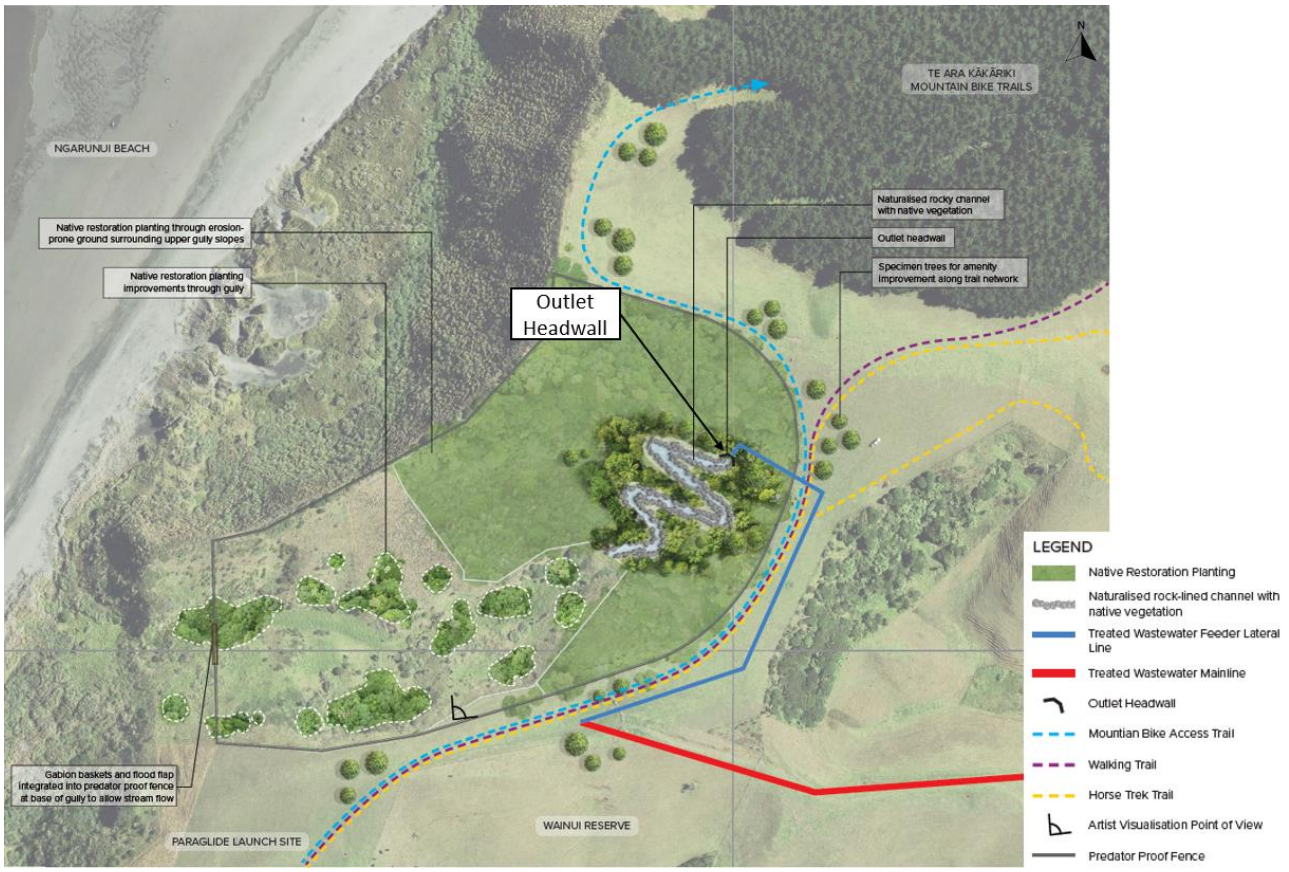

Figure 2-4. Indicative Wainui Reserve Western Gully Discharge (final design to be confirmed).

Figure 2-5. Location of the proposed outlet headwall (indicative) in relation to the WWTP site (outlined in red).

2.2.5 Contingency during peak flows

The capacity of the MABR/MBR has been designed to cater for almost all flow scenarios however there may be times that inflows exceed the MABR/MBR treatment capacity. During these conditions the incoming flows will be directed to the aerated ponds for treatment. The incoming wastewater will then go through UV treatment before being discharged to the existing marine outfall. Such peak flow events are expected to occur very infrequently.

3 Receiving Environment

3.1 Land Use Zoning

The WWTP is located on Wainui Road, Raglan, Waikato. The WWTP is located to the south-west of the Raglan township. Figure 3-1 shows the zoning of the Raglan WWTP and the surrounding area under the Proposed District Plan (Decisions Version) (WDP).

The site is zoned ‘General Rural’ under the WDP. The site is designated for wastewater treatment purposes (Designation WDC-48). The WDC is the requiring authority of the designation. Immediate land surrounding the WWTP is also zoned ‘General Rural’ providing a buffer between the WWTP and surrounding residential zoned land.

The gully where the proposed outfall headwall will discharge to, located within the Wainui Reserve, is zoned ‘Open Space’ under the WDP. The reserve is used for both pastoral agricultural and recreational purposes .

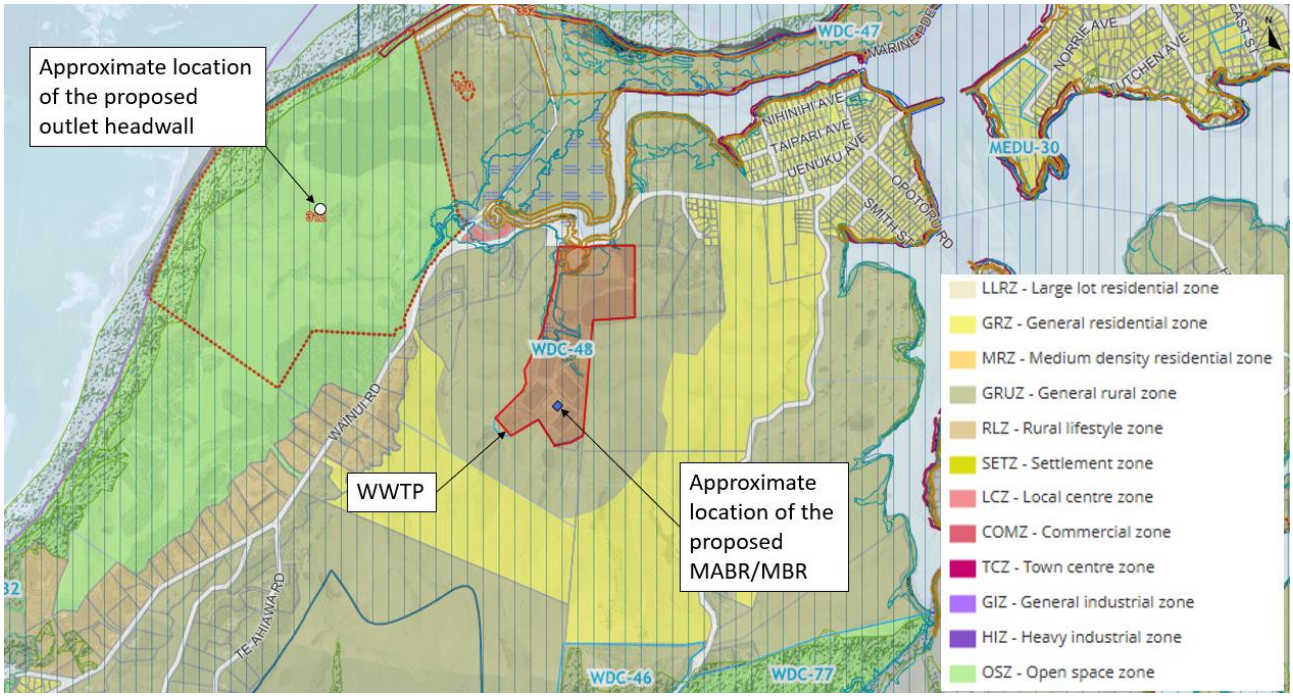

Figure 3-1. Zoning of the WWTP (outlined in red) site and the surrounding area (Source: Waikato Operative District Plan).

3.2 Sensitivity of the Surrounding Environment

Different land uses have different sensitivity to odour effects. The GPG Odour provides guidance with regards to the sensitivity of different land uses to odour amenity effects.

The area adjacent the WTTP is used for both pastoral agricultural and recreational purposes. This area will generally have a low occupancy, particularly at night. The MfE GPG Odour categories rural area as having a low sensitivity to odour. The reserve area within which the outfall is located is considered to have low sensitivity.

Rural residential dwellings will have a higher sensitivity to odour. The rural residential dwellings which are located closest to the WWTP are shown in Figure 3-2[1]. At these locations people may be present 24 hours per day and therefore could potentially be exposed to odour for an extended period. Generally, a relatively high level of air quality amenity would be expected in these areas. However, there may be a greater level of acceptance of rural type odours (such as those generated by agricultural activities). The GPG Odour categorises a rural dwelling as having moderate to high sensitivity to odour.

Residential areas are also considered to have high sensitivity to odour. The closest existing residential area is located approximately 550m to the northeast of the day pond on Rakaunui St. However, zoning would also allow for future residential development to occur approximately 300m to the east of the aeration ponds.

A cluster of farm buildings are located approximately 150m to the south of the aeration ponds (labelled A1 in Figure 3-2). These buildings do not appear to be used for residential purposes and appear to include a milking shed. Farm oxidation ponds are located within 50m of these buildings. These buildings are therefore considered to have a low sensitivity to odour.

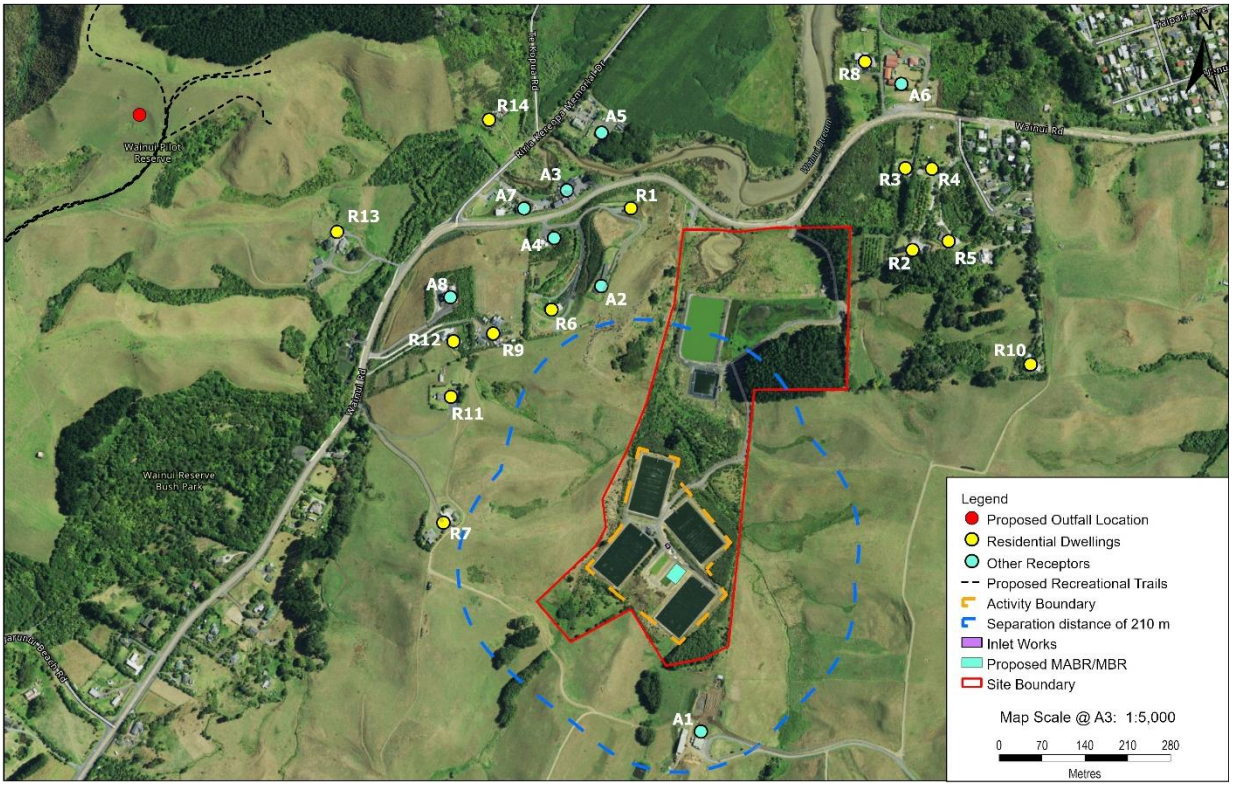

Figure 3-2. Location of sensitive receptors in the vicinity of WWTP and the indicative location of the proposed outfall.

[1] The figure also shows the Victoria Environment Protection Authority recommended separation distance of 210m. The separation distances are discussed in Section 5.4

3.3 Topography

The topography of an area influences wind and airflow, and therefore the dispersion of contaminants emitted from the site. Elevated terrain in proximity to an emission source may lead to impingement of emission plumes at lower locations and a potential for lower concentrations than at higher elevations.

The topography of the WWTP is shown in Figure 3-3. The topography of the outfall and its surrounding area is shown in Figure 3-4.

The WWTP site and the surrounding areas are located on gently undulating terrain. The WWTP is located in a valley which slopes upwards from the northern to southern end of the site. The elevation of the holding ponds at the northern end of the site is approximately 3m above sea level (asl) and the aerated treatment ponds are at an elevation of approximately 12m. The Wainui Stream runs to the north of the site, forming a shallow gully (at 1 to 2m asl).

The surrounding rural dwellings are located at higher elevations than the WWTP. The closest rural dwellings which are located to the west of the site have elevations ranging from approximately 25 to 30 m asl. Similarly, the farm buildings located approximately 150m to the south of the treatment ponds (labelled A1 in Figure 3-2) are also located at a higher elevation of approximately 30m asl.

The rural dwellings located to the northeast of the site on Wainui Rd and Rakaunui St are located at an elevation between 5m and 30m asl. However, these dwellings are separated from the WWTP by a line of hills. The intervening hills would tend to channel any odour emitted from the WWTP away from these receptors. Similarly, the café and childcare centre located to the northwest of the site are shielded from the site by a line of hills.

Furthermore, the site is located approximately 1.5km east of the coast and 0.8km to the south of Raglan Harbour. Wind flows at the site are therefore also expected to be influenced by coastal influences, such as land and sea breezes.

The proposed outfall headwall is located on top of a hill with an elevation of approximately 60m asl. The closest rural residential dwelling, approximately 390m to the south-east of the proposed outfall headwall, has an elevation of approximately 20m asl.

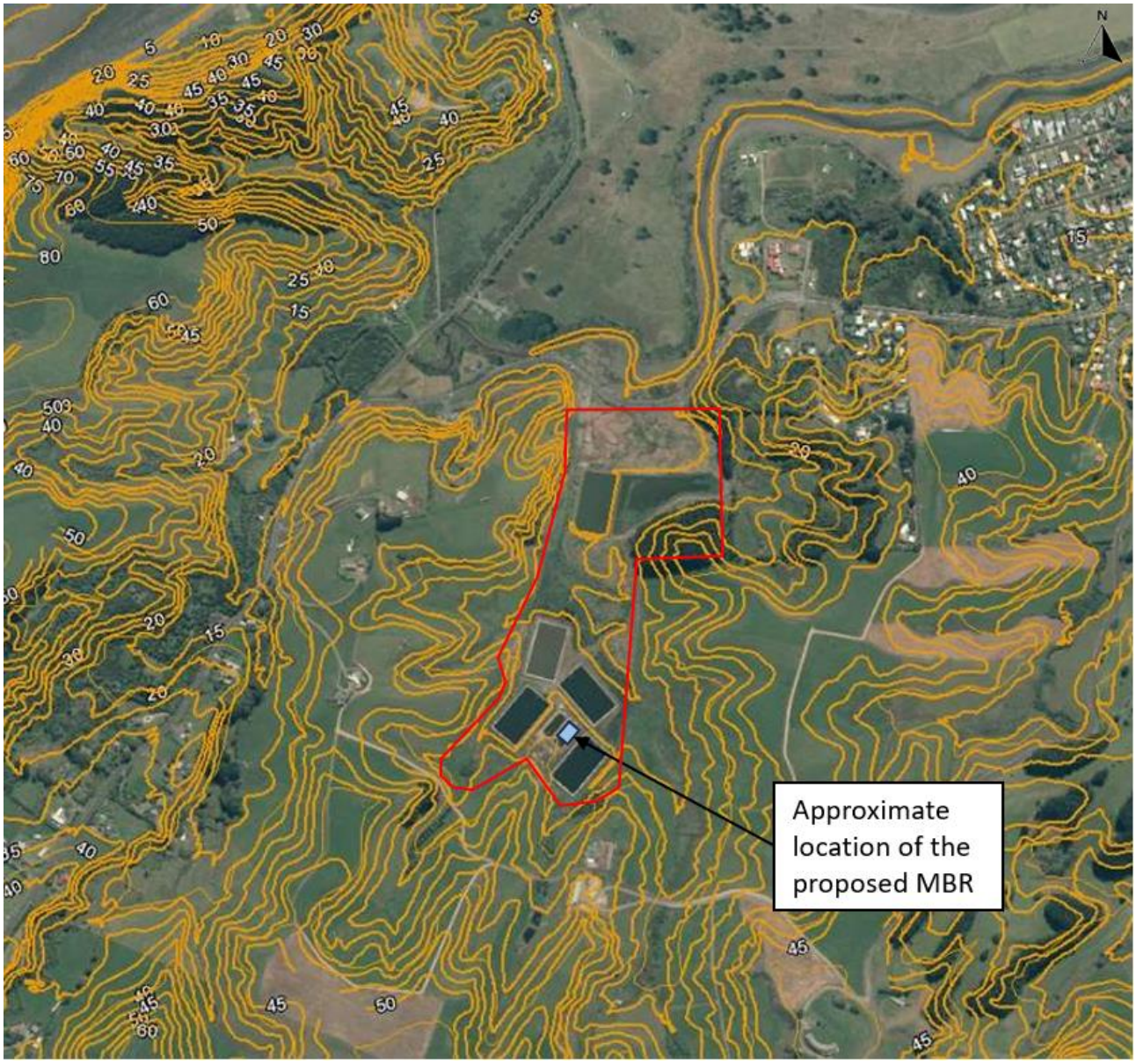

Figure 3-3. Topography of the area which surrounds the WWTP.

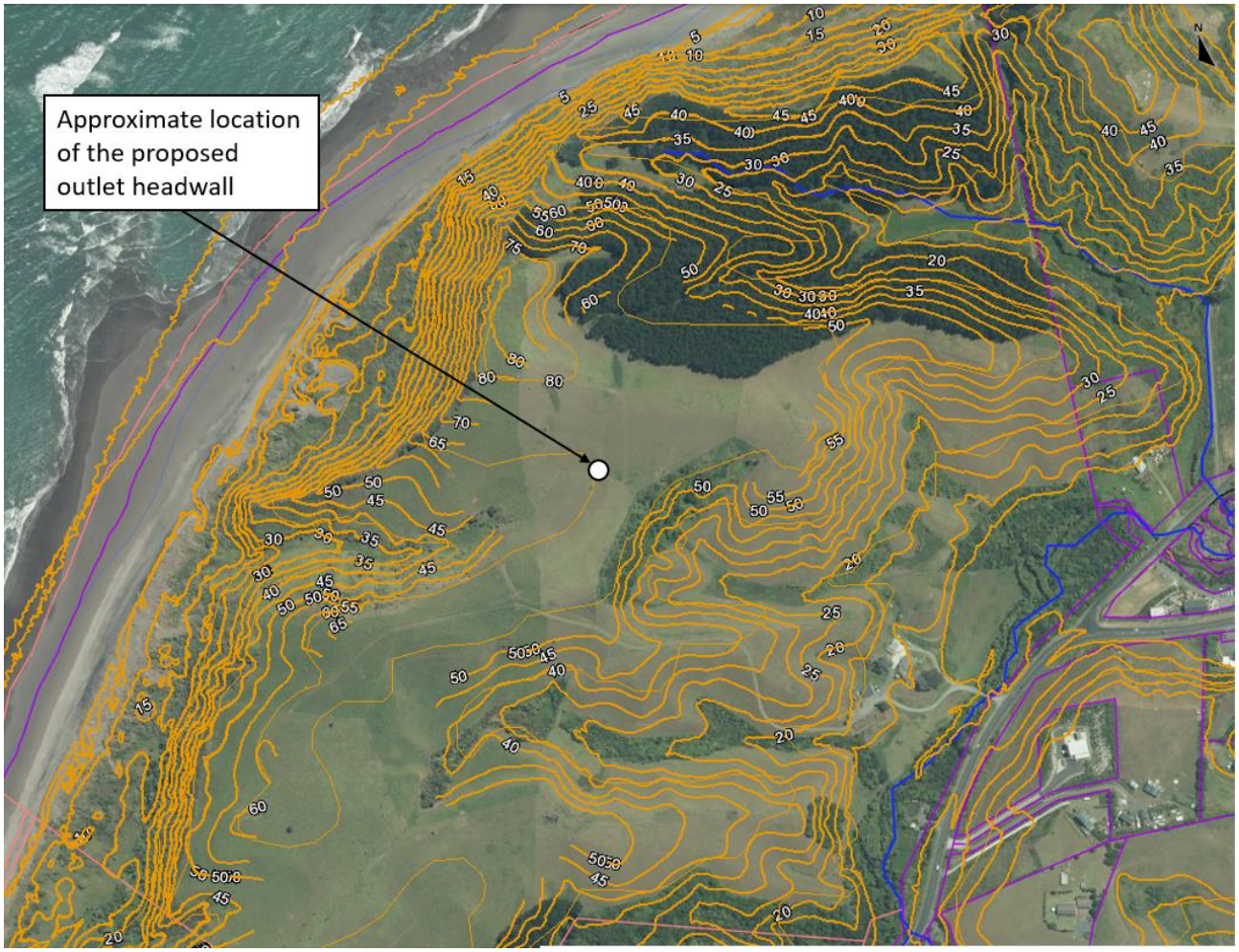

Figure 3-4. Topography of the area which surrounds the proposed outlet headwall.

3.4 Meteorological Conditions

Air pollutant levels are highly influenced by meteorological conditions. The most important of these parameters are wind speed, wind direction and the thermal stability of the atmosphere. Worst case dispersion conditions for the WWTP odour emissions are typically associated with low wind speeds (<1.5 m/s) and high stability atmospheric conditions. These conditions are typical of cool calm winter nights and early morning periods. During these meteorological conditions the maximum odour concentrations can be expected.

The topography of the area surrounding the WWTP is expected to channel local wind flows and the dispersion of any odours emitted to air away from the WWTP. The hills which surround the WWTP are expected to channel wind flows in approximately a northerly and southerly direction.

Drainage flows of the cooler denser air from the top of the hills down towards the WWTP are also expected to occur during cool stable night-time conditions, when worst-case dispersion conditions are also expected to occur. The drainage flows would tend to transport any odour emitted from the WWTP in a northly direction along the valley towards the Whāingaroa Harbour.

As noted in Section 3.3, the nearby farm buildings to the south of the WWTP are located at higher elevations than the WWTP. During worst-case dispersion conditions odour emitted from the site would also tend to be transported in a northerly direction away from these receptors.

The coastal location would also be expected to influence wind flows and dispersion conditions. Land and sea breeze conditions can be expected at the site. Winds flows are also likely to be channelled along the Whāingaroa inlet in an east/west direction.

The closest meteorological monitoring stations to the WWTP site are the Whatawhata AWS meteorological monitoring station, which is located approximately 20km to the northeast of the site, and the Port Taharoa meteorological monitoring station, which is located approximately 40km to the southwest of the WWTP.

The locations of the two meteorological monitoring stations and the site are shown in Figure 3-5. The figure also shows the distribution of hourly wind speeds and directions (windrose) observed at each of the monitoring stations. The windrose for the Whatawhata AWS meteorological monitoring station corresponds to the years 2014 – 2018. The wind rose for the Port Taharoa meteorological monitoring station corresponds to the years 2008 – 2012.

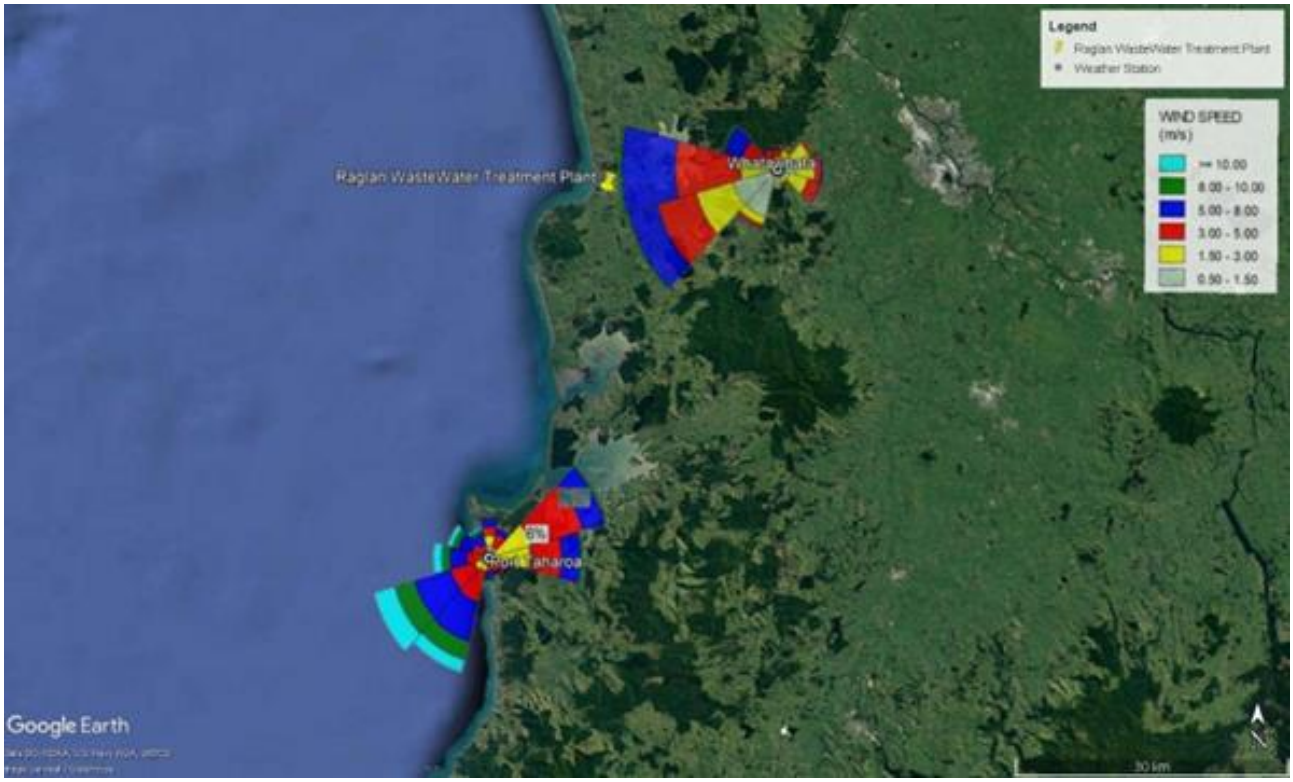

Figure 3-5. Wind speed and wind direction at the Whatawhata (2014 – 2018) and Port Taharoa (2008 – 2012) meteorological stations for all hours.

Due to the inland location of the Whatawhata meteorological monitoring station and the complex terrain which separates the monitoring station from the WWTP, the wind flows observed at the monitoring station are generally not expected to be representative of conditions at the WWTP.

The wind flows observed at the Port Taharoa meteorological monitoring station are expected to provide a more accurate indication of wind flows condition at the WWTP due to comparable coastal locations of the monitoring station and site. However, wind flows at both the Port Taharoa monitoring station and the WWTP

will be influenced by the topography that surrounds each site. In addition, meteorological conditions can also be expected to vary over the 40km which separates the monitoring station and the WWTP site.

The distribution of wind speed and wind direction measured at the Port Taharoa meteorological station superimposed on an aerial photograph of the site is shown in Figure 3-6. The windrose shows the predominance of winds from the southwest and northeast directions. The average wind speed observed at the meteorological station was 4.7 m/s from the period 2008 - 2012. The relatively high average wind speed observed at the site is likely due to the exposed coastal location of the station. Low wind speed (<1.5 m/s) were observed to occur for approximately 14.2% of the time.

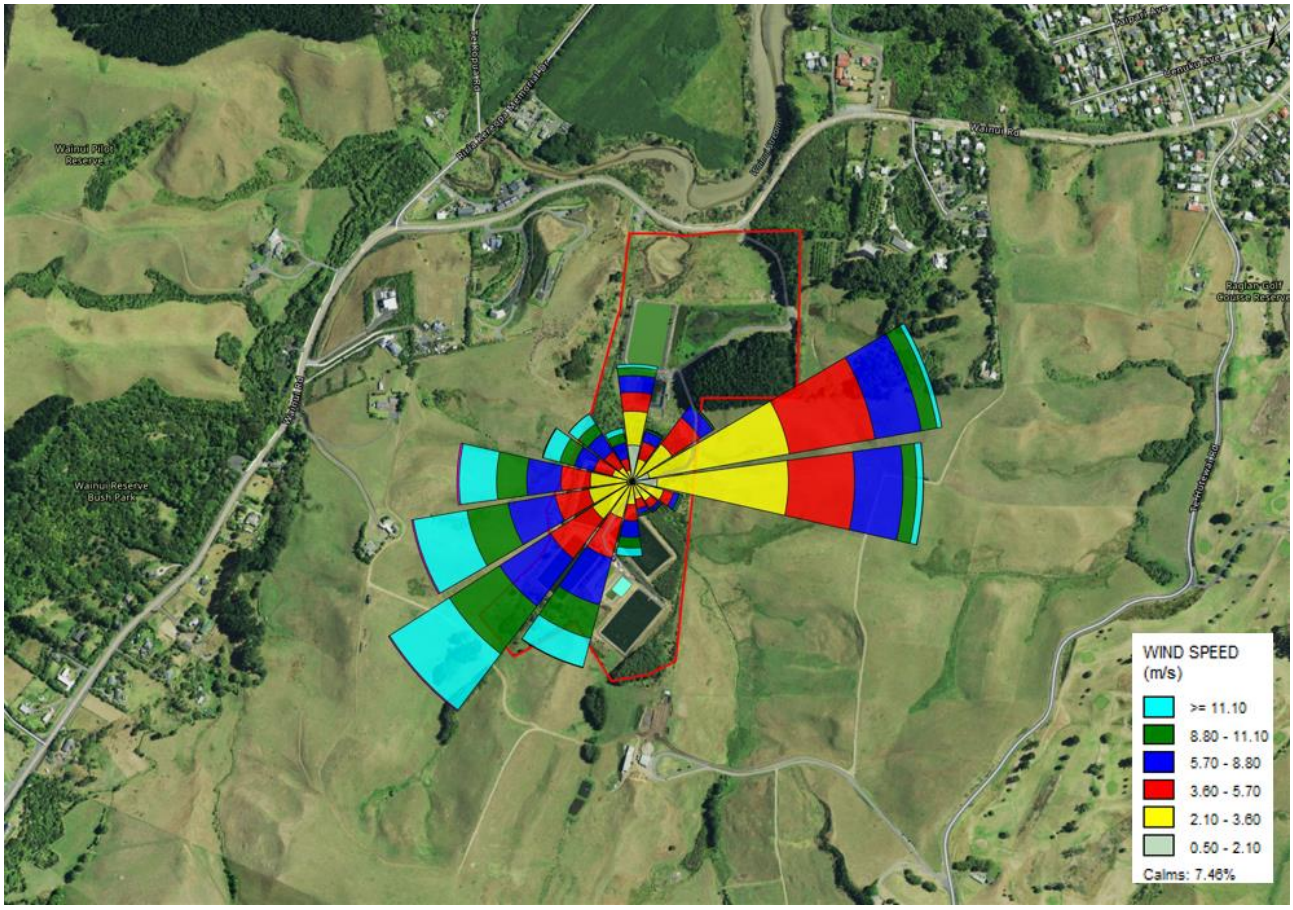

Figure 3-6. Wind distribution recorded at Port Taharoa (2008 - 2012) overlain on the WWTP site.

3.5 Background Air Quality

The WWTP is located in a rural coastal environment. Typical odours associated with agriculture activities are expected in the surrounding areas which are used for farming or are located adjacent to farms. These may include decomposition of organic material, fertiliser application, animal odours and potentially wastewater pond odours (such as those used for farming).

Typical odours associated with coastal land, such as the decomposition of seaweed are also likely to be experienced in areas close to the waterfront at times.

Odours emitted from the existing WWTP will also contribute to the current air quality levels in the vicinity of the site. However, the contribution from the WWTP to ambient air quality levels outside the site boundary is

generally expected to be low. This is based on the lack of odour complaints received that are attributable to the WWTP (refer to Section 5.5) and the separation distance between the WWTP and nearby sensitive receptors (refer to Section 5.4).

4 Emissions to Air

4.1 Overview

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

The odours emitted from anaerobic wastewater have a “rotten egg/sewer” type odour and are commonly considered to be highly unpleasant[2]. In contrast, the odour which is emitted from wastewater with a positive dissolved oxygen (DO) concentration typically has an “earthy” or “musty” character.

4.2 Emissions from the WWTP

Odours are discharged to the air during the treatment, storage and transfer of wastewater. Odours are generated through the decomposition of organic material present in the wastewater and generated from the treatment process.

The WWTP processes with the greatest odour potential are:

- Inlet works (screens)
- MABR/MBR
- Oxidation ponds

A new inlet works will be installed at the site. Current odour emissions from the inlet works are expected to remain the same. The inlet works screen is enclosed which minimises odour discharges to air. Generally, odour emitted from the inlet works is localised and would not be observed outside the site boundary.

The MABR is an open tank process. Aeration in the MABR will occur within the gas permeable media. Due to the efficiency of the aeration system generally very little or no bubbling is observed on the surface of the wastewater (unlike other aerated treatment system). The absence of any surface bubbling will minimise the emissions to air from the tanks (i.e. reduces the water to air transfer rate). Any odour discharged from the MABR unit will be minimal and usually only detectable when standing immediately adjacent to the unit.

The MBR is also an open tank treatment processes and will be a potential source of odour. The MBR’s maintenance cycle includes the scouring of the membranes by diffuse aeration and coarse bubbles. The aeration scouring maintains aerobic conditions in the tanks (inhibits the formation of odorous compounds). Only a very slight odour is typically emitted from MBRs which is usually only detectable when standing immediately adjacent to the unit.

The aeration ponds will only accept untreated wastewater when the inflows to the WWTP exceed the MABR/MBR plant’s treatment capacity. Therefore, for most of the time the only organic loading on the ponds would be WAS. Little to no odour is expected to be emitted from the ponds during this period.

[2] Dravnieks A, Masurat T, Lamm R A, Hedonics of Odours and Odour Descriptors: in Journal of the Air Pollution Control Association, July 1984, Vol. 34 No. 7, pp 752-755.

Higher organic loadings will occur during contingency. During this period there is a higher risk of odours being generated. To minimise the risk of adverse odour, the ponds' existing bubble aeration mechanism will be retained. The aeration will maintain a positive dissolved oxygen (DO) content in the ponds, thereby avoiding the risk of anaerobic conditions occurring.

Any odour generated will likely only be observed in the immediate vicinity of the ponds and would not be expected to be observable outside the WWTP boundary.

Odour emissions from the new pump station, UV treatment unit and the day pond are expected to be negligible. The incoming wastewater to these processes will be highly treated with a low organic content and positive DO content. Additionally, the UV treatment unit will also be enclosed which will further mitigate emissions.

During contingency events, treated wastewater from the aerated ponds will be stored at the holding ponds prior to being discharged to the existing marine outfall. Odour emissions from the holding ponds when in use are also expected to be minimal and no more from what currently occurs at the site. The holding pond would also only be used infrequently and therefore only a frequent source of odour.

The treated wastewater stored in the holding pond and day pond during contingency events is discharged every tidal event. The short storage period of the treated wastewater also minimises the risk of adverse odour events occurring.

4.3 Emissions from the Proposed Outlet and Disposal Area

Treated wastewater discharged from the outlet will be highly treated with a low organic content and positive DO content. The treated wastewater which is discharged from the outlet would be expected virtually odourless. Therefore any emissions to air are highly unlikely to be offensive or objectionable.

4.4 Odour emissions under abnormal WWTP operating conditions

Higher odour emission rates could occur during abnormal operating conditions. Possible events when higher odour emission rates could occur include the following:

- Organic overloading of the biological process in the MABR/MBR or aerated ponds;
- Excessive sludge in the aerated ponds;
- Fouling or clogging of the membrane of the MABR/MBR unit;
- Wastewater toxicity disrupting the plant biological processes;
- Loss of aeration to the biological process in the MABR/MBR (or aerated ponds when in use);
- Loss of electrical power;
- Mechanical failure (such as loss of aeration capacity, or outfall pump failure);

The frequency, duration and effect of these conditions will be managed through a combination of:

- System redundancy (e.g. additional aerator blowers for the aerated ponds, stand-by pump for the outfall pump);
- The ability to use the aerated ponds when the MABR/MBR is at capacity or during upset conditions.
- Enclosed inlet works;
- Operator training, and
- Plant management, maintenance and contingency planning.

4.5 Change in Odour Emissions with the Proposed Upgrade

The proposed upgrades to the WWTP are expected to reduce the odour emitted from the site. Emissions from wastewater treatment plant sources vary depending on the surface area which is exposed to the atmosphere and the odour potential of the wastewater.

The anaerobic ponds have been decommissioned therefore they will no longer be a potential source of odour. Similarly, the lower organic loading on the aeration ponds will also decrease emissions from these sources.

The MABR/MBR will be the main treatment processes. The MABR/MBR will have a smaller footprint (and open surface area) than the current pond-based system. The biological treatment processes will also be better controlled and monitored, which will further minimise the risk of adverse odours.

The MABR/MBR will provide a higher level of treatment compared to the existing treatment ponds. Treated wastewater will therefore have a lower organic content and consequently a lower odour potential. Odour potential of the treated wastewater pumped to the UV disinfection unit and the day storage pond would also be expected to be lower.

4.6 Summary of Emissions to Air

Table 4-1 identifies the main odour sources from the WWTP and provides an assessment of the effectiveness of the proposed odour control measures and the potential environmental significance of the odour discharges.

Table 4-1. Summary of odour emissions from the WWTP and proposed odour control procedures

Process	Odour Potential	Proposed Mitigation	Residual Odour Emissions to the Atmosphere
Inlet works	High	• Screening processes are enclosed • Screenings are washed to remove potentially odorous organic matter • Screenings and grit are covered in a bin prior to being removed from the site	Low
MABR/MBR	Medium	• On-line monitoring of critical parameters. • Aeration of the wastewater in the MABR (avoids anaerobic conditions) • MABR aeration system minimises surface disturbance and odour emissions • Aeration scouring of the MBR. • The treated wastewater is expected to a have low odour potential. The permeate will have a low organic concentration. • Use of aerated ponds when MABR/MBR is at capacity	Low
Aerated Ponds	Low (medium	• Oxygen will be naturally transferred from the atmosphere to the surface of	Low

Process	Odour Potential	Proposed Mitigation	Residual Odour Emissions to the Atmosphere
	odour potential during abnormal conditions when there is higher loading)	ponds helping to maintain a positive DO content in the wastewater and aerobic conditions. • Lower organic loading during normal operations • Stand-by blowers for aeration	
UV treatment	Low	• Process is enclosed. • The treated wastewater is expected to have a low odour potential (i.e. positive DO concentrations and low organic content).	Negligible
Day holding pond	Low	• The treated wastewater is expected to have a low odour potential (i.e. positive DO concentrations and low organic content). • The stored wastewater is expected to be discharged during the tidal flow hours minimising duration of storage times.	Low
Roadside holding ponds	Low	• The treated wastewater is expected to have a low odour potential (i.e. positive DO concentrations and low organic content). • The stored wastewater is expected to be discharged during the tidal flow hours minimising duration of storage times. • Only infrequently used during contingency events.	Low
Proposed outfall headwall and disposal area	Low	• The treated wastewater is expected to have very low odour potential (i.e. positive DO concentrations and low organic content).	Negligible
Existing outfall pump station	Low	• Process is enclosed. • The treated wastewater is expected to have a very low odour potential (i.e. positive DO concentrations and low organic content). • Duty and standby pump arrangement • Only infrequently used during contingency events.	Negligible

5 Assessment of Odour Effects

5.1 How Odour Causes Adverse Effects

For an odour discharge to create an adverse effect, it needs to be established that it is offensive or objectionable to an "ordinary person". It is usually insufficient for an odour discharge simply to be "detected" at or beyond the boundary of a site for an odour to be considered to have caused an adverse effect.

Guidance provided by the MfE GPG Odour, states that when assessing whether an odour is likely to have an adverse effect the FIDOL factors (Frequency, Intensity, Duration, Offensiveness and Location) should be considered. The FIDOL factors are universally used in New Zealand and internationally to assess odour effects. Consequently, a discernible odour does not necessarily mean the observed odour has an adverse effect. The FIDOL factors are summarised in Table 5-1.

Table 5-1. Summary of FIDOL factors

FIDOL Factor	Description
Frequency:	How often an individual is exposed to odour
Intensity:	The perception of the strength of the odour experienced. The intensity of odour experienced generally increases linearly with the logarithm of the odour concentration
Duration:	The length of any particular odour event
Offensiveness/character:	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, and the expected level of air quality amenity

Different combinations of these factors are significant when assessing adverse effects. Depending on the severity of an odour event, one single occurrence of a high intensity and/or highly unpleasant odour may be significant enough to create an adverse effect. This short-term impact is known as an "acute" odour effect. However, in other situations, an adverse effect may be created when a lower intensity and moderately unpleasant odour is experienced frequently over a long period. This longer-term impact is known as a "chronic" odour effect.

5.2 Odour Assessment Method

For this assessment, the potential odour nuisance effects from the WWTP have been based on the following:

- The sensitivity of the receiving environment,
- Separation distance between the WWTP and sensitive receptors,
- Review of the complaint record,
- Odour mitigation and management, and
- Consideration of odour effects with regards to the FIDOL factors.

The assessment approach is consistent with the GPG Odour guidance on methods assessing the effects of odour.

5.3 Sensitivity of Receiving Environment

5.3.1 Overview

As part of the "location" factor, the sensitivity of the receiving environment must be considered. Different locations have different sensitivities to odour. The degree of sensitivity to odour, in any particular location, is based on characteristics of the land use, including the time of day and the reason people are at the particular location (e.g. for work, home living or recreation). In a residential area, an acceptable odour frequency is likely to be much lower than would be expected in a rural area.

The MfE GPG Odour provides guidance with regards to the sensitivity of different land-use types to odour nuisance effects. Different land-uses are classified as having a 'high', 'moderate' or 'low' sensitivity to odour.

5.3.2 Odour sensitivity of areas surrounding the WWTP

Residential dwellings are located to the north-east and west of the site (refer to Section 3.2). These receptors are considered to have a high sensitivity to odour. Surrounding land to the south and east of the site is currently used for pastoral agricultural purposes however it is zoned 'General Residential' to allow for future development. This area may have a high sensitivity in the future when residential dwellings are established. Any residential dwelling established in the future will be located at least 260m from the WWTP.

Other receptors with high sensitivity to odour located within the surrounding area include the holiday apartments and childcare centre located to the north-west, and the Poihākena Marae located to the north-east of the site. The GPG Odour defines these locations as having a high sensitivity to odour. People of high sensitivity including children and/or elderly may be exposed in these areas at all times of the day and night.

Commercial buildings i.e. car repair shop, restaurant, surf shop, cable landing station to the west of the site have a moderate sensitivity to odour. The GPG Odour defines these locations as having a moderate to high sensitivity to odour. It is not expected that people would be at these locations for an extended period of time.

Some farm buildings are located to the west and south of the site. These locations will have a low sensitivity to odour, similar to the agricultural grazing land located within the immediate surrounding area of the WWTP.

5.3.3 Odour sensitivity of areas surrounding the proposed outfall location

The proposed outfall is located within the Wainui Reserve. The reserve is zoned 'Open Space' under the WDP. The outfall location and its surrounding area is primarily used for agricultural grazing purposes however there are a number of walking trails in the area. A proposed trail network i.e. mountain biking/walking/horse riding[3] will be located approximately 40m to the east of the proposed outfall headwall. There are also existing walking trails in the area: approximately 100m and 500m to the north-east and south-east of the proposed outfall respectively. The closest residential dwelling is approximately 390 m to the south-east of the proposed outfall location.

Agricultural grazing land located within the immediate surrounding area of the outfall will have a low sensitivity to odour. The GPG Odour defines rural areas as having a low sensitivity to odour from rural activities and moderate to high sensitivity to odours from other (non-rural) activities. Populations within rural areas are lower than in residential areas, which means there is a decreased risk of people being adversely

[3] *Raglan Coastal Reserves Management Plan for Papahua, Manu Bay and Wainui Reserves*, Waikato District Council, 9 August 2021.

affected by odour. People living in and visiting rural areas generally have a higher tolerance for odour emitted from rural activities.

Walking trails located within the surrounding area of the outfall will have a moderate sensitivity to odour. The GPG Odour defines recreational areas as having a moderate to high sensitivity to odour. People in recreational areas generally have moderate to high sensitivity. These locations are used for outdoor activities and exercises. People of all ages and sensitivity can be present at these locations. People at these locations may be more aware of the air quality amenity present due to its recreational purpose. However, people are only expected to be at these locations during the day.

5.4 Separation Distance Between WWTP Sources and Sensitive Receptors

5.4.1 Overview

Odours emitted from the WWTP will disperse and dilute with increasing distance downwind from the treatment processes. Therefore, the potential nuisance effect of any emitted odours from the site will also decrease with increasing downwind distance.

A summary of receptors within the surrounding area of the WWTP and the proposed discharge location is shown in Table 5-2. The locations of the receptors are shown in Figure 3-2. The separation distances in the table are based on the distance between receptor and the treatment process with the highest odour potential (i.e. inlet works, MABR/MBR, and aeration ponds). The new pump station, UV disinfection unit and storage ponds are considered to negligible sources of odour.

Table 5-2. Summary of receptors within the surrounding area of the WWTP and proposed discharge location.

Receptor no.	Sensitivity	Receptor	Separation distance from WWTP (m)
Separation distance from WWTP activity boundary			
A1	Low	339B Wainui Road - farm buildings	140
R1	High	339B Wainui Road	220
A2	Low	257A – farm building	260
R2	High	257B Wainui Road	260
R3	High	331B Wainui Road	300
R4	High	339A Wainui Road	310
R5	High	335 Wainui Road	340
A3	Moderate	257C Wainui Road – surf shop	360
A4	Moderate	331A Wainui Road – Raglan cable landing station	380
R6	High	257A Wainui Road	390
A5	High	248 Wainui Road – holiday apartments and restaurant	420
A6	High	248 Wainui Road – childcare centre	420

Receptor no.	Sensitivity	Receptor	Separation distance from WWTP (m)
R7	High	2B Rakaunui Street	490
A7	Moderate	86 Riria Kereopa Memorial Drive – car repair shop	510
R8	High	2C Rakaunui Street	560
R9	High	17 Rakaunui Street	560
R10	High	217 Wainui Road	580
R11	High	124 Wainui Road	610
A8	High	220 Wainui Road - Poihākena Marae	700
Separation distance from the proposed outfall headwall (m)			
	Moderate	Proposed trail network ie mountain biking/walking/ horse trek	40 E
R13	High	316 Wainui Road	390 SE
R14	High	17 Riria Kereopa Memorial Drive	560 SE
A6	High	220 Wainui Road - Poihākena Marae	1,200 E

Several Australian environmental protection authorities (EPA) and New Zealand agencies provide recommendations on separation distances between industrial land uses and/or wastewater treatment plants and sensitive locations in order to prevent land use conflicts occurring. No separation distances are defined for wastewater treatment plants within the Waikato Regional Plan.

Separation distances are not intended to replace the need for good pollution control but acknowledge that there may be unintended emissions at times, which should be allowed for. Separation distances are intended to minimise the effects of these unintended emissions.

Published separation distances are based on the type of WWTP and may at times consider specific treatment and odour control technologies installed on site. Separation distances are also applied in all directions and do not consider the influence that meteorological conditions and topography may have on the dispersion potential of any odours, or the relative odour potential of different site operations.

Separation distances are generally considered to be conservative and therefore often used as an initial screening method for assessing whether an activity is likely to have an adverse nuisance effect.

Separation distances published by the Victoria Environmental Protection Authority (Vic EPA) are widely used in New Zealand.[4] The Vic EPA methodology for ‘mechanical/biological wastewater plants’ was used as the proposed MABR/MBR will be the main treatment unit at the WWTP. A separation distance of approximately

[4] Separation Distance Guideline Publication 1949, published by Environment Protection Authority Victoria on August 2024

210m away from the activity boundary of the upgraded WWTP is recommended[5]. The Vic EPA recommended separation distance from the WWTP is shown in Figure 3-2.

5.4.2 Proposed WWTP

No residential dwellings are located within the 210m separation distance recommended by Vic EPA (refer Section 3.2). The closest residential dwelling is located approximately 220m away from the WWTP. Based on the Vic EPA separation distance, it expected that any odour discharged from the WWTP would not have adverse nuisance effects at any of the nearby dwellings. The topography of the surrounding area would also help channel any emitted odour away from these residents during poor dispersion conditions.

The closest building structures to the WWTP are the farm buildings located approximately 150m to the south of WWTP. However, these structures are not used for residential purposes and are considered to have low sensitivity to odour. The structures are also considered sufficiently distanced from the WWTP that any emissions are unlikely to be considered offensive or objectionable.

5.4.3 Proposed Outfall Location

The closest dwelling to the proposed is located more that 390m to the south of the outfall. Emissions from the outfall and disposal area are expected to be minimal. Due to the large separation distance and low odour potential of the discharge, any emitted odour is highly unlikely to have an effect at the residential property.

The Vic EPA has not published any recommended separation distances for the disposal of tertiary treated wastewater. However, the Vic EPA has recommended a separation distance of 50m for the disposal secondary treated wastewater. The separation distance to the nearest dwelling is 7.8 times larger the Vic EPA recommended separation distance.

5.5 Odour Complaint Records

Complaint records do not provide conclusive evidence of whether a nuisance odour is present. However, they do provide an indication of the relative impact of any emitted odour. Raglan WWTP has not received any odour complaints within the past five years. The lack of odour complaints indicates that the odour which is currently emitted from the site is sufficiently dispersed and diluted to not have any adverse effect on the sensitive receptors located within the surrounding area.

The proposed upgrades to the WWTP are expected to result in lower odour emissions and therefore lower offsite odour concentrations. The current complaint record would also indicate that any emissions from the upgraded plant would unlikely have an adverse effect.

5.6 Management, Monitoring and Contingency Procedures

A management plan outlines procedures, policies, and strategies for operating and maintaining the WWTP site. The existing discharge consent requires the implementation of a management plan for the site.

[5] Separation distance calculated for a mechanical/biological wastewater plants for a projected population of 8,821 people in the year 2055. Calculation of 10 x (8821)1/3 = 8,821. The activity boundary of the WWTP is defined as the area which includes all potential sources of odour from the WWTP (ie inlet works, aeration ponds, and MABR/MBR).

It is recommended that the proposed upgrades to the WWTP (refer Section 2.2) are incorporated in the existing management plan. The main changes to the management plan will be regarding the proposed MABR/MBR unit detailing: inspections and maintenance procedures; and contingency methods.

In general, a management plan must include the following:

- The management and operation procedures at the WWTP;
- Resource consent responsibilities;
- Inspections and maintenance procedures;
- Contingency methods for plant malfunctions;
- Complaint investigation and resolution procedures;
- Reporting procedures; and
- Training procedures for operators regarding the methods to be used to control odours.

5.7 FIDOL Factor Assessment

5.7.1 Frequency and duration

The local topography of the WWTP and the surrounding area indicate that winds will be channelled in a northly direction along the valley towards the Whāingaroa Harbour (refer Section 3.3).

Peak offsite odour concentration would be expected to occur during calm and low wind speeds (<1.5m/s) conditions. Wind distribution recorded at the Port Taharoa meteorological station (refer Section 3.4) indicates that sensitive receptors located to the north-west, north-east and west of the WWTP will only be infrequently downwind when low wind speed conditions occur. Rural residential dwellings to the west will be downwind during low wind speeds for approximately 0.5% of the time, dwellings to the north-east will be downwind approximately 0.2% of the time, and dwellings to the north-west will be downwind approximately 0.5% of the time. Additionally, receptors to the north-west and north-east are shielded from the WWTP site by a line of hills, further reducing odour effects at these locations.

5.7.2 Intensity

Emitted odour will disperse and dilute with increasing downwind distance. Therefore, the intensity of any odour experienced will decrease with increasing separation distance from any odour source at the site.

No residential dwellings are located within the 210m separation distance recommended by Vic EPA surrounding the activity boundary of the WWTP (refer Section 3.2 and 5.4). The closest residential dwelling is approximately 220m away from the WWTP activity boundary. Any emitted odour will be well dispersed and diluted before reaching any dwelling. The odour experienced at these dwellings is unlikely to be of any intensity to have any adverse effect.

Odour emissions from the upgraded WWTP are expected to be lower than what is emitted from the existing plant. The odour complaint records for the existing WWTP would support the assessment that intensity of any odour experience outside the site is unlikely to be considered offensive or objectionable.

5.7.3 Offensiveness

Offensiveness is subjective and perception of odour varies from person to person. In general, the odour emitted from wastewater treatment plants is considered to be unpleasant, particularly if conditions have

become anaerobic[6]. If odours are to be experienced beyond the WWTP boundary, they are likely to be considered moderately to very unpleasant.

The odour emitted from MABR/MBRs are generally have an “earthy” type of odour and not the more offensive “rotten egg” or “sewer” type odour associated with anaerobic wastewater. Anaerobic conditions are avoided by the aeration of the wastewater in the reactor.

The aeration ponds are also aerated which avoids anaerobic conditions from occurring.

The complaints records for the site have been reviewed (refer Section 5.5). These records help provide an indication of the relative offensiveness of the odour currently emitted from the site. No odour complaints have been received within the past five years. This suggests that any odour which is currently experienced offsite is not considered to be offensive.

Emissions of odour are expected to decrease from the upgraded MABR/MBR plant. The risk of anaerobic conditions occurring in MABR/MBR is minimised by system redundancies and process monitoring.

Overall provided that proposed odour management plant procedures are implemented, the offensiveness of any odour effect at any dwelling is expected to be low.

5.7.4 Location

Sensitivity of the receiving environment is discussed in Section 5.3. Overall, the surrounding area has a low sensitivity. The nearby rural dwellings are the sensitive receptors that would be most impacted by any emissions. However, these dwellings are located more than 220m from the WWTP.

The WWTP is considered to be appropriately located. Based on the WDP zoning the sensitivity of the receiving environment is not expected to change to any extent. Further residential development may occur to the east and south of the site, but any future dwellings will be at least 260m from the WWTP, and at higher elevation.

The proposed outfall is located within the Wainui Reserve. The area surrounding the proposed discharge location has a low sensitivity. The separation distance to the closest dwelling is approximately 390m. The outfall and disposal area are appropriately located. Any emissions from the outfall and disposal area are highly unlikely to have adverse odour effects

5.8 Summary of Odour Assessment

Based on consideration of the FIDOL factors, emissions of odour from the WWTP and the outfall disposal area are not expected to have an adverse effect provided that proposed mitigation methods are implemented and maintained. Overall, it is concluded that emissions are appropriately mitigated and no offensive or objectionable odours are expected to be experienced outside the site boundary during normal operating conditions.

Higher odour emissions may occur during abnormal operating conditions, however the risk of these events occurring will be minimised through plant design, monitoring and management procedures. The separation

[6] Environment Agency for England and Wales (2002) Integrated Pollution Prevention and Control (IPPC) Draft Horizontal Guidance for Odour, Part 1 Regulation and Permitting

distance between the WWTP and nearby receptors and the site topography would further minimise the risk of any dwelling being adversely affected.

6 Conclusion

Watercare is proposing to upgrade the Raglan WWTP which will involve the installation of a new MABR/MBR plant, inlet works, pump station, and UV disinfection plant. A new outfall headwall will also be constructed to the west of the site in the Wainui Reserve.

The existing anaerobic ponds have been decommissioned as part of the proposed upgrades. The existing aerated ponds will be retained but will only be used to treat wastewater when flows exceed the capacity of the MABR/MBR. WAS from the MBR will be pumped to the ponds.

The primary discharge to air from the upgraded WWTP will be odour. The inlet works and the proposed MABR/MBR will be the primary sources of any odour. The aeration ponds will be retained but will only treat incoming wastewater as a contingency when flows exceed the capacity of the MABR/MBR. The existing anaerobic ponds have been decommissioned and are no longer sources of odour. Overall, it is expected that the odour emitted from the upgraded plant will be lower than emitted from the existing plant configuration (due to changes in the processes).

The FIDOL factors have been used to assess the potential impact of the proposed upgrade of the WWTP and the new outfall and disposal area. Overall, it is concluded that emissions from the upgraded WWTP and outfall would not have an adverse odour effects or be considered offensive or objectionable provided that proposed mitigation measures are implemented and maintained.