In the Environment Court of New Zealand
Auckland Registry

I Mua I Te Kōti Taiao O Aotearoa
Ki Tāmaki Makaurau

ENV-2023-AKL-160

Under	the Resource Management Act 1991
In the matter of	An application for a direct referral to the Environment Court under section 87G of the Act for an order granting the applicant's resource consent applications to construct and operate a new asphalt plant at 54 Aerodrome Road, Mt Maunganui, together with an application for consent to authorise the continued operation of the existing asphalt plant on the site pending construction of the new plant
Between	**Allied Asphalt Limited**
	Applicant
And	**Bay of Plenty Regional Council and Tauranga City Council**
	Consent Authorities

Statement of Reply Evidence of Jennifer Simpson

Date: 26 April 2024

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Qualifications and experience

1 My full name is Jennifer Mary Simpson.

2 I hold the position of Technical Director - Environmental Engineering at Tonkin & Taylor Ltd. My qualifications and experience are as set out in my evidence in chief dated 29 February 2024

3 I confirm that in preparing this reply evidence I have complied with the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023.

Scope of evidence

4 Further technical information was requested from me at the air quality expert conferencing on:

(a) Updated dispersion modelling using the BOPRC 2021 meteorological modelling dataset (previous modelling used a 2014 to 2016 met dataset provided by BOPRC);

(b) Updated dispersion modelling considering air quality effects at worker accommodation within the Airport.

(c) Comparison of wind roses from the 2021 meteorological modelling dataset for the Allied site and the Airport weather station (in the context of understanding the differences between the 2014-2016 meteorological modelling dataset and the 2021 dataset).

5 This further information is provided in Attachment Seven and the implications for the conclusions of the Air Quality assessment are summarised in paragraph 9.

6 This reply evidence responds to the evidence of the following witnesses, where relevant to my evidence in chief and expertise:

(a) Mr Murray

(b) Mx Wickham

(c) Mr Shoemack

(d) Dr Wilton

(e) Mr Scott

(f) Ms Jones

(g) Ms Ngātuere

(h) Mr Ngātuere

(i) Ms Hughes

(j) Ms Kelway

7 I have structured my reply under the following topic headings:

(a) Modelling approach

(b) Environmental setting

(c) Background (baseline) air quality and assessment of cumulative effects

(d) Assessment criteria

(e) Assessment methodology, including key assumptions

(f) Odour effects from use of Reclaimed Asphalt Paving (RAP) and resin

(g) Adoption of the Best Practicable Option to minimise discharges to air

(h) Air quality effects of additional truck movements

(i) Acceptable risk criteria

(j) Air quality impacts at Whareroa Marae

(k) Interpretation of the NESAQ in relation to the existing asphalt plant

(l) Proposed conditions of consent.

8 A number of the issues raised in the evidence of 274 parties are technical in nature. Where appropriate, I have set out supporting technical information and analysis in an attachment and summarised the key points in the main body of this evidence.

Further dispersion modelling

9 The further dispersion modelling requested at the expert conferencing is set out in Attachment Seven. In summary:

(a) I consider that Mr Murray's concerns that use of the BOPRC 2014 - 2016 meteorological dataset "*may underestimate ground level concentrations in relation to alternative meteorological data that is* *available*"[1] have been addressed. All modelled concentrations for the existing plant are lower using the BOPRC 2021 meteorological dataset. For the proposed plant, longer term average model predictions are lower but there is a single unusual meteorological day in the 2021 dataset that generates higher modelled 24-hour concentrations than any other day in the 4-year meteorological period. In my opinion, this single higher modelled day does not alter the overall conclusions of the Air Quality Assessment, as it is unlikely that it would occur in reality and very unlikely that it would coincide with worst case background concentrations.

(b) The modelling has been repeated to include the airplane hangars within the Airport Designation, where residential activity may occur (240 Aerodrome Road, Dakota Way and Kittyhawk Way). Although most of the hangars at 240 Aerodrome Road and Dakota Way are used for business purposes, and there are no people living there, all locations have been considered for completeness. The worst-impacts of these locations are at the hangars at 240 Aerodrome Road. The predicted worst-case concentrations are higher than for the receptors considered in the Air Quality Assessment, but the overall conclusions of the assessment do not change.

(c) The provision of wind roses was to help explain the slight technical differences in the way the 2021 meteorological modelling dataset was developed compared to the 2014-2016 dataset[2]. In my opinion, neither meteorological dataset is preferable to the other and it is useful to have the additional years' modelling results.

Modelling approach

10 Mx Wickham states:[3]

> I support the Allied AQA conservative approach of modelling with CALPUFF for continuous operation at maximum load for assessment of annual average exposure. I agree with Ms Simpson that probabilistic scenario development is not needed.

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[1] Murray, para 29

[2] In essence, the main difference is that data from the weather station at the Airport has a greater radius of influence in the 2021 dataset compared to the 2014-2016 dataset

[3] Wickham, para 41

11 However, they also state that:[4]

> … the actual benefits of the new plant will be less than the modelling suggests because the modelling adopts a conservative approach of assuming maximum throughput for continuous operation and this artificially inflates the difference between the two scenarios.

12 Therefore, I understand Mx Wickham to be agreeing that a conservative approach is appropriate while criticising it for “artificially inflating” air quality effects of both plants, and consequently the difference in effects.

13 The conservatism in the air dispersion modelling is an important factor for the interpretation of the Air Quality Assessment given statements in evidence such as:

(a) Mr Shoemack’s statement that he considers:[5]

> … any additional pollution to this air shed is completely unacceptable.

(b) Ms Jones statement that[6]:

> Clear the Air does not accept that Allied Asphalt can cleanly operate a few hundred meters upwind from our schools safely, without endangering the health of our community.

14 Understanding the conservatism in the dispersion modelling is also important because the model predictions are used in Dr Denison’s HRA, and therefore the conservatism follows through into the estimates of health risk.

15 In her Appendix 1, Mx Wickham presents annual emission rates for a “maximum” scenario (continuous operation) and “corrected” emissions adjusting for more realistic hourly plant throughputs and operating hours. This same type of adjustment can be used to provide a more realistic estimate of annual average concentrations, to account for the plant not operating continuously.

16 This approach cannot be used to adjust shorter averaging period model predictions (1-hour or 24-hour) but I consider it is a reasonable basis to

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[4] Wickham, para 31

[5] Shoemack, para 45

[6] Jones, para 34

adjust annual average model predictions. The adjusted annual average represents the "central tendency" of the annual average model predictions. This means that the concentration may be slightly higher or lower in any given year based on the year-to-year variability in meteorology in the hours that the plant is operating, but over the longer term would be close to this value (if the plant operated at 300,000 TPA).

17 The model adjustment factors are shown in **Table 1**. The annual average model predictions presented in the Air Quality Assessment can be multiplied by these adjustment factors to give a more realistic estimate of annual average concentrations. These more realistic estimates are between 10 and 25% of the original model predictions.

Table 1 : Model adjustment factors to account for non-continuous operation

Plant	**Annual production**	**Adjustment factor to account for non-continuous operation**	
		NO_2	**PM_{10}**
Existing plant	68,000 TPA	10%	11%
Proposed plant	300,000 TPA	17%	23%

18 The adjustment factors for NO_2 shown in **Table 1** can be applied to the annual average concentrations of any of the pollutants considered in the modelling study (apart from PM_{10} and $PM_{2.5}$).

19 Adjusted model predictions, for annual average PM_{10} and NO_2 are set out in Attachment One. It is important to note that for the proposed plant these estimates represent the maximum envelope of effects that would be authorised by the consent being sought. In this sense they are still highly conservative rather than "realistic" because, as explained in Mr Palmer's evidence, annual production is expected to increase incrementally with demand. Therefore, for most of the term of the consent the effects will be much lower.

20 Mr Scott states that:[7]

> The report intimates that any increased emissions in the airshed are acceptable because they are well

[7] Scott, para 104

> below the standards. In the context of a polluted airshed, any increased burden of contaminants on the public, noting the direction set out in Policy 12 of the RNRP (in particular (b), (d) and (e)), is unacceptable.

21 First, I note that the MMA is a polluted airshed for PM_{10} only. Although Policy AQ P12 refer to "activities which discharge PM_{10} and other particulates", in my opinion the later references to a Polluted Airshed in clauses (1), (2) and (3) and to minimising discharges of PM_{10} to air in (6) make it clear that this policy relates specifically to an iterative management approach to manage PM_{10} and not all air pollutants from sites that also happen to discharge PM_{10}. In my opinion, the proposal by Allied to replace the existing asphalt plant with a new plant that incorporates the Best Practicable Option to minimise discharge to air of particulate matter is consistent with the policy direction in AQ P12.

22 To Mr Scott's second point, the Air Quality Assessment should not be interpreted as saying that "any" increased emissions in the airshed are acceptable because they are well below the standards. Possibly Mr Scott has misinterpreted the approach in my evidence of expressing the modelled contributions from the site and cumulative effects as a percentage of an air quality guideline. This is a common method to provide context to modelled concentrations. It is not intended to mean that the air quality guidelines are being used as "levels to pollute up to", as suggested by Mr Shoemack.[8]

23 However, in my opinion, subject to the best practicable option being used to minimise discharges to air to the greatest extent practicable, it is possible to establish that a level of additional (incremental) effect is so low that it is acceptable, even for pollutants where background concentrations may be elevated.

24 In a polluted airshed, Regulation 17(1) of the NESAQ sets a significance threshold of 2.5 $\mu g/m^3$ (24-hour average), or 5% of the air quality standard, for the incremental contribution of new discharges. Where the modelled concentration is less than 5% of the standard the discharge is considered insignificant and is not required to be offset.

25 This approach is similar to recent guidance published by the Victoria (Australia) EPA[9] where the modelled particulate concentrations at a

[8] Shoemack, para 30

[9] EPA Victoria. (2022). Guideline for assessing and minimising air pollution in Victoria (for air pollution managers and specialists). Publication 1961. p 104

sensitive receptor can be compared with a value of 4% of the relevant air pollution assessment criteria to determine their significance.[10]

26 The most conservative approach I am aware of is guidance from the UK Institute of Air Quality Management[11]. Their guidance includes a matrix to describe long term (annual average) air quality impacts considering both the cumulative air quality (including the effects of the project) and the incremental contribution of the project. They recommend expressing the project contribution at a sensitive receptor as a percentage of the assessment criterion as a whole number with 0% (i.e. less than 0.5%) of the assessment criterion being considered negligible in every case (even where the cumulative concentration, which will be almost entirely due to background, is significantly above the assessment criteria). Where the cumulative air quality effects are less than 75% of the assessment criteria, they consider a project contribution less than 5% can be described as negligible.

27 In my opinion, where an effect is less than 1% of an air quality standard or guideline, it is reasonable to describe the effect as negligible (compared to that standard or guideline).

28 The adjusted model results for annual PM_{10} and NO_2 shown in Attachment One are all less than 1% of the relevant New Zealand guidelines and standards and the WHO 2021 guidelines. It is important to note that the predicted effect is at a specific worst-case receptor and not on the airshed as a whole.

Environmental setting

29 Mr Shoemack states that there are "*numerous vulnerable groups within and adjoining the MMA*"[12]. In my opinion it is important to make a clear distinction between the MMA, which is largely zoned industrial and has restrictions on residential and other sensitive land uses, and areas adjacent to the MMA.

30 The Mt Maunganui airshed largely comprises the Port Industry and Mt Maunganui industry zones in the Tauranga City Plan. Residential activities

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[10] In Victoria, the Environmental Reference Standards for PM_{10} (annual and 24-hour average) and $PM_{2.5}$ (24-hour average) are the same as in New Zealand, but the $PM_{2.5}$ annual standard is 8 µg/m^3 compared to the Proposed NESAQ of 10 µg/m^3.

[11] Environmental Protection UK and Institute of Air Quality Management. (2017). Land-Use Planning & Development Control: Planning For Air Quality. p 25

[12] Shoemack, para

are a non-complying activity in these zones. Other than the worker accommodation in hangars within the Airport Designation, I am not aware of any residential activities within the MMA in the vicinity of the Allied site.

31 Mr Murray[13] states there may be locations where people are living in the industrial zone that are not easy to identify. As a resource consent would be required, lawful residential activities should be relatively easy to identify, and none have been identified in consultation with BOPRC. If people are living unlawfully within the Industry zone then, in my opinion, this would be a compliance matter for Tauranga City Council.

32 In the Air Quality Assessment, the only sensitive activities (i.e. locations where vulnerable groups may be present) identified within 500 m of the Allied site were the Little Einstein's Montessori pre-school at 1 MacDonald Street (approximately 550 m from the Site, on the eastern edge of the MMA) and the worker accommodation at de Havilland Way (approximately 480 m).

33 In the expert conferencing, it was identified that there are also people living in some of the airplane hangars within the airport designation, particularly on Dakota Way (approximately 300 m from the Site) and Kittyhawk Way (approximately 450 m from the Site). I understand from Mr Batchelar that residential use of these hangars has been provided for through the Outline Plan of Works for the Airport designation. Residential activities are intended to be ancillary to people's work at or related to the airport. This should mean there are unlikely to be vulnerable groups such as children or the elderly living here. I understand the restriction regarding ancillary use is reflected in the lease conditions for the hangars. However, as it is unclear whether these lease conditions are being enforced by the Airport, I have assessed air quality impacts on the basis that these hangars are sensitive locations.

34 In my opinion, from an air quality perspective, the Allied site is appropriately located within an industrial area and well separated from sensitive activities.

Intensification of the residential area adjoining the Mt Maunganui Industrial area.

35 Mr Scott's evidence explains that:[14]

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[13] Murray, para 21

[14] Scott, para 60

> In accordance with the direction of the National Policy Statement for Urban Development (NPS-UD), it is anticipated that the plan change will enable high-density residential development of up to 6 storeys as a permitted activity within 1km of the site, with medium-density residential of 3 storeys in height even closer. This aligns with the Mount to Arataki Spatial Plan, which has already been adopted.

36 This issue is also raised by others including Ms Jones[15], Ms Ngātuere[16] and Ms Hughes[17].

37 In my opinion, intensification of the existing residential area is not an issue for this application, because:

(a) It is not relevant to effects of the existing plant because that plant will be closed before residential intensification occurs.

(b) The impacts of emissions in the residential area from the proposed asphalt plant at the Allied site are very small compared to health-based assessment criteria and there should be no adverse effects of odours.

(c) Residential activities are not being brought any closer (which might give rise to increased effects).

38 As the asphalt plant emissions are from a tall stack, an additional model run has been undertaken to confirm that the effects of the proposed asphalt plant on air quality at higher floors of any future 6-storey building are also acceptable (by default the model produces ground level concentrations). I have only undertaken this assessment for the proposed plant, as the existing asphalt plant would be decommissioned by the time this development occurred. I have relied on Mr Batchelar to advise me on the proposed location and height for high-density residential development at Bayfair.

39 As I would have expected given the distance from the site, the modelling set out in Attachment Seven (Section 3) confirms that modelled concentrations on upper floors of a 6-storey building in the area indicated in Plan Change 33 would not be higher than concentrations at ground level. The effects of emissions from the Allied site on air quality at the locations

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[15] Jones, para 28

[16] Awhina Ngātuere, para 26.

[17] Hughes, para 18

where 6-storey development could occur are lower than the effects at worst case locations considered in the Air Quality Assessment.

Alternative locations

40 I understand that Tauriko has been suggested by some of the 274 parties as a possible alternative location for an asphalt plant and this has been assessed by Ms Makinson from a traffic perspective.

41 In 2019 I supervised the preparation of an air quality assessment, including air dispersion modelling, for a resource consent application for discharges to air from a petfood manufacturing company. The main issue with the discharges to air from this activity were odour. The pet food company was considering purchasing a property on Taitimu Road in Tauriko. The application was never lodged with Bay of Plenty Regional Council.

42 From that assessment, I understand that key features of the Tauriko area relevant to the dispersion of air emissions are:

(a) Complex terrain with differing drainage flows, in particular towards the Wairoa River valley to the west, depending on the particular location within the industrial zone.

(b) Modelled wind patterns showing the effects of channelling by terrain. As such, winds are likely to be quite variable across the area. At the location that was being considered, the air flow was predominantly south southwesterly but there was also a relatively high frequency of light south southeasterly winds (more than 10% of hours were predicted to be a light south southeasterly (less than 2 m/s)). Calm conditions (less than 0.5 m/s) were predicted to occur approximately 3% of the time.

43 I am aware that under Plan Change 33 Tauranga City Council is proposing to rezone land to the west and northwest of the existing industrial area (Tauriko West) from rural to residential[18]. This will significantly increase the density of sensitive receivers downwind of the current industrial area under the moderately frequent light south southeasterlies.

44 I also understand that the developers are seeking to extend the Tauriko industrial zone to the south of Belk Road[19]. Discharges to air in this area

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[18] https://www.tauranga.govt.nz/portals/0/data/council/city_plan/plan_changes/pc33/variation/tauriko-west-factsheet.pdf

[19] https://letstalk.tauranga.govt.nz/projects/private-plan-change-35-tauriko-business-estate-stage-4

will tend to be channelled down the Wairoa River valley towards the proposed residential area.

45 Compared to the Mt Maunganui industrial area, the Tauriko meteorological data indicates a higher frequency of light to moderate winds, which are typically the worst case for dispersion of emissions from tall stacks. Given its inland position, I would also expect a higher frequency of calm, stable inversion conditions compared to a more exposed coastal location.

46 Overall, I do not consider the Tauriko area has any advantages with respect to air quality effects compared to the Mt Maunganui industrial area, and has some features that would suggest it could be worse, depending the particular location of the emitting industry within the Tauriko Industry Zone and whether proposed future residential development occurs.

Background (baseline) air quality and assessment of cumulative effcts

47 Dr Wilton states:[20]

> The report uses air quality data from monitoring sites to estimate exposures in surrounding areas. This is the method used in health risk assessments and is appropriate as long-range transport of particulate, including fugitive dust sources, is known to occur over significant distances including across continents. The MMA is the most comprehensively monitored airshed in the country and thus extrapolation distances (up to five kilometres) are significantly less than what is typical for risk assessments.

48 The cumulative effects of the emissions from the existing and proposed asphalt plants have been assessed by combining the model predictions with representative background concentrations, which represent the baseline air quality if the Allied plant were not there. For PM_{10}, the monitoring data at de Havilland Way includes the effects of the existing Allied plant. Baseline air quality can be estimated by deducting the modelled impacts of the existing plant.

49 The most-impacted locations for the effects of the Allied Plant are within the MMA and I have used monitoring data from within the MMA (de Havilland Way) to characterise existing air quality (which includes the effects of the Site) and background air quality (without the effects of the Site) at these locations.

50 However, in my opinion, a more nuanced approach is required to assess cumulative effects in the residential area west of the Site. This is because

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[20] Wilton, para 22

the relative contribution of different sources to air quality in the residential area differs from areas inside the MMA due to the combined effects of separation distance and meteorology.

51 Mx Wickham states that[21]

> Based on the Mount Maunganui air quality review and [ESR] HRA, I consider that existing air quality in the Mount Maunganui area is degraded in comparison with other residential areas of Tauranga, with associated adverse health effects.

52 In February 2024, BOPRC commenced air quality monitoring for PM_{10} using a reference method for comparison with the NESAQ in the residential area of Mt Maunganui. The monitoring has not been going long enough to provide useful information for this Hearing. As such, it is necessary to use monitoring date from locations in the MMA (which can be influenced by nearby sources) to infer air quality in other locations.

53 The ESR health risk assessment assumed that PM_{10} air quality across the entire Mt Maunganui residential area is represented by the monitoring data at Rata Street (using a value of 20 µg/m^3 annual average). PM_{10} air quality at Rata Street and Whareroa Marae is compared in **Table 2**. This illustrates how PM_{10} concentrations can vary widely across the MMA. In my opinion, the ESR Report could equally have chosen to use PM_{10} monitoring data from Whareroa Marae as representative of air quality across Mt Maunganui (outside the MMA). In both cases there would be uncertainty (and arguably neither is "correct"), but there would have been a significant difference in the conclusions because annual average PM_{10} concentrations at Whareroa Marae are lower than in Otumoetai.

Table 2 : Comparison of annual average PM_{10} concentrations at Rata Street and Whareroa Marae

Year	Annual average PM_{10} concentration (µg/m^3)		NZ AAQG / WHO 2021 (µg/m^3)
	Rata Street	Whareroa Marae	
2019	20.4	17.2	20 / 15
2020	18.0	14.2	

[21] Wickham, para 25

2021	19.3	11.4	
2022	21.1	9.7	
2023	19.7	7.6	

54 To illustrate the differences in air quality patterns in the Mt Maunganui residential area compared to Rata Street, I requested the monitoring data from the BOPRC low cost sensor network. BOPRC have provided me with this data on the proviso that I only use it to show patterns or trends, and not actual concentrations. The reason for this is that the low cost sensors are not a reference method and should not be used to compare with air quality guidelines or standards.

55 Attachment Two shows polar plots for PM_{10} at three of the low cost sensors and the Rata Street monitor for the period May 2023 to April 2024[22], overlaid on an aerial map. Polar plots are similar to a pollution rose and illustrate the pollutant concentration (colour), wind speed (distance from the centre) and wind direction on a single plot. As the low cost sensor stations do not measure wind speed and direction, I have used Metservice weather data from the Airport to represent winds at these locations.

56 I have included two sets of polar plots, one showing the maximum short term concentration for each wind speed/direction combination and the other showing the average concentration over the monitoring period for each wind speed/direction combination. The patterns are similar at the three low cost sensor sites and show that the highest peak and highest mean concentrations occur under onshore winds.

57 In my opinion, based on the directions and wind speeds, these plots show that the dominant source influencing PM_{10} concentrations at the low cost sensor locations in the residential area is marine aerosols. The polar plot for Rata Street shows a similar influence of marine aerosol but (importantly) an additional strong signature from local sources to the southwest.

58 The difference in patterns of air quality in the residential area is particularly important in relation to cumulative effects of the Allied emissions. For particulate matter, the maximum short term impacts of the Allied site cannot

[22] The date periods vary slightly for the different locations and are shown on the Figures in Attachment Two

coincide with high background concentrations as they occur under the opposite wind directions.

59 However, air quality within the MMA has informed the policy framework under Plan Change 13 and is an important context for this application. I am also concerned that both Ms Kelway and Dr Wilton have conflated air quality in the industrial area (where there is monitoring data available) and air quality in the wider residential area (where air quality monitoring has only recently started).

60 In my opinion, the key issues for this application in relation to background concentrations and cumulative effects are that:

(a) the incremental effects of the proposed Allied plant are so small that they do not make any material difference to cumulative effects.

(b) in relation to PM_{10} and $PM_{2.5}$, the overall proposal to replace the existing plant will result in a positive effect on cumulative air quality.

Assessment criteria

61 Mr Shoemack states that[23]:

> In my opinion the WHO's 2021 annual guidelines in respect of PM_{10} and $PM_{2.5}$ are the most appropriate criteria against which to assess air quality in the MMA to ensure the protection of human health. They provide the most up to date, evidence-informed recommendations on air quality levels that "pose important risks to public health".

62 I do not agree that the WHO 2021 guidelines (or the New Zealand standards and guidelines for averaging periods of 24 hours or greater) are appropriate as assessment criteria within the MMA, except at the small number of sensitive locations that have been identified. In my evidence in chief I referred to following good practice in relation to where the air quality standards and guideline apply[24]. To further clarify this, I have reproduced the relevant table from the good practice guidance in Table 3. Although it is not clearly stated, annual average standards apply at the same locations as 24-hour standards, as this relates to the potential for people to be exposed continuously over the averaging period. Neither 24-hour or annual

[23] Shoemack, para 28

[24] Evidence in chief, para 47

average guidelines/standards apply in “industrial areas where residential use is not allowed”.

Table 3: Location and applicability of the ambient standards for assessment purposes[25]

Averaging period	Locations where assessment against the ambient standards should apply	Locations where assessment against the ambient standards should not apply
1 hour	This includes any outdoor areas where the public might reasonably be expected to spend one hour or longer, including pavements in shopping streets, as well as accessible facades (eg, balconies, terraces).	Any industrial premises that have resource consents (for that pollutant).
8 hours	This includes all outdoor locations where members of the public are likely to be exposed for eight hours as well as the facades of residential properties, schools, hospitals, libraries, etc.	Any industrial premises that have resource consents (for that pollutant). Any location where people are not likely to be exposed for 8 hours – for example roads and footpaths.
24 hours	This includes all outdoor locations where members of the public might reasonably be exposed for 24 hours.	Any industrial premises that have resource consents for that pollutant. Any location where people are not likely to be exposed for 24 hours – for example roads, footpaths and industrial areas where residential use is not allowed.
All		In any enclosed space (ie, not in the open air), including: • indoors • inside tunnels • inside vehicles.

63 Mr Shoemack may have intended to refer more broadly to the use of the WHO 2021 guidelines for PM_{10} and $PM_{2.5}$ in preference to the New Zealand standards and guidelines.

64 The Air Quality Assessment noted the following regarding the WHO 2021 guidelines[26]:

> In September 2021 the WHO published updated global ambient air quality guidelines (WHO 2021 guidelines). The WHO 2021 guidelines are intended to be used as science-based recommendations to policymakers at a national or local level for consideration in setting their own standards and frameworks for managing air pollution. The WHO

[25] Reproduced from Ministry for the Environment. (2016). Good practice guide for assessing discharges to air from Industry. Wellington p 47

[26] Tonkin & Taylor. (2024) Updated Air Quality Assessment – Existing and proposed asphalt plants, Mt Maunganui. p 28

2021 guidelines are generally lower than the current New Zealand air quality standards and guidelines.

At the time of writing, the Ministry for the Environment has not provided any indication of the regulatory or policy response in New Zealand to the WHO 2021 guidelines. As such, it is considered premature for these guidelines to be adopted as assessment criteria. However, the modelling predictions have been considered against the relevant WHO 2021 guidelines to provide a complete assessment.

65 The status of the WHO 2021 guidelines does not affect my conclusions in relation to air quality effects of Allied's existing and proposed asphalt plants. This is because they have been considered in the Air Quality Assessment and the effects of the emissions are very small in comparison to both the New Zealand standards and guidelines and the WHO 2021 guidelines. However, in my opinion, it is important to note that:

(a) adoption of the WHO 2021 guidelines will not be a straightforward exercise and will require careful consideration of costs and benefits; and

(b) the policy response will need to address how discharges from industry will be managed within the Resource Management Act framework, particularly for NO_2 and particulate matter where industrial sources are generally only a small contributor to existing levels[27].

66 Internationally, I understand that the European Commission is the most advanced in considering a policy response to the WHO 2021 guidelines. They have noted that more than 70% of their monitoring sites do not meet the WHO 2021 $PM_{2.5}$ guideline and would not be able to meet it with currently available technology. They are considering three alternative policy options, the most aggressive of which would see adoption of the WHO 2021 guidelines by 2030, with alternative approaches to phase the guidelines in as late as 2050.

67 Similarly, any future change to the New Zealand ambient air quality standards to reflect the WHO 2021 guidelines would require a regulatory impact statement that considers the costs and benefits of various policy approaches.

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[27] For example, the Health and Air Pollution in New Zealand study found that one third of the health costs attributable to $PM_{2.5}$ was from marine aerosols.

68 In the context of a resource consent application, the WHO 2021 guidelines can be used to help characterise the scale of air quality effects but, in my opinion, they should not be treated as pass/fail criteria.

Approach in Regional Natural Resources Plan (RNRP)

69 Objective AQ 02 in the RNRP specifically refers to air quality meeting the NESAQ [28].

70 As an air quality specialist reading the RNRP, I understand the approach is to ensure that air quality meets the air quality standards set in the NESAQ and the Health-based Guideline Values in Table 1 of the Ambient Air Quality Guidelines[29], with the ability to implement new standards and guidelines in the future without the need for a plan change. For PM_{10}, this is explained in the Section 32AA Evaluation Report for Plan Change 13 - s293, which says the following in relation to the proposed new Policy AQ P12[30]:

> The Court found that the amended provisions are the most appropriate way to achieve the objectives of PC13 because, subject to the directions they would make under s293, they:
>
> *"(a)…*
>
> *(b) are the most appropriate to manage the MMA as a polluted airshed and bring it into compliance with the NESAQ and meet annual average PM_{10} concentration guidelines as soon as reasonably practicable*
>
> *(c) provide flexibility through Policy AQ P12 [AREA2-P2] to respond to possible future changes in air quality standards and guidelines without the need for a further plan change….*

71 Importantly, the discharges to air from the Allied site would not frustrate the ability to meet the WHO 2021 guidelines in the future, if they are adopted as New Zealand standards or guidelines. This is because the impacts are very small in relation to these guidelines.

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[28] Objective AQ 02

[29] AQ P4(b)

[30] Bay of Plenty Regional Council. (2024). Plan Change 13 – s293 Section 32AA Evaluation Report. p 25

Assessment methodology

72 Some of the expert witness statements raise matters related to the assessment methodology in regard to:

(a) The background concentration adopted in the assessment of cumulative effects of PM_{10}

(b) That the NO_2 emissions rates may have been underestimated

(c) That data from the Waka Kotahi passive monitoring site indicates elevated background levels of NO_2

(d) That the assessment of benzene and dioxins is limited by the absence of background air quality monitoring data

(e) That effects of hydrogen sulphide have not been considered.

73 I will respond to each of these in turn.

PM_{10}

74 Mx Wickham's evidence summarises her suggestion (raised at expert conferencing) to add the modelled impacts of the Allied site to a range of possible background concentrations (35 to 43 µg/m^3, 24-hour average).

75 I understand that Mx Wickham's point (as expressed in the Air Quality JWS[31]) is that "*the use of a more conservative background value would suggest the existing plant increases daily PM_{10} levels from just below to just above the WHO guideline*".

76 In the Air Quality Assessment, the highest 24-hour average PM_{10} concentrations at a sensitive receptor are predicted to occur at de Havilland Way, where there is an air quality monitor. The fourth highest 24-hour PM_{10} concentrations at De Havilland Way between 2020 and 2023[32] were between 40.2 and 49.0 µg/m^3 (24-hour average) and the WHO 2021 guideline was only exceeded in one year. These measurements include the impact of the existing Allied asphalt plant. Therefore, based on the monitoring data, the emissions from the existing plant are very unlikely to cause an exceedance of the WHO 2021 guideline at the most impacted location considered in the Air Quality Assessment (de Havilland Way).

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[31] Air Quality JWS, p2

[32] excluding 2019 when there were known issues at the adjacent bulk storage facility

77 Cumulative impacts on 24-hour PM_{10} concentrations at the hangars within the Airport Designation are discussed in Attachment Seven (Section 2.4). Although the modelled contribution from the existing Allied site is higher at these locations than at de Havilland Way, the background concentration is likely to be lower because of the increased separation distance to industrial sources. Therefore, I consider it unlikely that the emissions from the existing Allied plant would cause exceedances of the WHO 2021 guideline (and the proposed plant would not, given the much lower emissions).

78 I am concerned that the statements in Mx Wickham's evidence about adding "*fractional increases to an airshed that already exceeds the WHO guideline*"[33], when read along with the comments in the Air Quality JWS regarding use of monitoring data from Rata Street to represent the residential area[34] may give the impression that the cumulative 24-hour impacts in their Table 3 could occur in the residential area. I did not discuss background air quality or cumulative PM_{10} impacts in the residential area in my evidence in chief as they are lower than at the worst-impacted receptor.

79 The highest 24-hour (4th highest) incremental PM_{10} contributions at a receptor in the residential area to the east of Maunganui Road are 2.9 $\mu g/m^3$ for the existing plant and 0.6 $\mu g/m^3$ for the proposed plant. Even assuming the measured concentrations at de Havilland Way (next to a bulk storage facility) are representative of air quality in the residential area, the emissions from the Allied site will not be additive to peak daily concentrations. This is based on the low cost sensor monitoring data, which shows that the maximum 24-hour concentrations in the residential area occur under onshore winds, which would blow the discharges from the Allied site in the opposite direction.

NO_2

80 Two issues have been raised in relation to the assessment of effects if NO_2:

(a) That the NO_2 emissions rates may have been underestimated

(b) That data from the Waka Kotahi passive monitoring site indicates elevated levels of NO_2

NOx emission rates for the proposed plant using diesel

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[33] Wickham, para 43

[34] that refers to including monitoring data from Rata Street as representative of a residential area

81 Mx Wickham states[35]:

> Notwithstanding the lower quality rating, I consider the batch plant emission factor more appropriate for estimating emissions from a batch plant (than the lower emission factor from a drum mix plant employed in the Allied AQA).

82 I briefly commented on the lower reliability of the AP42 NOx emission factors for batch asphalt plants, to explain why I did not use them, in my evidence in chief. To expand on this, the AP42 NOx emission factor for batch plants is based on only two stack tests. Only one of the stack tests was for a plant using diesel[36] and this result was similar to the average of the stack test results reported for drum plants (for which there was a much larger dataset).

83 Taking into account the stack emission testing on batch asphalt plants in Australia using diesel[37], in my opinion, the NOx emission factor used in the Air Quality Assessment for the proposed plant using diesel will be conservative (likely by a factor of 2 when comparing with the Australian stack test results).

84 Given the above, Mx Wickham's estimate of NOx emissions from the proposed plant using the US EPA batch plant emission factor (their Table 2, column 4) will grossly overstate emissions when the plant is using diesel. The values presented in Mx Wickham's table are 400% higher[38] than estimates using data from testing of similar batch plants in Australia. In my opinion it would be inappropriate to use this emission factor and the assessment of NOx emissions from the proposed plant using diesel is conservative.

NOx emission rates for the proposed plant using natural gas

85 Mr Murray notes that the stack testing data on Australian plants[39]:

> … indicates that when using diesel the emission factor is conservative and when using natural gas the

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[35] Wickham, para 33

[36] The other test was for a plant burning heavy fuel oil, which would be expected to give rise to higher NOx emissions than diesel due to higher fuel nitrogen

[37] Evidence in chief, Table 1, p 16

[38] For example, for the proposed plant at 300,000 TPA the revised estimate using stack testing data is 4.1 TPA compared to 17 TPA in Mx Wickham's table

[39] Murray, para 32

emission factor may underestimate the emission rate.

86 Marini has indicated that the NOx emission concentration from the proposed asphalt plant operating on natural gas is expected to be less than 100 mg/Nm^3. This is consistent with the one available stack test result, from the Laverton, Melbourne plant[40] where the stack emission concentration was 48 mg/Nm^3. The NO_X mass emission rate for the Laverton plant of 3.1 kg/hour (shown in Attachment Six of my evidence in chief) was calculated using the stack volumetric flow rate measured at the Laverton plant (and scaled up to 200 TPH production). This is lower than the NOx emission rate of 2.6 kg/hour used in the dispersion modelling.

87 A stack concentration of 100 mg/Nm^3 equates to a mass emission rate of 3.9 kg/hour (at 200 TPH asphalt production rate) at the maximum expected flow rate in the asphalt plant stack. The dispersion modelling assumed a maximum NOx emission rate of 2.6 kg/hour for natural gas and 5.6 kg/hour for diesel. Therefore, the worst case NOx emission rate (based on 100 mg/Nm^3) would still be significantly lower than the NOx emission rate for diesel used in the Air Quality Assessment. Therefore, the overall conclusion of the Air Quality Assessment that the effects will be acceptable regardless of whether the plant is operated on natural gas or diesel does not change.

88 For completeness, a further assessment of annual average concentrations for the proposed plant operating on natural gas with a stack concentration of 100 mg/Nm^3 is presented in **Table 4**.

Table 4: Assessment of effects on annual average NO_2 assuming NOx emissions of 100 mg/Nm^3 from proposed asphalt plant on natural gas

Parameter	**MGLC (Allied plant contribution only) (µg/m^3)**	**Background concentration (µg/m^3)**	**Cumulative MGLC (Allied plus background) (µg/m^3)**
Annual average (using NIWA empirical relationships) - assuming continuous operation at maximum load			
Modelled concentration (µg/m^3)	0.33	6.5	6.8

[40] Evidence in chief, Attachment Six

Percentage of WHO 2021 10 µg/m^3	3.3%	65%	68%
Annual average (using NIWA empirical relationships) - adjusted to account for 300,000 TPA production limit			
Modelled concentration (µg/m^3)	0.06	6.5	6.6
Percentage of WHO 2021 10 µg/m^3	0.6%	65%	66%

89 In my opinion, an emission rate of 3.9 kg/hour could be used as a basis for comparison with the NOx stack emission testing proposed in Condition 25 (Annexure 3 of Mr Batchelar's evidence).

90 This emission rate of 3.9 kg/hour could also be used as a basis for comparison of NOx emissions if the plant is required to be operated on diesel on an ongoing basis. In my opinion, based on the stack testing data from Australian plants, it is conceivable that the plant would operate under this level on diesel. However, if it cannot then I consider it reasonable that BPO for control of NOx emissions should be re-evaluated at that time. I consider the wording set out in Condition 14(c) (Annexure 3 of Mr Batchelar's evidence) would achieve this purpose.

Conclusions in regard to effects of NO_2

91 Mr Scott states that[41]

> Proposed condition 14A also allows the applicant to decide for themselves whether it is practical to implement further mitigation to reduce NO_2 discharges from the site. Since NOx is a known issue in the airshed and the use of diesel would increase the level of that contaminant.
>
> In this case, the increase would result in the breach of standards for NOx …

92 The Air Quality JWS states that:

[41] Scott, para 98-99

> It was also agreed that the use of natural gas as a fuel is BPO subject to availability and the cost not being prohibitive (noting that this will need to be determined through an appropriate consent condition). If the use of natural gas is not practicable, biodiesel or diesel are the best practicable fuel alternatives.

93 The Air Quality Assessment shows that, while emissions of NOx may be higher from using diesel, regardless of whether natural gas or diesel is used the effects on NO_2 concentrations:

(a) Would not result in a breach of the standards,

(b) Would be negligible (less than 1%) compared to the WHO 2021 guidelines

94 Therefore, a preference for use of natural gas reflects that it is BPO to minimise discharge to air, not that the effects of using diesel are unacceptable.

95 Conditions 11 to 14 of the long-term air discharge consent[42] set out a framework that reflects natural gas as the preferred fuel, but would allow the use of diesel in certain circumstances. In my opinion, these conditions are appropriate.

Waka Kotahi passive NO2 monitoring data

96 Mx Wickham states that[43]

> Waka Kotahi passive monitoring reports that annual NO_2 concentrations in the MMA exceed the WHO annual guideline (ESR 2023b).

97 Mr Murray specifically also refers to the Waka Kotahi passive monitor at Maunganui Rd “indicating that there are elevated levels of NO_2 in the Mount Maunganui area due to traffic”. [44]

98 I am familiar with the Waka Kotahi national NO_2 monitoring network as I have supervised production of the last three annual reports (2021, 2022 and 2023). The passive NO_2 monitoring network is used by Waka Kotahi to indicate long term trends in emissions from the vehicle fleet. It is not

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[42] Batchelar, Annexure 3

[43] Wickham, para 21

[44] Murray, para 52-53

intended to measure air quality locations where people could be exposed for long period of time.

99 **Figure 1** shows the position of the Maunganui Road monitor prior to 2023. The monitor was within the road corridor between the lanes of traffic. This location will be subject to emissions from queuing traffic and concentrations are likely to be higher at this location than on free flowing sections of Maunganui Road/State Highway 2.

Figure 1: Location of Mount Maunganui passive NO_2 sampler (HAM008)[45]

100 Further information about the monitoring location, measured NO_2 concentrations, and estimates of NO_2 concentrations at increasing distance from the road, are presented in Attachment Three. In summary:

(a) The results at Maunganui Road are typical of high traffic State Highway monitoring locations. Concentrations on arterial roads are lower.

(b) The results from passive monitoring cannot be directly compared to air quality guidelines as they are known to over-predict NO_2

[45] Reproduced from Waka Kotahi. (2012). Ambient air quality (nitrogen dioxide) monitoring network – site metadata report 2007 to 2011, p 87

concentrations by 33 percent (on average) compared to reference monitors.

(c) Using a conservative screening method, and the concentration measured at the new slightly more traffic-impacted location, the concentration of NO_2 is estimated to reduce below the WHO 2021 annual guideline within approximately 30 m from the road.

101 I consider this indicates that annual average NO_2 concentrations may exceed the annual WHO 2021 guideline at the first row of houses along Maunganui Road/SH2. This provides some context for comments in evidence that NO_2 concentrations may be elevated "close" to roads.

102 Little Einstein's Montessori School is the most impacted sensitive receptor that is also close to State Highway 2 (approximately 50 m from State Highway 2). The annual average NO_2 guideline does not strictly apply at this location as children are not present continuously for the entire year. However, for the purpose of illustrating cumulative effects at a traffic-impacted location, I have considered the cumulative impact at this location if the plant is operating on diesel.

103 The highest modelled annual average NO_2 concentration for the proposed plant using diesel (using empirical methods to estimate conversion of NO to NO_2) is 0.45 $\mu g/m^3$.[46] Adjusting for non-continuous operation, the modelled contribution reduces to less than 0.08 $\mu g/m^3$. The stack testing results for plant in Australia suggest the actual concentration could be half this value (0.04 $\mu g/m^3$). Therefore, even if it was assumed that the background concentration was 10 $\mu g/m^3$ (the screening model suggests it will be lower), the change in cumulative concentration would be 0.04% (10 to 10.04 $\mu g/m^3$). The incremental impact of the site and cumulative effect will be lower than this at any other traffic-impacted sensitive receptor. In my opinion, it is reasonable to describe this level of effect as negligible.

Benzene and dioxins

104 Mx Wickam states that[47]

> A significant limitation of the air quality assessment of toxic discharges to air (benzene, dioxins) is that it is incremental only in the absence of any understanding of background concentrations.

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[46] Evidence in chief, Table 2-5

[47] Wickham, para 41

Benzene

105 Specifically in relation to benzene they say[48]:

> There is an absence of ambient air quality monitoring data for benzene in the industrial Mount Maunganui Airshed to inform cumulative assessment.

106 It is often necessary to undertake air quality assessments in locations or for pollutants where there is no background monitoring data available. My evidence in chief draws on a range of sources to characterise likely background benzene concentrations and it is not correct that there is no assessment of cumulative effects of benzene (refer Table 3 of my evidence in chief, page 25).

107 Mr Murray[49] has questioned the use of monitoring data from Khyber Pass Road, in Auckland, as:

> Background levels of benzene in Mount Maunganui may be higher than this (Khyber Pass) due to the fuel bulk storage facilities and port activities

108 I note that Khyber Pass is the only site where short term benzene concentrations have been measured for comparison with the 1-hour OEHHA acute REL.

109 To respond to Mx Wickam and Mr Murray's comments I have contacted Mr Shane Iremonger, Team Leader Science at the BOPRC to understand what historical monitoring has been undertaken for benzene. He advised me that benzene monitoring using passive diffusion samplers has been undertaken over two periods; from August 2000 to July 2021 at five monitoring locations and from November 2008 to October 2009 at three locations. Benzene levels at Totara Street were measured during both monitoring campaigns, and in both cases the highest results were recorded at Totara Street.

110 The annual average background concentrations recorded at Totara Street were 5.4 $\mu g/m^3$ and 1.2 $\mu g/m^3$ in 2000/01 and 2008/09, respectively. This level of reduction between 2001 and 2009 is consistent with what has been observed at other monitoring sites in New Zealand, reflecting the introduction of lower maximum benzene levels in fuel. Benzene

[48] Wickham, para 51

[49] Murray, para 35

concentrations at most locations in New Zealand where there is monitoring data are lower now than in 2009.

111 The Totara Street site was selected for monitoring because of its industrial nature, which includes bulk fuel storage tanks that may be a specific source of benzene, and proximity to the Port. I consider the higher annual average benzene concentration recorded at Khyber Pass from 2009 to 2014 compared to Totara Street addresses the issue raised by Mr Murray. This suggests that use of short term data from Khyber Pass (from 2013 and 2014) as being representative of background benzene concentrations should be conservative.

112 This additional monitoring data also supports the long term background concentration of 1 $\mu g/m^3$ (annual average) used in the assessment. This concentration is representative of benzene concentrations in the MMA and background concentrations in the residential area are likely to be lower.

Dioxins

113 The assessment of effects of dioxin emissions does not include an estimate of background concentrations. In my opinion, it is unnecessary to estimate a background concentration as the modelled contribution to annual impacts is 0.00010% of the OEHHA chronic guideline for the existing plant and 0.00018% for the proposed plant. Taking into account non-continuous operation the contribution will be an order of magnitude lower. Therefore, regardless of the background concentration, the emissions from the Allied site will be *de minimis*.

114 For completeness, I note that the only recent dioxin monitoring that I am aware of has been in the vicinity of large industrial sources. For example, I was involved in dioxin monitoring in the vicinity of the Dow AgroSciences plant in New Plymouth (which operated an incinerator) and the New Zealand Steel Mill at Glenbrook. In both cases the measured concentrations were well below the OEHHA chronic guideline. Therefore I consider it very unlikely that dioxin concentrations in Mt Maunganui would approach this guideline.

Hydrogen sulphide

115 I agreed at expert conferencing to provide more information on H2S emissions from the asphalt plant. The Air Quality JWS summarises the situation with regard to hydrogen sulphide (H_2S), which is that the only appreciable source of H_2S at both the existing and proposed plants is the displacement of vapours from the headspace of the bitumen tank when it is being filled.

116 There is the potential for localised odours from vapour displacement, particularly during bitumen tank filling. However there is no evidence that the current storage and handling of bitumen at the site is causing odour issues (as I discuss later at paragraphs 142 to 144). If localised H_2S odour is identified as an issue in the future, the current industry practice is to install a water seal pot on the tank vent. I understand that this generally provides enough back pressure to minimise H_2S emissions.

117 Given the separation distance to Whareroa Marae, the contribution of the Allied site to measured H_2S concentrations at Whareroa Marae will be *de minimis*.

Odour

Odour and health effects

118 The evidence of Ms Jones, Ms Kelway and Ms Hughes talks about their experience of odours attributable to the two existing asphalt plants in the MMA.

119 There are also comments, such as Ms Jones, that:[50]

> This cocktail of contaminants drifts over our schools and often, under certain meteorological conditions, hovers there, thick in the air where our children are trying to learn and play.

120 It is understandable that the community would be concerned about the nature of the contaminants that are causing the odour they have experienced, and whether the odour is an indicator of air pollution that could cause toxic effects. However, some of the contaminants associated with bitumen have very low odour thresholds, meaning they can be smelled at concentrations well below those that would cause health effects. This is highlighted in the dispersion modelling undertaken as part of the Air Quality Assessment, which shows the potential for odour effects from the existing plant and also shows that effects of other contaminants are small compared to the relevant assessment criteria.

Addition of RAP

121 Anecdotally, the addition of RAP is thought to increase odour emissions from asphalt manufacture, but I am not aware of any quantitative analysis to verify this.

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[50] Jones, para 18

122 Mr Murray states[51]:

> There is some uncertainty around the manufacturing of Reclaimed Asphalt Paving (RAP) in relation to odour. Data from stack emission testing on an asphalt plant in Australia (when using 10% and 20% RAP) indicates that the odour emission rate could increase by more than 3 times than when not using RAP in the manufacturing process, although modelling at this rate still indicates that the odour guidelines will be met. To ensure that odour is not a problem when using RAP, a condition may be included to control the amount of RAP used in the manufacturing process if consent is granted.

123 Mx Wickham (who has misinterpreted Mr Murray's comment as saying that emissions of odour with the use of RAP have not been assessed) recommends[52]:

> ..conditions of consent prohibiting the use of reclaimed asphalt paving to give greater confidence that the projected odour improvements predicted from the new plant will be achieved in practice.

124 As described in my evidence in chief, the only available stack odour emission testing for an equivalent batch asphalt plant while RAP was being added was from the Laverton plant while it was being commissioned (which may have affected odour emissions) and a full odour panel could not be used because of COVID restrictions. The odour emissions (adjusted for production rate) were higher than the odour emission rate used in the Air Quality Assessment.

125 Further odour emission testing was undertaken on the Laverton Plant, specifically to determine odour emissions at varying RAP levels, to provide information for this hearing. The results are presented in Attachment Four and summarised in **Table 5** in comparison to the modelled odour emission rate for the proposed plant in the Air Quality Assessment.

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[51] Murray, para 41

[52] Wickham, para 20

Table 5: Odour emissions at varying RAP addition rates (Laverton, Australia)

Percentage RAP (%)	Production rate	Odour concentration	Odour emission rate	Pro rated odour emission rate to 200 TPA	Odour emission rate used in AQA
%	**Tonnes per hour**	**OU**	**OU-m^3/sec**	**OU/sec**	**OU/sec**
0	161	2100	27650	34,300	
15	165	1600	24000	29,100	39,000
30	150	1800	23700	31,600	

126 The results shown in **Table 5** indicate that odour emission rates do not increase with the addition of RAP and, with the addition of RAP, remain well within the odour emission rates used in the Air Quality Assessment. In my opinion this addresses the concerns of Mr Murray and Mx Wickham and a restriction on addition of RAP is not warranted.

Addition of resin

127 Another issue raised by Mr Murray is the addition of resins to asphalt[53].

> I'm unsure whether the applicant uses resin in its asphalt mixes. I suggest this matter is clarified by the applicant. If resin is used, it would be useful to discuss the implications at caucusing.

128 There was insufficient time to discuss this at the air quality caucusing but I have obtained further information from Allied, which is summarised below.

129 Resin is added to an asphalt product called Open Grade Porous Asphalt (Epoxy Modified) (Epoxy OGPA). This is a specialist asphalt product and Allied do not anticipate making large volumes.

130 The finished Epoxy OGPA product contains less than 8% (typically 6%) of an epoxy-modified bitumen. The epoxy is a two-part mixture comprising a resin (Part A) and a binder (Part B). The binder is a non-hazardous (other than as a skin sensitiser) mix of predominantly fatty acids. The resin is a

[53] Murray, para 34

Bisphenol A (BPA) and epichlorohydrin-based resin (70-90%). The volume of resin added to the OGPA asphalt finished product is approximately 1.5%.

131 BPA is described as having a mild phenolic odour. The Epoxy OGPA product is made at relatively low temperatures (120°C). BPA has a boiling point of approximately 250°C so is unlikely to generate appreciable vapours. In any case, the resin components are added to the bitumen in the mixer and any fumes will be drawn back through the combustion zone of the burner before being discharged through the baghouse and stack. Discharges to air from the asphalt manufacturing process are expected to be negligible.

132 I understand that site staff have not noticed any appreciable change in odour from the finished product. Allied and Fulton Hogan are not aware of any odour problems caused by this product at other sites.

133 Overall, I consider the manufacture of Epoxy OGPA is unlikely to cause odour effects or result in any appreciable discharge of harmful air pollutants.

Best Practicable Option to minimise discharges to air

Low NOx burner

134 Mx Wickham states that low-NOx burners are not proposed[54] and that "*The air quality experts agreed unanimously that the best practicable option emissions control is the use of low NOx burners*"[55].

135 Mx Wickham's statement is not an accurate reflection of the Air Quality JWS where it was agreed that "*Further information should be provided by Allied on the feasibility of low NOx burners*". The reason I agreed with this position is that I did not have enough information at the time about low NOx technology for asphalt plants and the extent to which the proposed plant incorporates low-NOx burner technology.

136 To the best of my knowledge there is no emission standard for low NOx burners used in industrial processes, but that the term low NOx burner broadly means a burner that incorporates a control system for fuel/air mixing and combustion temperature.

137 In my experience, conventional burners that did not incorporate modern control systems, were typically stated as achieving a NOx emission

[54] Wickham, para 6

[55] Wickham, para 48

concentration of 350 mg/Nm^3. As discussed at paragraph 86, Marini has indicated that the proposed plant will achieve a maximum NOx emission concentration of 100 mg/Nm^3 when using natural gas. Stack testing of plants in Australia indicates emissions will generally be well below this and may even meet this level when using diesel.

138 On this basis, I understand that the burner on the proposed asphalt plant is a low-NOx burner and is consistent with the Best Practicable Option (BPO) to control NOx emissions.

Enclosure of the loadout area

139 The Air Quality JWS reflects the opinions of the different air quality experts regarding enclosure of the loadout area.

140 The main purpose of partial or full enclosure of the loadout area at the proposed asphalt plant would be to improve the capture efficiency of the extraction system (that directs odours to the blue smoke filter). This will reduce the risk of localised odour impacts of the loadout area, mainly to immediate neighbours.

141 Most asphalt plants in New Zealand, including the existing plant, do not have any extraction (or treatment) system. Therefore the proposed plant will be a significant improvement over the current plant even if it there is no enclosure.

142 I asked Mr Eastham if there was any feedback from neighbours of the Site regarding odours from the existing plant. Mr Eastham has provided me with a list of 10 neighbours in the immediate vicinity of the Site who were contacted to see if they had any concerns with odour from the existing asphalt plant. Responses were received from:

(a) SEEKA at 1 Harvard Way

(b) HR Cement at 53 and 60 Aerodrome Road

(c) TranzLiquid at 26 Aeropark Way, off Aerodrome Road

(d) Hewletts Road Machinery at 71 Hewletts Road

143 HR Cement and TranzLiquid immediately adjoin the site to the south and Hewletts Road Machinery immediately adjoins the site to the north, while 1 Harvard Way is to the west of the site.

144 These neighbours have provided email confirmation that they have not had issues with odours from the current plant. As the proposed plant will

incorporate improved control of odours from the loadout area (extraction to the bluesmoke filter), in my opinion it is reasonable to assume that the loadout at proposed plant will also not cause issues for these neighbours.

145 Mr Garton has described some of operational issues with full enclosure of the loadout area, based on experience at Reliable Way, Auckland. The Reliable Way asphalt plant is located adjacent to a residential area, which includes a large retirement village. Given the proximity to sensitive receptors, a very high standard of control for fugitive odour was considered appropriate for that plant, notwithstanding that it causes operational difficulties.

146 The sensitivity of the receiving environment to adverse effects, and effects on the environment of different options are both factors to be considered in determining BPO. In comparison to Reliable Way, the Allied site is in an industrial zone with a relatively large separation distance to sensitive receptors. Feedback from neighbours suggests that the current loadout, which does not incorporate an extraction system or any enclosure, is not causing localised odour issues. Consequently, I am still of the opinion that proposed extraction system and blue smoke filter can be considered BPO without the need of full enclosure. However, I also consider that partial enclosure would be likely to improve the collection efficiency of the system.

Air quality effects of additional truck movements

147 Two issues have been raised in relation to air quality effects of trucks:

(a) Air quality effects of additional trucks on public roads, particularly if production increases to the proposed limit of 300,000 TPA.

(b) That the dispersion modelling doesn't include the impact of trucks at the site.[56]

148 Mr Scott states that[57]

> While the operation of vehicles on the roads is a permitted activity, the generation of those additional trips is a result of the increase in capacity proposed for the new plant. The contribution of additional PM_{10} as a result of those trucks (likely powered by diesel) should therefore form part of the assessment of the proposal as a full discretionary activity.

[56] Air Quality JWS, Section 2 p 6

[57] Scott, para 102

149 Ms Ngātuere also considers that[58]

> … the new plant will have the capacity to have increased production which among other things will equate to more trucks which is going to contribute to elevated pollution levels in the MMA.

150 A similar issue is raised by Ms Hughes.[59]

151 I have used the Waka Kotahi Air Quality Screening Model to assess the effects of increased truck movements if the proposed plant produces 300,000 TPA asphalt, based on the change in vehicle movements described in Ms Makinson's evidence. This is summarised in Attachment Five.

152 The Screening Model estimates suggest that there will no change in the concentration of PM_{10} (<0.1 µg/m^3 24-hour average) and a 0.1 µg/m^3 change in annual average NO_2 concentrations at a nominal distance of 20 m from the road. The change in NO_2 concentrations is within the accuracy of the Screening Tool and, in my opinion, suggests there will be no measurable change.

153 In regard to including trucks at the site in the dispersion modelling, this is significantly more difficult than an assessment of on-road emissions. Modelling assessments of vehicle emissions (including in the Waka Kotahi Air Quality Screening Model) use drive cycle emission factors, which incorporate assumptions about periods of acceleration, deceleration and idle based on average speed. An assessment of effects of trucks within the site would require a large number of assumptions and there are no reliable idle emission factors. In my opinion, given the location of the Site in an industrial area with good separation from sensitive activities, exhaust emissions from trucks within the site are very unlikely to give rise to unacceptable effects.

Acceptable risk criteria

154 Mx Wickham states[60]

> I support assessment against the more health protective criterion of 1 in a million for exposure by residential receptors to carcinogenic risks.

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[58] Awhina Ngātuere, para 29

[59] Hughes, para15

[60] Wickham, para 70

155 I understand that their reasoning is that this is included in the MfE Good Practice Guide (GPG Industry)[61]:

> Historically air quality assessments in New Zealand have adopted an acceptable environmental risk for exposure by residential receptors to individual environmental pollutants of 1 in 1,000,000. This is still recommended when assessing discharges to air from industry.

156 The GPG Industry has only a very brief discussion of health risk assessments and includes a specific recommendation to seek expert assistance for any health risk assessment. As such, it is not a source of guidance on how to undertake a health risk assessment in New Zealand.

157 I have prepared, and contributed to the preparation of, a number of health risk assessments since joining Tonkin & Taylor in 1998. Examples include for the replacement air discharge consent for the Dow AgroSciences Plant in Paritutu, New Plymouth (working with Dr Bruce Graham), a supermarket built on a site with an underlying solvent plume, discharges to air from the Redvale Landfill and, more recently, a multi-pathway health risk assessment for the proposed Wayby Valley landfill in Auckland.

158 In my experience, which includes working closely with contaminated land specialists, I have always understood 1 in 100,000 to be the acceptable risk criterion in New Zealand. The background to this is reflected in the following excerpts from the supporting documentation for the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Public Health (NES Soil):[62]

> In New Zealand, an acceptable increased risk level of 1 in 100,000 was first used in the national drinking water standards (MoH, 1995) and this has since been adopted in a number of government publications (eg, MfE and MoH, 1997; MoH, 2005)…
>
> The consensus of the Toxicology Advisory Group was that the acceptable increased risk level should remain at 1 in 100,000 (=10^{-5}) ….
>
> Finally, to facilitate comparison of different estimates of the potency of non-threshold substances in this document, where slope factors are used, a toxicological intake value (risk specific dose) has been calculated assuming an acceptable risk level of 10^{-5}.

159 I note the word <u>remain</u> in the second paragraph cited.

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[61] MfE. (2016). Good practice guide for assessing discharges to air from industry. p 53

[62] Ministry for the Environment. (2011). Toxicological Intake Values for Priority Contaminants in Soil. p 3 and 4

160 The reasoning given in the GPG Industry that *air quality assessments in New Zealand historically used a 1 in 1,000,000 risk criterion* is not consistent with my experience (dating back to 1998). The GPG Industry does not acknowledge that a 1 in 100,000 risk criterion has been used to derive the New Zealand Standards for drinking water and contaminated soil and does not address the detailed review and recommendations from the Toxicology Advisory Group for the development of the NES Soil. As such, it is my assumption that the author of this section of the GPG Industry was not aware of that context.

161 Given the GPG Industry is non-statutory guidance and is not intended as guidance on how to undertake a risk assessment, I do not consider the unsubstantiated recommendation in the GPG Industry for a 1 in a million acceptable risk criterion should be given any weight.

Air quality impacts at Whareroa Marae

162 I have read the statements of evidence of Joel and Awhina Ngātuere and acknowledge the concerns they hold about cumulative effects of air quality at Whareroa Marae and the wider Mt Maunganui area.

163 Whilst acknowledging these concerns, based on the Air Quality Assessment, the further analysis set out in my evidence in chief and this reply statement, and the proposed conditions of consent, I consider that the effects of discharges to air from the proposed asphalt plant at Whareroa Marae will be so low that they can be described as *de minimis*.

164 Mr Ngātuere states that[63]:

> In our opinion a cautious approach must be taken with all consent applications in our area especially where the applications involve significant capital investment like a new Plant in this case.

165 There are numerous asphalt plants operating all around New Zealand and, in general, their air quality effects are well understood. The proposed plant is a more modern (and lower emitting) plant compared to almost all existing asphalt plants in New Zealand. Therefore, I consider there is a high degree of uncertainty about the emissions from the proposed plant.

166 In my opinion, a cautious (conservative) approach has been used in the Air Quality Assessment to ensure that worst case effects have been considered. Where appropriate, further analysis has been undertaken using more conservative assumptions (for example that people might be living in

---

[63] Joel Ngatuere, para 36

any of the airport hangars and that there is 6-storey residential development at Bayfair). Using this approach, in my opinion, the proposed asphalt plant will:

(a) Contribute to improving PM_{10} and $PM_{2.5}$ air quality in the MMA (whilst allowing Allied to operate an asphalt plant)

(b) Have a very small effect on concentrations of other pollutants compared to the current New Zealand standards and guidelines and will not make it more difficult to achieve the WHO 2021 guidelines if they are adopted in the future.

Mass emissions of pollutants

167 Mx Wickham has converted their estimates of $PM_{2.5}$ and NOx emissions to a "damage costs" as they consider this indicates the relative burden between options. In my opinion this approach is not helpful because, as they say[64]:

> This approach further does not account for the increased stack height of the proposed plant, or even account for the emissions being from any stack – they are social costs averaged from all sources in New Zealand (i.e. primarily domestic home heating and traffic as outlined in HAPINZ 3.0).

168 As an air quality specialist, I use tools like dispersion modelling to account for differences in the way pollutants are emitted (e.g. from tall stacks compared to at ground level) and where they are emitted (e.g. the available separation distance to sensitive receptors to allow for dispersion and dilution). Therefore, in my opinion, the dollar value used in Mx Wickham's calculation is inappropriate.

169 I understand that Mx Wickham was trying to provide some context for the scale of emissions of different pollutants from the existing and proposed plants. In my opinion, this is less informative than considering the difference in effects of those pollutants (as outlined in the Air Quality Assessment).

170 Dr Wilton has prepared an emissions inventory for the MMA.[65] Emissions inventories have the same limitation I have just described, in that the effects of emissions from different sources are not proportional to emission rate (particularly because of differing dispersion).

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[64] Wickham, para 75

[65] Environet. (2023). Mount Maunganui Airshed Emission Inventory 2022.

171 Notwithstanding this limitation, it may provide some context for the difference in emissions from the existing and proposed asphalt plant to compare them with estimates of total anthropogenic emissions of these pollutants in the MMA (noting that for PM_{10} this does not include the significant influence of natural sources, such as marine aerosols).

172 Estimates of annual PM_{10} ad NOx relative to total annual emissions from man-made sources in the MMA are shown in Attachment Six. This analysis indicates that, assuming 300,000 tonnes per annum asphalt production, the change in emissions equates to a 0.7% reduction in PM_{10} emissions and a 0.4 or 0.8% increase in NOx emissions (for natural gas and diesel, respectively). As discussed in paragraph 83, the annual diesel emissions are likely to be overstated by a factor of two, based on stack test data from Australian plants.

173 These changes in emissions cannot be directly equated to changes in air quality effects (this is done through dispersion modelling), however it does illustrate that the change in annual emissions (even assuming 300,000 tonnes per annum asphalt production) is very small in the context of emissions into the MMA.

NESAQ

174 At their paragraph 79, Mx Wickham states that:

> Ms Simpson's evidence indicates that the existing plant would exceed the significance criterion in Regulation 17(1) (i.e. the discharge increases daily PM_{10} by more than 2.5 $\mu g/m^3$ in a polluted airshed). I understand this means:
>
> (a) production of the existing plant may not increase above 68,000 tpy because then Regulation 17(2)(b) wouldn't apply and consent is prohibited under Regulation 17(1); and
>
> (b) the new plant may not be run at the same time as the existing plant for the same reason

175 I do not agree with Mx Wickham's interpretation of Regulation 17(1) in relation to discharges from the existing asphalt plant.

176 Regulations 17(1) and (2) are reproduced below for ease of reference.

17. Certain applications must be declined unless other PM_{10} discharges reduced

(1) A consent authority must decline an application for a resource consent (the proposed consent) to discharge PM_{10} if the discharge to be expressly allowed by the consent would be likely, at any time, to increase the

concentration of PM_{10} (calculated as a 24-hour mean under Schedule 1 by more than 2.5 micrograms per cubic metre in any part of a polluted airshed other than the site on which the consent would be exercised.

(2) However, subclause (1) does not apply if—

(a) the proposed consent is for the same activity on the same site as another resource consent (the existing consent*) held by the applicant when the application was made; and*

(b) the amount and rate of PM_{10} discharge to be expressly allowed by the proposed consent are the same as or less than under the existing consent; and

(c) discharges would occur under the proposed consent only when discharges no longer occur under the existing consent.

177 In my opinion, the reference to the discharges "expressly allowed by the consent" in (1) and 2(b) means that Regulation 17 controls consented discharges, which are almost always higher than the actual discharges from an industrial facility. This is because emissions are often variable and, to ensure they always comply with the consent limit, there needs to be some "headroom" (a consented envelope) for the facility to operate within.

178 The resource consent for the existing asphalt plant at the Allied site did not include any operating hours or production limits. The consented envelope for PM_{10} emissions is therefore limited by the existing plant consent limit for Total Suspended Particulate and the need to operate the plant in accordance with the consent application (meaning that Allied could not install a new plant with a higher production rate, so production is limited by the capacity of the existing plant).

179 As such, I do not consider there is any impediment under Regulation 17 to operating the existing asphalt plant at a production rate greater than 68,000 tpy. However, I understand that the amount of asphalt produced is determined by demand and there is unlikely to be a significant increase in production over the term of the short term consent. This is discussed in more detail in Mr Palmer's reply evidence.

180 If the Court considers that operation of the existing plant at a higher production rate is effectively a "change" to a consented discharge, I note that I further disagree with Mx Wickam's interpretation of how the significance threshold in 17(1) applies. My interpretation of 17(1) is that for a change to a consented discharge in a polluted airshed, the significance threshold only applies to the effect of the change, not the entire discharge.

Therefore, there would be no impediment under Regulation 17 to a modest increase in production that did not increase the concentration of PM_{10} by more than 2.5 µg/m^3 (24-hour average) over and above the effects authorised by the existing consent (if it is deemed the consent infers a production limit).

181 In regard to operation of the existing and proposed plants at the same time, I agree with Mx Wickham to the extent that the discharges of PM_{10} cannot occur simultaneously. In my opinion this means that there would be no impediment to commissioning and testing parts of the new plant, so long as the burners were not operated concurrently. In this regard I have reviewed the wording proposed by Mr Batchelar (Condition 3) and in my opinion it is an appropriate way to address this issue.

Air quality management framework

182 Dr Wilton says[66]:

> As I have explained above, as a general policy approach for management of a polluted airshed, in my opinion management measures are recommended to reduce all contaminants in the MMA but with specific focus on PM_{10}, $PM_{2.5}$, NO_2 and SO_2 …

183 The MMA is a polluted airshed for PM_{10} only. There is clear policy direction in the RNRP to reduce emissions of particulate matter from industrial sources in the MMA (which will be assisted by the reduction in PM_{10} emissions from the Allied site). Concentrations of other pollutants relevant to these consent applications (e.g. NO_2 and SO_2) in the MMA are below the NESAQ and, as the airshed is not "polluted" for these contaminants, the RNRP does not reflect a policy direction to reduce emissions of these contaminants (or "all" contaminants) in the MMA.

Conclusion

184 I have reconsidered the overall conclusions I set out in my evidence in chief in light of the matters raised in the evidence of other witnesses and my responses to those matters as set out in this reply evidence.

185 My opinions and conclusions have not changed and the Allied proposal, subject to the conditions proposed, is supportable on air quality grounds and is consistent with my understanding of the relevant policy framework which seeks to achieve progressive reductions in particulate concentrations in the MMA by, amongst other things, requiring industry to take

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[66] Wilton, para 42

responsibility for their contributions by adopting the best practicable option to reduce particulate emissions.

186 The air quality effects of all pollutants assessed are negligible compared to current New Zealand standards and ambient air quality guidelines, and compared to the WHO 2021 guidelines and is therefore consistent with the policy framework that, amongst other things seeks to safeguard the life supporting capacity of the air and protect human health.

Jennifer Simpson

Dated 26 April 2024

Attachment One: Updated estimates of annual average concentrations accounting for non-continuous operation

The dispersion modelling results presented in the Air Quality Assessment, which provide the exposure estimates used in the HRA, are based on continuous operation at maximum load for both the existing and proposed asphalt plants. This describes the maximum envelope of effects of the two plants if there were no limits on annual production.

Appendix F of the Air Quality Assessment outlines the reasons why a quantitative estimate of the likely effects of the proposed plant with a production limit of 300,000 TPA was not made. In summary, this is because for any given receptor, the effects of the discharges from the asphalt plant will differ significantly from hour to hour with varying meteorology. Therefore, modelling the effects of non-continuous operation requires the specific operating hours to be selected, which is not appropriate as the plant could operate at any time.

A detailed probabilistic assessment, such as a Monte Carlo simulation, could be used to estimate the distribution of modelled impacts at a receptor of an asphalt plant operating non-continuously. This would be a significant piece of work and is not considered warranted. However, the central tendency of annual average concentrations, assuming that the hours of plant operation and meteorology are independent variables (i.e. there is no daily or seasonal pattern in the hours of plant operation or meteorology) can be estimated on a pro rata basis[67].

Two alternative methods can be used to estimate the air quality impacts of the asphalt plant operating on a non-continuous basis:

- Adjusting for the difference in annual production rate on a pro rata basis (in effect, this assumes the plant operates continuously but at a lower production rate); or
- Adjusting for the difference in operating hours on a pro rata basis (in effect, this assumes that the plant operates at typical production rate for a reduced number of hours in the year).

The adjustment based on operating hours gives a slightly higher estimate than the adjustment based on annual production. Therefore the following adjustment has been made:

Pro rated concentration = Modelled annual concentration x (“Actual” operating hours/Modelled operating hours) x (“Actual” emission rate/Modelled emission rate)

[67] On a year to year basis, the annual average concentration may be higher or lower than this central value but, over many years of operation, the average of the dataset of annual average concentrations would be expected to tend towards this central value (if the key assumptions are true).

The adjustment factors differ slightly for NO_2 and PM_{10} because:

- Hourly NO_2 emission rates are assumed to be proportional to hourly production rate; and
- Hourly PM_{10} emission rates are based on a mix of stack testing data and consent limits.

The adjustment factors for NO_2 can be applied to the modelled concentrations (based on continuous operation) of any pollutant except $PM_{2.5}$ and PM_{10}.

Updated estimates of PM_{10} and NO_2 concentrations are set out in Tables 1-1 and 1-2.

Adjusted model results using this approach were circulated to the air quality and health experts on 4 April 2024 as part of the expert conferencing. In reviewing the calculations, I found that I had inadvertently used the same NOx emission rate regardless of asphalt production rate. As NOx emissions are assumed to vary proportional to production, I have made this adjustment, which slightly reduces the modelled concentrations for NOx. The adjusted PM_{10} concentrations are the same as those previously circulated.

Table 1-1: Adjusted estimates of annual average NO_2 concentrations accounting for non-continuous operation

Plant	Scenario	NO_2 emission rate[68]	Annual asphalt production	Operating hours	Modelled annual NO_2 concentration at most affected receptor	% WHO 2021 guideline
		kg/hr	Tonnes		µg/m³	
Modelled scenarios						
Existing plant	Modelled emissions scenario (80 TPH)	2.2	700,800	8760	0.20	2%
Proposed plant (natural gas)	Modelled emissions scenario (200 TPH)	2.6	1,752,000	8760	0.20	2%
Proposed plant (diesel)	Modelled emissions scenario (200 TPH)	5.6	1,752,000	8760	0.40	4%
More realistic estimate accounting for lower production/operating hours						
Existing plant	"Actual" operating scenario (50 TPH)	1.4	68,000	1,360	0.02	0.2%
Proposed plant (nat gas)	"Actual" operating scenario at annual production cap (120 TPH)	1.6	300,000	2,500	0.03	0.3%
Proposed plant (diesel)	"Actual" operating scenario at annual production cap (120 TPH)	3.4	300,000	2,500	0.07	0.7%

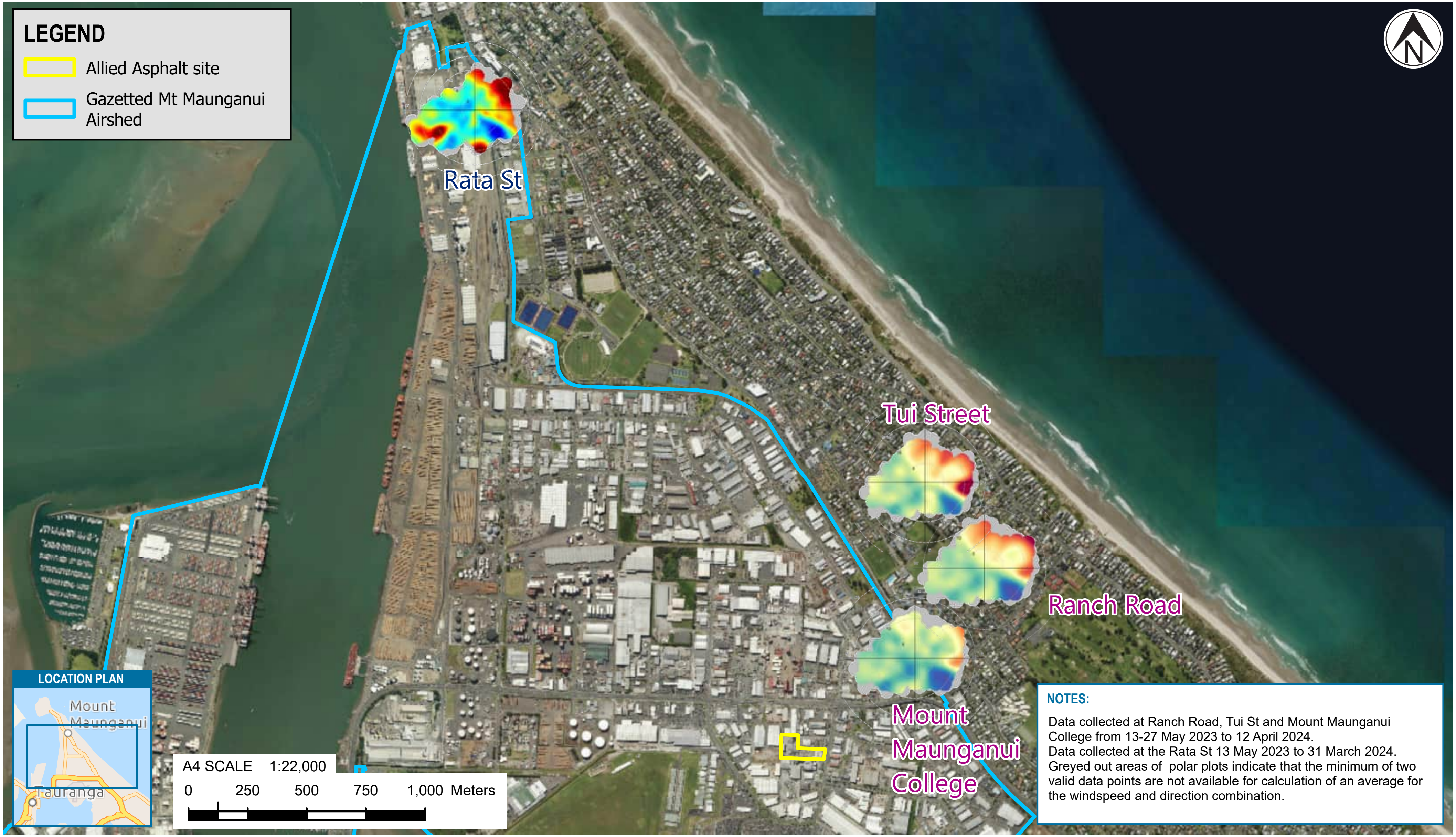
[68] I note that there was an error in the information circulated to the air quality and health experts on 4 April 2024 as this used the same NOx emission rate regardless of asphalt production rate. As NOx emissions are assumed to vary proportional to production, this adjustment has been made, which slightly reduces the modelled concentrations.

Table 1-2: Adjusted estimates of annual average PM_{10} concentrations accounting for non-continuous operation

Plant	Scenario	PM_{10} emission rate	Annual asphalt production	Operating hours	Modelled annual PM_{10} concentration at most affected receptor	% WHO 2021 guideline
		kg/hr	Tonnes		µg/m³	
Modelled scenarios						
Existing plant	Modelled emissions scenario (80 TPH)	3.36	700,800	8760	0.70	4.7%
Proposed plant	Modelled emissions scenario (200 TPH)	1.0	1,752,000	8760	0.16	1.1%
More realistic estimate accounting for lower production/operating hours						
Existing plant	"Actual" operating scenario (50 TPH)	2.4[69]	68,000	1,360	0.08	0.5%
Proposed plant	"Actual" operating scenario at annual production cap (120 TPH)	0.8	300,000	2,500	0.04	0.2%

69 The "typical" PM_{10} emission rate for the existing plant (2.4 kg/hour) is based on the average of TSP emission rates measured from stack testing over the period 2019 to 2022.

Attachment Two: Polar plots for PM_{10} at low cost sensors and the Rata Street monitor



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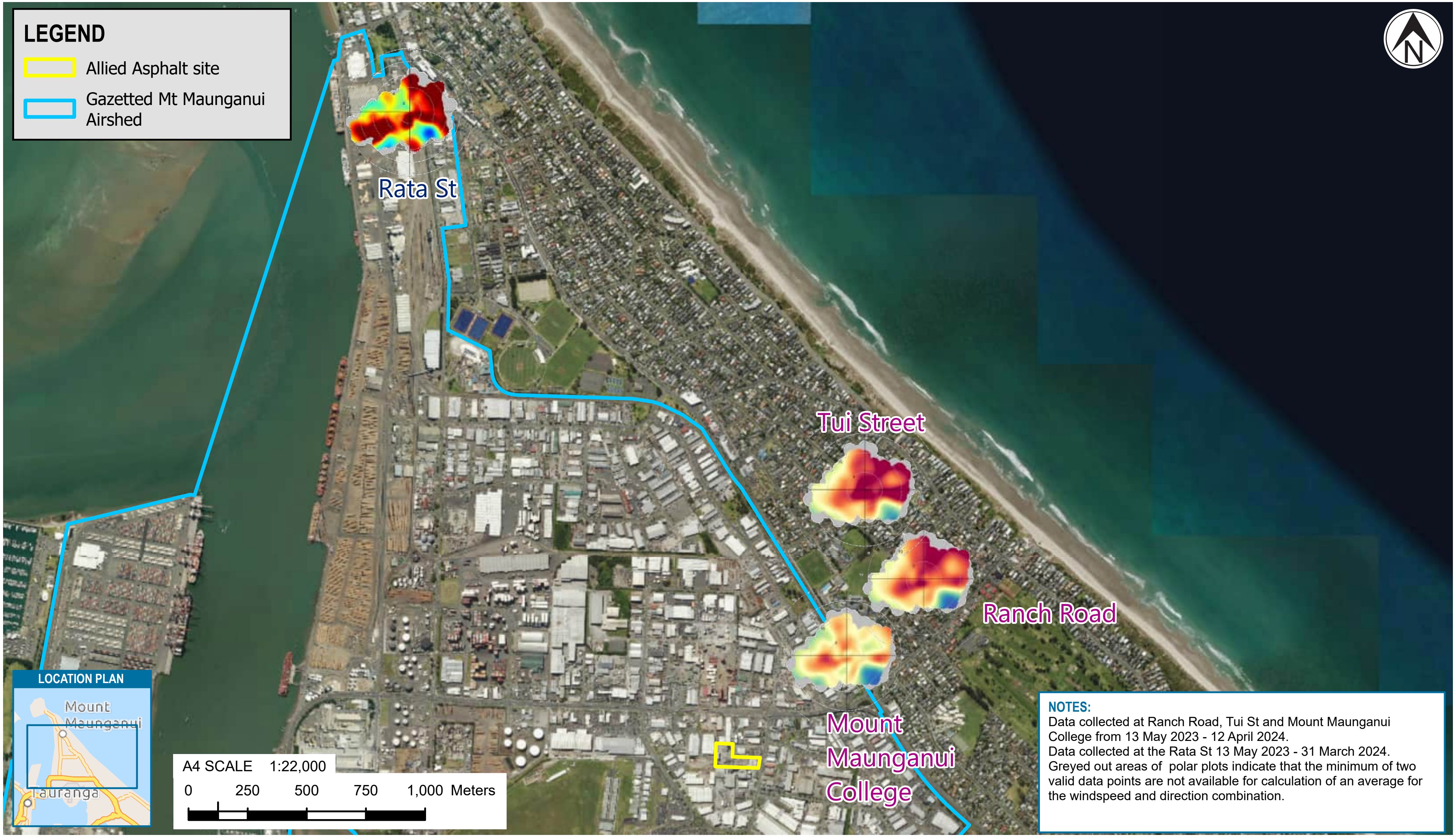
First version (17/04/2024)	0	ROTU

PROJECT No.	1018258.0000	
DESIGNED	ROTU	APR.24
DRAWN	ROTU	APR.24
CHECKED	RANI	APR.24
APPROVED	DATE	

CLIENT **ALLIED ASPHALT LTD**
PROJECT **AIR QUALITY ASSESSMENT**
TITLE MEAN PM10 POLAR PLOTS - LOW COST SENSORS AND RATA ST MONITOR
SCALE (A4) 1:22,000 FIG No. FIGURE 1. REV 0

\\ttgroup.local\corporate\Auckland\Projects\1018258\WorkingMaterial\GIS\lowcostsensors\MtMaunganui.aprx Layout: Low cost sensors - max plots 2024-Apr-19 7:06 pm Drawn by ROTU



NOTES:
Data collected at Ranch Road, Tui St and Mount Maunganui College from 13 May 2023 - 12 April 2024.
Data collected at the Rata St 13 May 2023 - 31 March 2024.
Greyed out areas of polar plots indicate that the minimum of two valid data points are not available for calculation of an average for the windspeed and direction combination.

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DESIGNED	ROTU	APR.24
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APPROVED DATE

CLIENT **ALLIED ASPHALT LTD**
PROJECT **AIR QUALITY ASSESSMENT**
TITLE MAX PM10 POLAR PLOTS - LOW COST SENSORS AND RATA ST MONITOR

SCALE (A4) 1:22,000 FIG No. FIGURE 2 REV 0

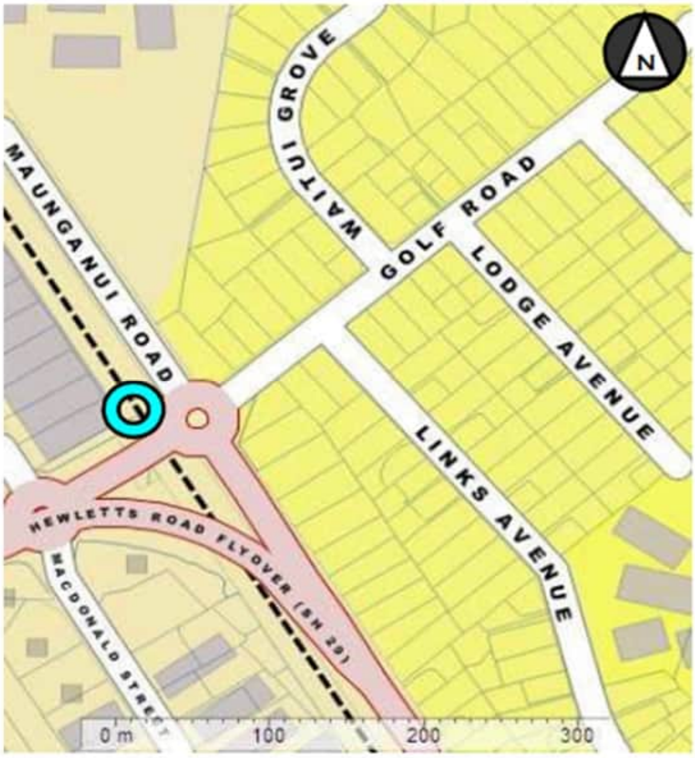
Attachment Three: Waka Kotahi passive NO_2 monitoring data and estimate of NO_2 concentrations at distance from road

Monitor location

Waka Kotahi operates a passive NO_2 monitor, as part of their national monitoring network (the monitor ID is HAM008). Until 2023, the monitoring location was on the roundabout at the intersection of Hewletts Road and Maunganui Road, as shown in the location plan (Figure 3-1) and photograph (Figure 3-2) reproduced below[70].

The monitoring location was moved in 2023 to the roundabout further west on the intersection of Hewletts Road and Newton Street (just visible on the left of the location plan). The monitor is attached to the Give Way sign on a traffic island within the flow of traffic.

Figure 3-1: Location of HAM008 passive monitor (circled in blue)



[70] Waka Kotahi. (2012). Ambient air quality (nitrogen dioxide) monitoring network – site metadata report 2007 to 2011, p 87

Figure 3-2: Photograph of location of HAM008 passive monitor (circled in red)

Measured NO_2 concentrations

The passive monitoring method used by Waka Kotahi is a screening method that has been found to overstate NO_2 concentrations by an average of 33% compared to the results from continuous reference monitors.[71] The concentrations discussed below have not been adjusted for this over-prediction.

The annual average NO_2 concentrations measured at the HAM008 site between 2007 and 2022 are illustrated in Figure 3-3. The concentration recorded in 2021 was unusually high and this may have been influenced by data gaps (3 months missing data) and 3 months with notably high concentrations, which may be due to roadworks in the area affecting congestion and queuing near the monitor.

The concentration recorded at the new monitoring site in 2023 was 28.7 µg/m^3, which is slightly higher than the concentration recorded at the previous site in 2022 (21.5 µg/m^3).

The NO_2 concentrations recorded in Mt Maunganui are generally consistent with other State Highway monitoring sites, noting that most monitors are adjacent to

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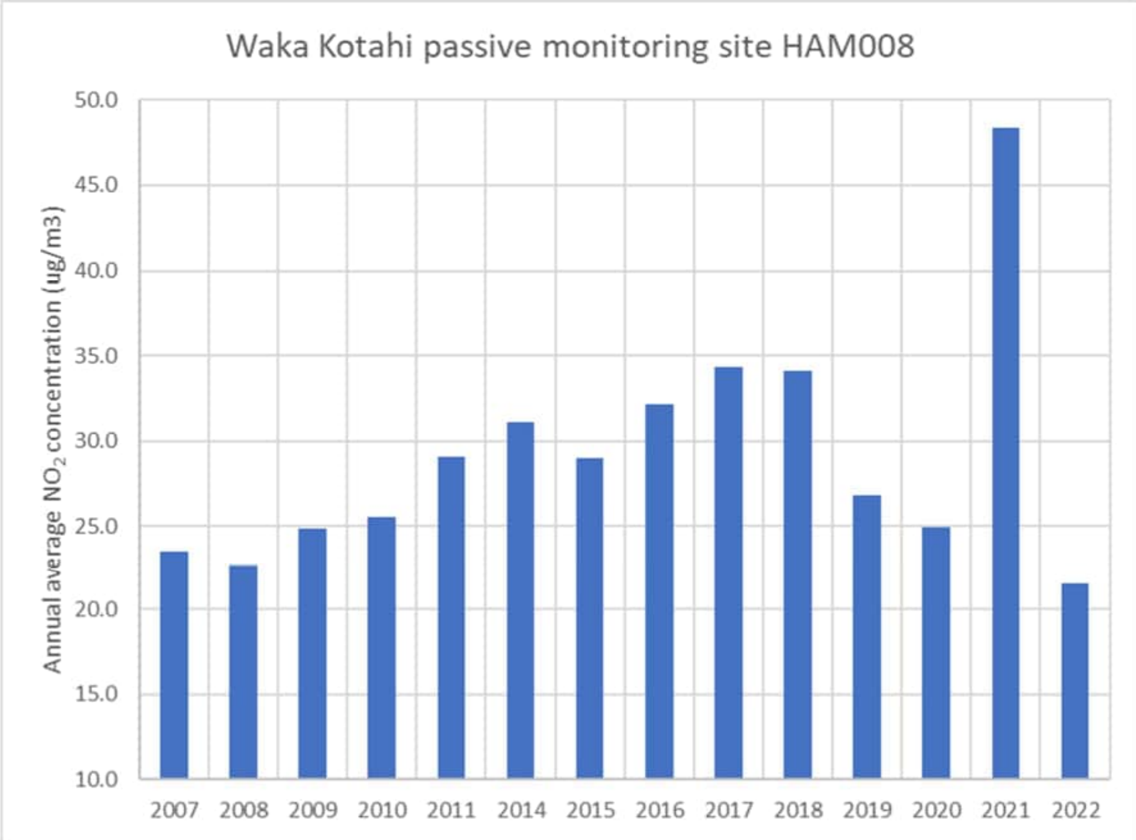
[71] Waka Kotahi. (2023). Ambient air quality (nitrogen dioxide) monitoring programme annual report 2007–2022, p 11

the road rather than within the flow of traffic. Most monitoring sites (32 out of 39) within 20 m of State Highways recorded NO_2 concentrations between 10.1 and 24.9 µg/m^3 in 2022.

Figure 3-3: **NO_2 concentrations recorded at HAM008**



Estimated change in NO_2 concentrations with increasing distance from the road

The change in traffic contribution of NO_2 from a road with increasing distance can be estimated using a screening dispersion modelling method used in the Waka Kotahi Air Quality Screening Tool.

The screening model uses a generalised dispersion curve set out in the UK Highways Agency Design Manual for Roads and Bridges (DMRB)[72]. According to the Highways Agency, this algorithm has been extensively validated for CO concentrations and can be used for other gaseous pollutants and contaminants that behave like gases (such as fine particulate matter).

---

[72] National Highways. (2007). '*Design Manual for Roads and Bridges, Volume 11, Section 3 Environmental Assessment Techniques, Part 1 HA207/07 Air quality*'.

The DMRB algorithm is used to estimate the traffic contribution, which is expressed as the annual average concentration in µg/m^3 (atmospheric concentration) per g/km.hr (emission). The DMRB dispersion curve is a piecewise function that describes how the road contribution varies with distance (d) from the road centreline using following equations.

Equation 1: $If\ 2m < d \leq 5m$:

$$traffic\ contribution = 0.063541 \frac{\mu g}{m^3} per\ g/kmh$$

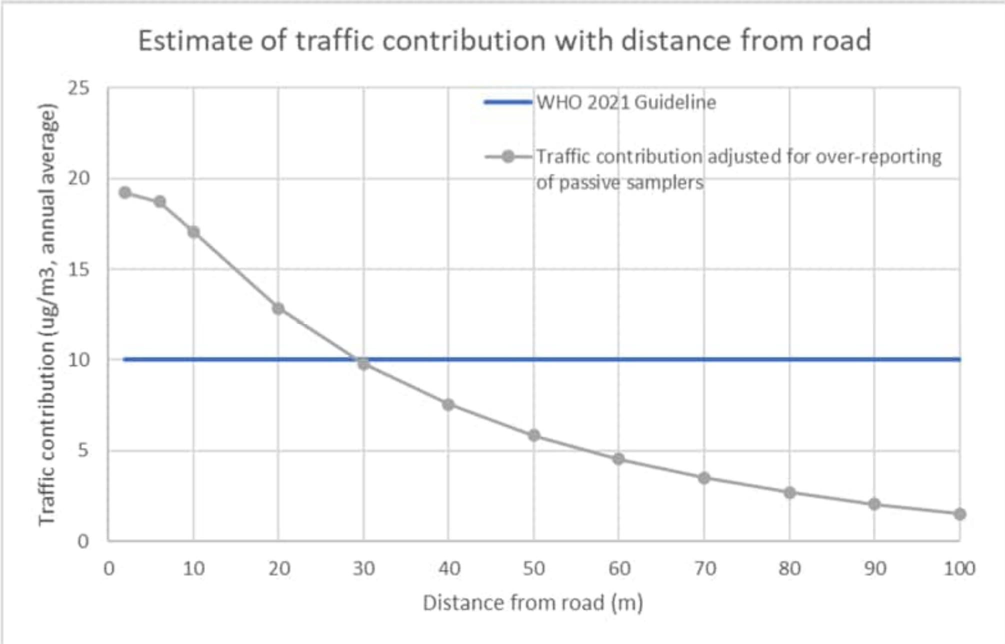
Equation 2: $If\ 5m < d \leq 168m$:

$$traffic\ contribution = 0.17887 + 0.00024d - \left(\frac{0.295776}{d}\right) + \left(\frac{0.2596}{d^2}\right) - 0.0421\ln(d) \frac{\mu g}{m^3} per\ g/kmh$$

Using the slightly higher concentration recorded at the relocated monitor position (28.7 µg/m^3) at a distance of 2 m from the road, the formulae set out above can be used to estimate the concentration at increasing distances from the road.

An adjusted initial concentration to account for the passive monitoring method overstating the concentration by 33% compared to a continuous monitoring method is shown for comparison. This illustrates that the road contribution would be expected to reduce to below the WHO 2021 air quality guidelines at a distance of approximately 30 m from the road.

Figure 3-4: Estimated traffic NO_2 contribution with distance from road



Attachment Four: Test Report for odour emissions at varying RAP levels

Ektimo

Fulton Hogan VIC, Laverton

Citywide Asphalt Plant Odour Emission Monitoring

Report R016777

Document Information

Client Name:	Fulton Hogan VIC
Report Number:	R016777
Date of Issue:	19 April 2024
Attention:	Rory Bracken
Address:	Level 1, Building 7 Botannica Corporate Park 572 Swan Street Richmond Victoria 3121
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Iman Mafakher
Air Monitoring Consultant

NATA Accredited Laboratory
No. 14601

Glenn Trenear
Ektimo Signatory

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to Test Methods section for full details of testing covered by NATA accreditation.

Ektimo

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by Fulton Hogan VIC to perform odour emission testing from the Baghouse Exhaust Stack, serving the tower batch mix asphalt plant, located at their Laverton North site. Testing was performed during variable production conditions, while producing the 20SI product at a rate of 150 tonnes/hr to 165 tonnes/hr. No process interruptions were noted during the testing periods.

1.2 Project Objective & Overview

The objective of the project was to determine the odour emission rate from the Baghouse Exhaust Stack under three different operating conditions.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Baghouse Exhaust Stack - 30% RAP	4 April 2024	Odour concentration Character and hedonic tone
Baghouse Exhaust Stack - 15% RAP		
Baghouse Exhaust Stack - 0% RAP		

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a wet basis at STP.

Plant operating conditions have been noted in the report on page 9.

1.3 Results Summary

The following table summarises the results of the testing programme.

Location	Product	Production Rate	Sampling Time	Odour Concentration [ou]	Odourant Flow Rate [ou.m³/min]
Baghouse Exhaust Stack	30% RAP	150 tonnes/h	10:11 – 10:19	1,800	1,400.000
	15% RAP	165 tonnes/h	11:51 – 11:59	1,600	1,400.000
	0% RAP	161 tonnes/h	10:32 – 10:40	2,100	1,700.000

Ektimo

2 Results

2.1 Baghouse Exhaust Stack - 30% RAP

Date	4/04/2024	**Client**	Fulton Hogan
Report	R016777	**Stack ID**	Baghouse Exhaust Stack
Licence No.	-	**Location**	Laverton
Ektimo Staff	Natalia Martinez, Iman Mafakher	**State**	VIC
Process Conditions	30% RAP - 150 tonnes/hr		240322

Stack Parameters		
Moisture content, %v/v	15	
Gas molecular weight, g/g mole	27.5 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.23 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.96	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0955	
Temperature, °C	76	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	1000	
Volumetric flow rate (wet STP), m³/min	790	
Volumetric flow rate (dry STP), m³/min	670	
Mass flow rate (wet basis), kg/h	58000	

Odour	Average		Test 1		Test 2	
Sampling time			1011 - 1019		1011 - 1019	
	Concentration	Odourant Flow Rate	Concentration	Odourant Flow Rate	Concentration	Odourant Flow Rate
	ou	ou.m³/min	ou	ou.m³/min	ou	ou.m³/min
Results	1800	1400000	1800	1400000	1700	1300000
Lower uncertainty limit	1500		1400		1300	
Upper uncertainty limit	2100		2400		2200	
Hedonic tone			Very unpleasant		Very unpleasant	
Odour character			Chemical (hydrocarbon)		Chemical (hydrocarbon)	
Analysis date & time			05/04/24, 1000-1200		05/04/24, 1000-1200	
Holding time			24 hours		24 hours	
Dilution factor			1		1	
Bag material			Teflon™		Teflon™	
Butanol threshold (ppb)	41					
Laboratory temp (°C)	22					
Last calibration date	July 2023					

Ektimo

2.2 Baghouse Exhaust Stack - 15% RAP

Date	4/04/2024	**Client**	Fulton Hogan
Report	R016777	**Stack ID**	Baghouse Exhaust Stack
Licence No.	-	**Location**	Laverton
Ektimo Staff	Natalia Martinez, Iman Mafakher	**State**	VIC
Process Conditions	15% RAP - 165 tonnes/hr		240322

Stack Parameters		
Moisture content, %v/v	15	
Gas molecular weight, g/g mole	27.5 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.23 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.96	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1149	
Temperature, °C	76	
Velocity at sampling plane, m/s	17	
Volumetric flow rate, actual, m³/min	1100	
Volumetric flow rate (wet STP), m³/min	900	
Volumetric flow rate (dry STP), m³/min	760	
Mass flow rate (wet basis), kg/h	66000	

Odour	Average		Test 1		Test 2	
Sampling time			1151 - 1159		1151 - 1159	
	Concentration ou	Odourant Flow Rate ou.m³/min	Concentration ou	Odourant Flow Rate ou.m³/min	Concentration ou	Odourant Flow Rate ou.m³/min
Results	1600	1400000	1600	1400000	1500	1400000
Lower uncertainty limit	1300		1200		1200	
Upper uncertainty limit	1900		2100		2000	
Hedonic tone			Very unpleasant		Very unpleasant	
Odour character			Chemical (hydrocarbon)		Chemical (hydrocarbon)	
Analysis date & time			05/04/24, 1000-1200		05/04/24, 1000-1200	
Holding time			22 hours		22 hours	
Dilution factor			1		1	
Bag material			Teflon ™		Teflon ™	
Butanol threshold (ppb)	41					
Laboratory temp (°C)	22					
Last calibration date	July 2023					

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2.3 Baghouse Exhaust Stack - 0% RAP

Date	4/04/2024	**Client**	Fulton Hogan
Report	R016777	**Stack ID**	Baghouse Exhaust Stack
Licence No.	-	**Location**	Laverton
Ektimo Staff	Natalia Martinez, Iman Mafakher	**State**	VIC
Process Conditions	0% RAP - 161 tonnes/hr		240322

Stack Parameters		
Moisture content, %v/v	15	
Gas molecular weight, g/g mole	27.5 (wet)	29.1 (dry)
Gas density at STP, kg/m³	1.23 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.96	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0955	
Temperature, °C	76	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, actual, m³/min	1000	
Volumetric flow rate (wet STP), m³/min	790	
Volumetric flow rate (dry STP), m³/min	670	
Mass flow rate (wet basis), kg/h	58000	

Odour	Average		Test 1		Test 2	
Sampling time			1032 - 1040		1032 - 1040	
	Concentration	Odourant Flow Rate	Concentration	Odourant Flow Rate	Concentration	Odourant Flow Rate
	ou	ou.m³/min	ou	ou.m³/min	ou	ou.m³/min
Results	2100	1700000	2600	2000000	1700	1300000
Lower uncertainty limit	1800		2000		1300	
Upper uncertainty limit	2600		3400		2200	
Hedonic tone			Very unpleasant		Very unpleasant	
Odour character			Chemical (hydrocarbon)		Chemical (hydrocarbon)	
Analysis date & time			05/04/24, 1000-1200		05/04/24, 1000-1200	
Holding time			24 hours		24 hours	
Dilution factor			1		1	
Bag material			Teflon™		Teflon™	
Butanol threshold (ppb)	41					
Laboratory temp (°C)	22					
Last calibration date	July 2023					

3 Sample Plane Compliance

3.1 Baghouse Exhaust Stack

Sampling Plane Details	
Source tested	Mixing
Pollution control equipment	Filter baghouse
Sampling plane dimensions	1200 mm
Sampling plane area	1.13 m²
Sampling port size, number & depth	4" BSP (x2), 60 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Centrifugal fan 8 D
No. traverses & points sampled	2 12
Sample plane conformance to AS 4323.1	Ideal sampling plane

4 Plant Operating Conditions

The below plant operating conditions have been supplied by Fulton Hogan personnel.

Location Description	Date	Sample Collection Time	Product	Mixing (Tonnes/hr)
Baghouse Exhaust Stack	4 April 2024	1011 – 1019	30% RAP	150
		1151 – 1159	15% RAP	165
		1032 – 1040	0% RAP	161

See Fulton Hogan records for complete process conditions.

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5 Test Methods

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate & velocity	AS 4323.1	AS 4323.1	8%, 7%	✓	✓
Odour	AS 4323.3	AS 4323.3	refer to results	✓	✓¥
Odour characterisation	NA	direct observation	NA	NA	×

260324

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

¥ Odour analysis conducted at the Ektimo VIC laboratory by forced choice olfactometry. Results were reported to Ektimo on 5 April 2024 in report OV-00957.

6 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

Unless specifically noted, all samples were collected and handled in accordance with Ektimo's QA/QC standards.

7 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BaP-TEQ	Benzo(a)pyrene toxic equivalents
BSP	British standard pipe
CEM/CEMS	Continuous emission monitoring/Continuous emission monitoring system
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
DECC	Department of Environment & Climate Change (NSW)
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier transform infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
I-TEQ	International toxic equivalents
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Particulate matter having an equivalent aerodynamic diameter less than or equal to 10 microns (µm).
$PM_{2.5}$	Particulate matter having an equivalent aerodynamic diameter less than or equal to 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those for which an analytical standard is not available), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
TM	Test method
TOC	Total organic carbon. This is the sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
WHO05-TEQ	World Health Organisation toxic equivalents
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

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Attachment Five: Screening air quality assessment of impact of increased truck movements

Table 5-1 shows the change in daily traffic for a maximum daily production of 3500 TPD in the proposed asphalt plant. This data has been provided by Ms Makinson.

The Waka Kotahi screening model[73] can be used to estimate air quality impacts based on the Annual Average Daily Traffic flow. Annual production is proposed to be limited to 300,000 TPA, therefore the plant could only operate for 86 days in the year at maximum daily production. The change in daily traffic numbers has been annualised based on the worst-case day (ie the worst case day x 86/365).

Table 5-1: Daily traffic data for the proposed Allied asphalt plant on maximum production day (3500 TPD)

Scenario	Site daily traffic data		
	Daily traffic	**Light vehicles (LV)**	**Heavy commercial vehicles (HCV)**
Existing	144	14	130
Proposed (assuming 3500 TPD asphalt)	602	16	586
Change in daily traffic on worst case day	458	2	456
Annualised AADT change	108	1	107

73 https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-sustainability-in-our-operations/environmental-technical-areas/air-quality/air-quality-screening-model/#:~:text=The%20Waka%20Kotahi%20screening%20model,arrive%20at%20a%20cumulative%20concentration.

Table 5-2 shows the impact on AADT on Hewletts Road of the proposed plant producing 300,000 TPA asphalt.

Table 5-2: Change in Annual Average Daily Traffic on Hewletts Road

Scenario	**Hewletts Road annual average daily traffic data**			
	Annual average daily traffic	**Percent HCV**	**Annual average daily LV**	**Annual average daily HCV**
Existing (including current Allied vehicle movements)	42299	10	38069	4230
Proposed assuming 300,000 TPA (annualised)	42407 (0.26% change)	10	38070	4337 (2.6% change)

The two scenarios shown in Table 5-2 have been run through the Waka Kotahi Air Quality Screening Tool to generate predicted concentrations at a nominal distance of 20 m from the road (see screenshots in Figures 5-1 and 5-2). Background concentrations are assumed to be zero as the assessment is interested in the incremental change associated with the change in traffic.

The screening model shows no change in the estimated concentration of PM_{10} (<0.1 µg/m^3 24-hour average) and a 0.1 µg/m^3 change in annual average NO_2 concentrations at a nominal distance of 20 m from the road.

Figure 5-1: Air Quality Screening Tool Screenshot - Existing traffic on Hewletts Road (including existing Allied plant)

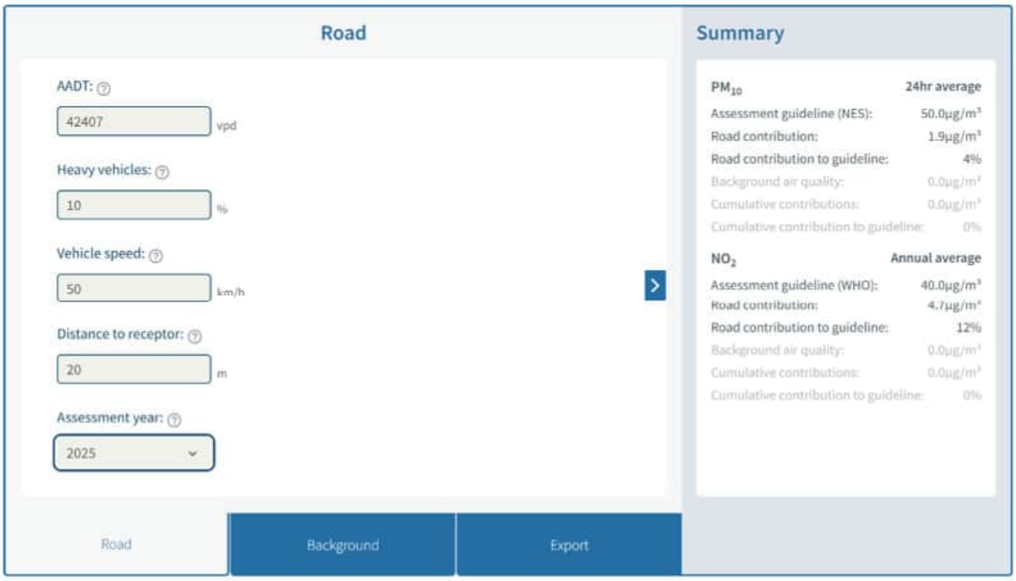
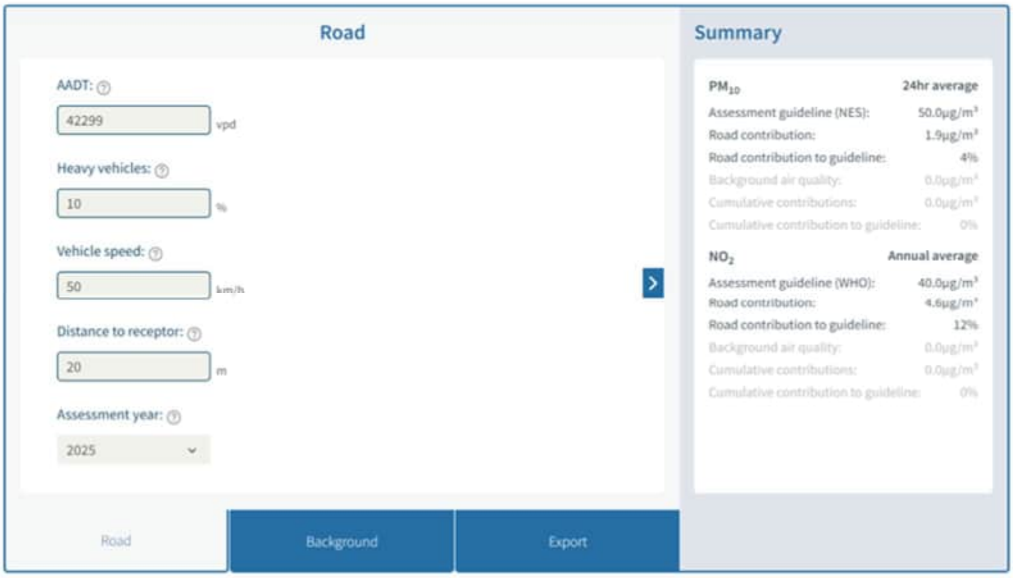


Figure 5-2: Air Quality Screening Tool Screenshot - Traffic on Hewletts Road at maximum annual production for proposed Allied plant



Attachment Six

Table 6-1: Change in PM_{10} emissions as a percentage of emissions in MMA

Plant	Scenario	Emission rate (kg/hour)	Operating hours	Annual emissions (tonnes)	Change in annual emissions (tonnes)	Change in emissions as a percentage of NOx emissions in MMA (174 tonnes)
Existing plant	"Actual" operating scenario (pro rated) (50 TPH)	2.4	1360	3.26		
Proposed plant	"Actual" operating scenario at annual production cap (120 TPH)	0.8	2500	2.00	-1.26	-0.7%

Table 6-2: Change in NOx emissions as a percentage of emissions in MMA

Plant	Scenario	Emission rate (kg/hour)	Operating hours	Annual emissions (tonnes)	Change in annual emissions (tonnes)	Change in emissions as a percentage of NOx emissions in MMA (1036 tonnes)
Existing plant	“Actual” operating scenario (pro rated) (50 TPH)	1.4	1360	1.87		
Proposed plant (natural gas)	“Actual” operating scenario at annual production cap (120 TPH)	1.6	2500	3.90	2.03	0.4%
Proposed plant (diesel)	“Actual” operating scenario at annual production cap (120 TPH)	3.4	2500	8.40	6.53	0.8%

Attachment Seven: Additional dispersion modelling

This report describes additional dispersion modelling undertaken to address the following:

Section 1: Updated dispersion modelling using the BOPRC 2021 meteorological modelling dataset (previous modelling used a 2014 to 2016 met dataset provided by BOPRC);

Section 2: Updated dispersion modelling considering air quality effects at worker accommodation within the Airport Designation.

Section 3: Consideration of potential future 6-storey residential development

As requested at the Air Quality conferencing, Section 1 also includes a comparison of wind roses from the 2021 meteorological modelling dataset for the Allied site and the Airport weather station (in the context of understanding the differences between the 2014-2016 meteorological modelling dataset and the 2021 dataset).

1 Modelling using 2021 meteorological dataset

1.1 Introduction

The Air Quality Assessment used a modelling meteorological dataset provided by the BOPRC for the years 2014 to 2016. The BOPRC has recently produced an additional modelling meteorological dataset for 2021. Further dispersion modelling has been undertaken using the 2021 meteorological dataset.

Model results for PM_{10} and CO for the existing and proposed plants are presented in the following sub-section to demonstrate the difference in model results using the 2021 meteorological dataset compared to the 2014-2016 dataset for all of the relevant averaging periods.

Where the model results using the 2021 dataset are lower than the 2014-2016 dataset, no further consideration is required.

Consistent with the Air Quality Assessment, the highest 1-hour and 8-hour average are the worst-case off-site modelled concentrations at any location, and the 24-hour and annual average model predictions are at the most-impacted sensitive receptor. The sensitive receptors included in this modelling are the same as those considered in the original Air Quality Assessment. Model results at additional receptors are considered in Section 2.

1.2 Model results using BOPRC 2021 meteorological data

Table 1 presents the model results for the existing asphalt. The predicted off site concentrations for all averaging periods are lower for the 2021 meteorology than the 2014-2016 results. The location of the MGLCs are slightly 2021 compared to the worst case presented in the Air Quality Assessment.

Table 1: Comparison of model results for 2021 met dataset and 2014- 2016 mete dataset (used in Air Quality Assessment) – Existing Plant

Contaminant	Averaging period	MGLC (Allied plant contribution only, µg/m^3)		Location of MGLC	
		2014-2016	2021	2014-2016	2021
PM_{10}	Highest 24-hour	4.5	4.3	1 De Havilland Way	3 De Havilland Way
	Second highest	4.2	3.9	1 De Havilland Way	5 De Havilland Way
	Fourth highest	3.5	2.9	1 De Havilland Way	5 De Havilland Way
	Annual	0.7	0.5	1 MacDonald Street	1 MacDonald Street
CO	1-hour (99th percentile)	254	188	Tyreworks site, over N boundary	Hewletts Road Machinery site, over NW boundary
	8-hour	152	145	Tyreworks site, over N boundary	Hewletts Road Machinery site, over NW boundary

Table 2 presents the model results for the proposed asphalt. The predicted off site concentrations for annual averaging periods are lower for the 2021 meteorology than the 2014-2016 results.

Unlike the model results for the existing plant, the maximum predicted 8-hour and 24-hour average concentrations are higher when the 2021 meteorological dataset is used and the location of the most impacted receptor is different. The implications of the 24-hour average model predictions for the proposed Allied plant are discussed in Section 1.3.

Table 2: Comparison of model results for 2021 met dataset and 2014- 2016 mete dataset (used in Air Quality Assessment) – Proposed Plant

Contaminant	Averaging period	MGLC (Allied plant contribution only, µg/m^3)		Location of MGLC	
		2014-2016	2021	2014-2016	2021
PM_{10}	Highest 24-hour	0.98	1.8	3 De Havilland Way	563 Maunganui Road
	Second highest 24-hour	0.88	0.77	1 De Havilland Way	Gwen Rogers Kindergarten
	Fourth highest 24-hour	0.76	0.67	1 MacDonald Street	1 De Havilland Way
	Annual	0.16	0.11	1 MacDonald Street	1 MacDonald Street
CO	1-hour	234	225	HR Cement site, over SE boundary	HR Cement site, over SE boundary
	8-hour	184	266	Clark Engineering, 28b Jean Batten Road (approximately 50 m SW of the Site boundary)[A]	52 Hewletts Road, East Coast Harley Davidson (approximately 230 m N of the boundary)

Table Notes:

A: This was identified as 50 m southeast of site boundary in the AQA.

1.3 Implications of 2021 model results for air quality effects of the proposed Allied plant

The highest, second highest and fourth highest model predictions from the Air Quality Assessment and using the BOPRC 2021 meteorological dataset (from Table 2) are illustrated graphically in Figure 1. Although the 2021 dataset generates a higher maximum 24-hour concentration, the second highest concentration is lower than the highest concentration considered in the Air Quality Assessment.

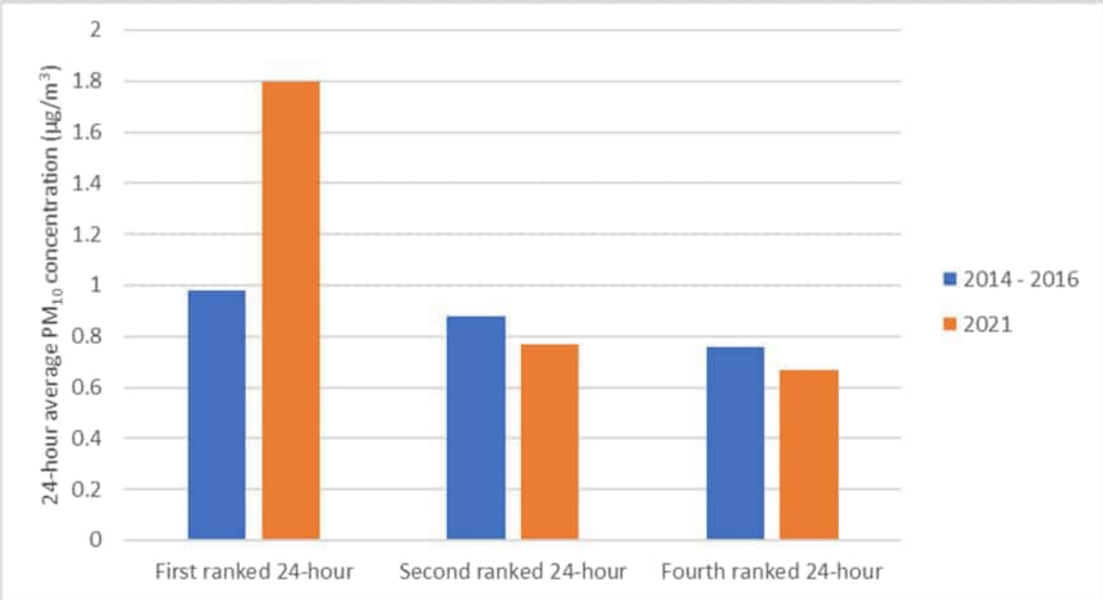


Figure 1: 24 hour PM_{10} MGLC for the proposed plant

1.4 Reasons for difference between 2021 and 2014-2016 meteorological datasets

Meteorological modelling datasets will differ from year to year, reflecting real differences in meteorology. I have reviewed the documentation for the 2021 and 2014-2016 meteorological modelling to identify any other obvious differences for differences between the two sets of modelling meteorological data.

One key difference between the models is that the settings for the 'radius of influence' of the surface weather stations is larger in the 2021 modelling compared to the 2014-2016 modelling. This means that the weather data from surface weather stations will influence wind patterns over a larger area compared to the underlying broad-scale meteorological wind field from the prognostic model.

There is a range of surface observational data included in the model, including the metservice Automated Weather Station (AWS) at Tauranga Airport. The model settings will mean that at the location of the Allied site (and the area between the Allied site and the Airport), the modelled wind fields will be highly influenced by the surface observation data from the Airport weather station.

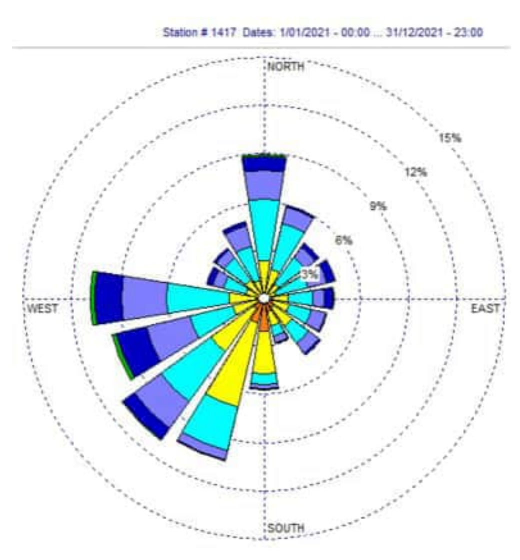
Figure 2 shows windroses that have been produced from the Metservice data for the Airport and CALMET outputs for the location of the Airport weather station and the Allied site. The CALMET output for the location of the Airport weather station should be identical to the metservice data as the Airport weather station is input data to the CALMET model.

The key features of these wind roses are:

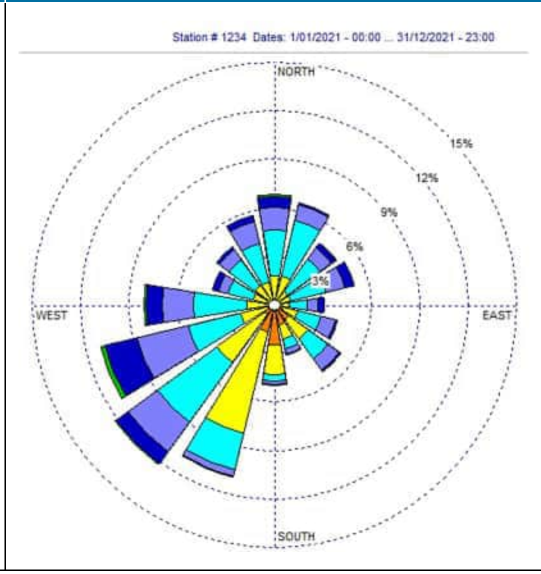
- There are differences between the Metservice data for the Airport AWS and the CALMET data at the same location. This suggests that the raw Metservice data for 2021 has been manipulated or substituted.
- The wind roses generated form the CALMET data show very similar patterns at the location of the Airport AWS and at the allied site, indicating that the model is performing as expected.

All dates

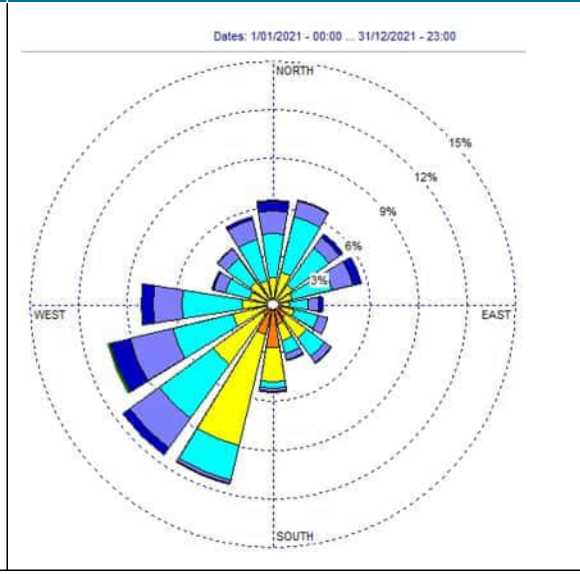
METSERVICE – AIRPORT AWS STATION



CALMET – AIRPORT AWS STATION LOCATION



CALMET – EXISTING STACK LOCATION



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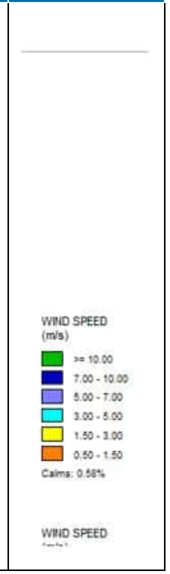


Figure 2: Wind roses for 2021 prepared using 1-hour data provided by MetService for Tauranga Airport (left), from CALMET for the Airport weather station location (centre) and from CALMET for the proposed location of the asphalt plant stack at the Allied site (right)

1.5 Discussion and conclusions

The 2021 meteorological dataset includes a single 'worst case' day. Extracting this day from the meteorological file shows that it comprised a consistent light to moderate southwesterly wind persisting through most of the day and night coinciding with cold conditions and a low (50 m) mixing height. No other days with the same characteristics occur elsewhere in the four years of meteorological data.

In terms of assessing cumulative impacts, there is only one day in the four years of modelled data where the contribution from the Allied site could be higher than was assessed in the Air Quality Assessment. The likelihood of this coinciding with elevated background concentrations is small as background concentrations are elevated under high wind speeds. I do not consider this single "high" day affects the overall conclusions of the air quality assessment.

2 Additional receptors within Airport Designation

2.1 Receptor locations in Airport Designation

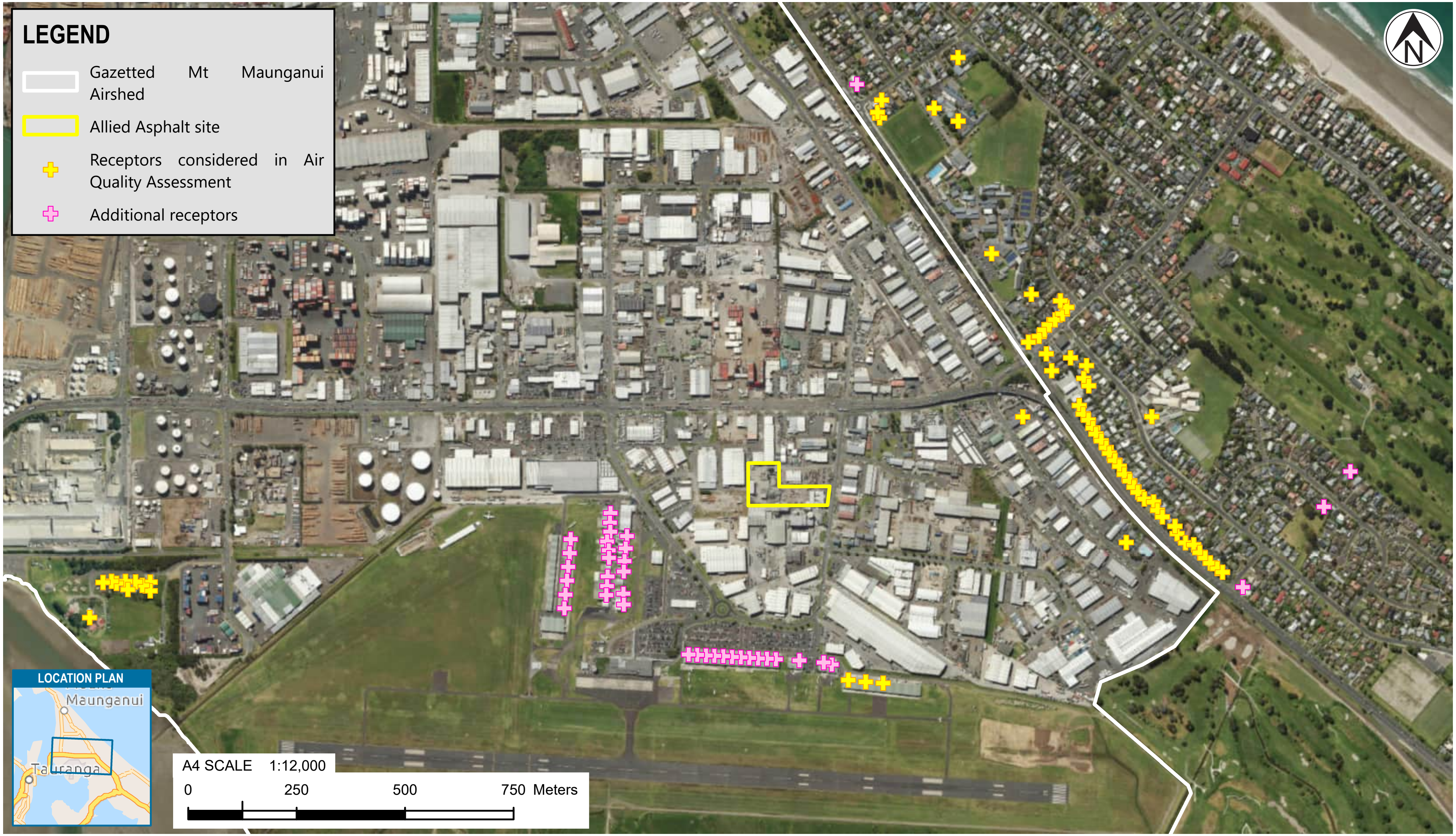
It was identified at the Air Quality expert conferencing that there may be additional locations with the Airport Designation where people may be living in hangars.

The dispersion modelling has been repeated (for all four meteorological years) to include the airplane hangars at 240 Aerodrome Road, Dakota Way and Kittyhawk Way. Although most of the hangars at 240 Aerodrome Road and Dakota Way are used for business purposes, and there are no people living there, all locations have been considered for completeness.

39 additional receptor locations have been included in the modelling, as represented by the pink crosses on Figure 3.

COPYRIGHT ON THIS FIGURE IS RESERVED   DO NOT SCALE FROM THIS FIGURE.

P:\1018258\WorkingMaterial\GIS\MtMaunganui\MtMaunganui.aprx Layout: New receptors 2024-Apr-22 6:47 pm Drawn by ROTU



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PROJECT **AIR QUALITY**

TITLE MODELLED RECEPTORS AND ADDITIONAL RECEPTORS INCLUDED FOR REPLY EVIDENCE

SCALE (A4) 1:12,000   FIG No. FIGURE 3.   REV 0

2.2 Model results for new receptors

Table 3 compares, for the existing asphalt plant, the highest model predictions for the receptors used in the Air Quality Assessment and the highest model predictions include the addition receptors shown in Figure 3. Table 4 presents the same comparison for the proposed plant

The predicted off site concentrations for all averaging periods are lower for the 2021 meteorology than the 2014-2016 results. The location of the MGLCs are slightly 2021 compared to the worst case presented in the Air Quality Assessment.

Table 3: Comparison of model results for new receptors with worst-affected receptors from Air Quality Assessment – Existing Plant

Contaminant	Averaging period	MGLC (Allied plant contribution only, µg/m^3)		Location of MGLC	
		Highest from Air Quality assessment	Highest including new receptors	Highest from Air Quality assessment	Highest including new receptors
PM_{10}	Highest 24-hour	4.5	9.9	1 De Havilland Way	1 Dakota Way
	Fourth highest 24-hour	3.5	7.7	1 De Havilland Way	1 Dakota Way
	Annual	0.7	0.8	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)
$PM_{2.5}$	Highest 24-hour	2.2	5.0	1 De Havilland Way	1 Dakota Way
	Fourth highest 24-hour	1.8	3.8	1 De Havilland Way	1 Dakota Way
	Annual	0.4	0.4	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)
SO_2	Highest 24-hour	3.7	8.2	1 De Havilland Way	1 Dakota Way
	Fourth highest 24-hour	2.9	6.4	1 De Havilland Way	1 Dakota Way
Primary NO_2 (NO_X)	Highest 24-hour	0.29 (2.9)	0.65 (6.5)	1 De Havilland Way	1 Dakota Way
	Fourth highest 24-hour	0.23 (2.3)	0.50 (5.0)	1 De Havilland Way	1 Dakota Way
NO_2 using empirical method (Primary NO_2 using screening method)	Annual	0.24 (0.47)	0.26 (0.52)	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)

Table Notes:

A: NO_2 derived from total NO_X using empirical relationship developed by NIWA (2019).

Table 4: Comparison of model results for new receptors with worst-affected receptors from Air Quality Assessment – Proposed Plant

Contaminant	Averaging period	MGLC (Allied plant contribution only, µg/m^3)		Location of MGLC	
		Highest from Air Quality assessment	Highest including new receptors	Highest from Air Quality assessment	Highest including new receptors
PM_{10}	Highest 24-hour	1.80	1.75	563 Maunganui Road	3 Dakota Way
	Fourth highest 24-hour	0.76	1.31	1 MacDonald Street	4 Dakota Way
	Annual 24-hour	0.16	0.17	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)
$PM_{2.5}$	Highest 24-hour	0.88	0.87	563 Maunganui Road	3 Dakota Way
	Fourth highest 24-hour	0.38	0.66	1 MacDonald Street	4 Dakota Way
	Annual	0.08	0.08	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)
SO2	Highest 24-hour	0.11	0.10	563 Maunganui Road	3 Dakota Way
	Fourth highest 24-hour	0.05	0.08	1 MacDonald Street	4 Dakota Way
Primary NO_2 (NO_X)	Highest 24-hour	0.98 (9.8)	0.98 (9.8)	563 Maunganui Road	3 Dakota Way
	Fourth highest 24-hour	0.40 (4.0)	0.73 (7.3)	1 MacDonald Street	4 Dakota Way
Primary NO_2 (NO_2 using empirical method)	Annual	0.45^A (0.89)	0.47 (0.94)	1 MacDonald Street	Hangar 2 (240 Aerodrome Road)

Table Notes:

A: NO_2 derived from total NO_X using empirical relationship developed by NIWA (2019).

2.3 Assessment of air quality effects at new receptors

The key findings from the data shown in Table 3 and Table 4 can be summarised as follows:

<u>Effects of the existing asphalt plant</u>

- There is a very small (less than 10%) increase in the worst-case annual average model predictions at any sensitive receptor. This would not alter the conclusions of the Air Quality Assessment in regard to impacts of the existing plant on annual average pollutant concentrations.

- There is a relatively large increase (approximately double) in the modelled worst case 24-hour average concentrations, which is also reflected in the fourth highest model concentrations. This is discussed further below

<u>Effects of the proposed asphalt plant</u>

- There is a very small (less than 10%) increase in the worst-case annual average model predictions at any sensitive receptor. This would not alter the conclusions of the Air Quality Assessment in regard to impacts on of the proposed plant on annual average pollutant concentrations.
- There is a small reduction in the highest modelled 24-hour average concentrations, but a moderately large (approximately 50%) increase in the fourth highest worst case modelled concentration.

An assessment of the effects of the existing and proposed plants on 24-hour average concentrations at the receptor locations within the Airport Designation is set out in Tables 5 to 8.

For PM_{10}, there is further discussion about an appropriate background concentration and cumulative effects in Section 2.4.

Table 5: Modelled effects on PM_{10} air quality

Parameter	MGLC (Allied plant contribution only)		Cumulative MGLC (Allied plus background)	
	Existing plant	Proposed plant	Existing plant	Proposed plant
24-hour average – maximum day				
Modelled concentration (µg/m³)	9.9	1.8	40.1	32.0
Percentage of NESAQ 50 µg/m³	19.8%	3.5%	80.2%	63.9%
24 hour average - fourth highest				
Modelled concentration (µg/m³)	7.7	1.3	37.9	31.5
Percentage of WHO 2021 45 µg/m³	17.0%	2.9%	84.1%	70.0%

Table 6: Modelled effects on $PM_{2.5}$ air quality

Parameter	MGLC (Allied plant contribution only)		Cumulative MGLC (Allied plus background)	
	Existing plant	Proposed plant	Existing plant	Proposed plant
24-hour average – maximum day				
Modelled concentration (µg/m^3)	5.0	0.9	19.0	14.9
Percentage of Proposed NESAQ 25 µg/m^3	19.8%	3.5%	75.8%	59.5%
24 hour average - fourth highest				
Modelled concentration (µg/m^3)	3.8	0.7	17.8	14.7
Percentage of WHO 2021 15 µg/m^3	25.6%	4.4%	118.9%	97.7%

Table 7: Modelled effects on SO_2 air quality

Parameter	MGLC (Allied plant contribution only)			Cumulative MGLC (Allied plus background)		
	Existing plant	Proposed plant		Existing plant	Proposed plant	
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
24-hour average						
Modelled concentration (µg/m^3)	8.2	0.11	0.02	22.0	13.9	13.8
Percentage of NESAQ 120 µg/m^3	6.9%	0.09%	0.01%	18.4%	11.6%	11.5%
24-hour average - 4th highest						
Modelled concentration (µg/m^3)	6.4	0.08	0.01	20.2	13.9	13.8
Percentage of WHO 2021 40 µg/m^3	15.9%	0.197%	0.03%	50.4%	34.7%	34.5%

The assessment of effects of NOx emissions on NO_2 is complicated by the need to account for the conversion of emitted NO to NO_2. This is explained in detail in my evidence in chief, where I used a range of different methods, with varying levels of conservatism, to estimate impacts. The available methods different depending on the averaging period being considered, with the 24-hour average model predictions being the most difficult to adjust.

Table 8 sets out the results using two methods, both of which will overstate the actual impacts of the emissions from the Site:

- The Proxy NO_2 method, which is known to be highly conservative; and
- An alternative, but also very conservative screening method, assuming 100% of emitted NO is converted to NO_2 and adding this to a conservatively high background concentration of 27.4 µg/m^3 NO_2, based on monitoring data adjacent to a highly trafficked road (Khyber Pass in Auckland).

Table 8: Modelled effects on NO_2 air quality

Parameter	MGLC (Allied plant contribution only)			Cumulative MGLC (Allied plus background)		
	Existing plant		Proposed plant	Existing plant		Proposed plant
	ULO	Natural gas	Diesel	ULO	Natural gas	Diesel
24-hour average						
Modelled Primary NO_2 concentration and cumulative concentration using Proxy NO_2 method (µg/m^3)	0.5	0.6	1.0	75.5	75.6	76.0
Percentage of NESAQ 100 µg/m^3	0.50%	0.57%	0.98%	75.5%	75.6%	76.0%
24-hour average - 4th highest						
Modelled concentration assuming 100% conversion of emitted NO to NO_2 (µg/m^3)	5.0	5.7	9.8	32.4	33.1	37.2
Percentage of WHO 2021 25 µg/m^3	20.1%	22.8%	39.3%	129.7%	132.4%	148.9%

2.4 Discussion and conclusions

For PM_{10}, the background concentration used in Table 5 is 30.2 µg/m^3 (24-hour average), as recommended by the BOPRC for use in the Air Quality Assessment. Background PM_{10} concentrations at Dakota Way are likely to be lower than at de Havilland Way because of the greater separation to industrial sources. 24-hour PM_{10} air quality in this area is likely to "somewhere between" that measured at de Havilland Way and at Whareroa Marae. The highest fourth highest PM_{10} concentration measured at Whareroa Marae between 2021 and 2023 was 26.5 µg/m^3 (24-hour average). This can be compared to between 40.2 and 49.0 µg/m^3 (24-hour average) at de Havilland Way, which is impacted by an adjacent bulk storage facility. In my opinion, on balance, a background concentration of 30.2 µg/m^3 (24-hour average) would be a reasonable assumption for Dakota Way.

Given the absence of a reliable method to estimate effects on 24-hour average NO_2 concentrations for comparison with the WHO 2021 guidelines, I consider the assessment of impacts on annual average NO_2 concentrations is a more reliable basis for assessing effects on NO_2 air quality (with respect to the WHO 2021 guidelines). As noted in Section 2.2, there is a very small (less than 10%) increase in the worst-case annual average model predictions at any sensitive receptor when the additional receptors on the Airport Designation are considered. This would not alter the conclusions of the Air Quality Assessment in regard to impacts on of the proposed plant on annual average pollutant concentrations.

3 Consideration of effects on 6-storey buildings in the Bayfair development

3.1 Receptor locations

Tauranga City Council Plan Change 33 by the is proposed to enable greater housing density in apartment buildings with a maximum height of 21 m (six storeys) in the Bayfair area.

As the asphalt plant emissions are from a tall stack, an additional model run has been undertaken to confirm that the effects of the proposed asphalt plant on air quality at higher floors of any future 6-storey building are also acceptable (by default the model produces ground level concentrations). This assessment has only been undertaken for the proposed plant, as the existing asphalt plant would be decommissioned by the time this development occurred.

Three potential locations for 6-storey residential development were considered as shown in Figure 4[1]. These locations were selected in consideration of separation distance and the model concentration contours, to ensure the worst case location has been included.

[1] 32 Ascot Rd, 45 Ascot Rd and 602 Maunganui Road

Figure 4: Location of receptors to represent 6-stortey residential development in Bayfair

3.2 Model results

Model results were extracted for the Bayfair receptors at 3.5 m height intervals up to a maximum of 21 m, representing 6-storeys. The highest 24-hour average concentrations are predicted to occur at ground level, while roof level (21 m) produced the highest “fourth highest 24-hour” and annual average results. The model results are compared with the worst-case modelled impacts considered in the Air Quality Assessment in Table 9.

Table 9: Comparison of model results for 6-storey residential development in Bayfair and most-impacted locations considered in the Air Quality Assessment – Proposed Plant

Contaminant	Averaging period	Assessment criterion (from Table 5.1 of the AQA) (µg/m^3)	Maximum concentration (Allied plant contribution only, µg/m^3)		Location of maximum concentration	
			Air Quality Assessment	Bayfair receptors	Highest concentrations from Section 1	Bayfair receptors
PM_{10}	Highest 24-hour	50	0.98 (2.0%)	0.33 (0.7%)	563 Maunganui Road	32 Ascot Road – Ground floor
	Fourth highest 24-hour	45	0.76 (1.7%)	0.23 (0.5%)	1 MacDonald Street	602 Maunganui Road – Roof level
	Annual	20	0.16 (0.8%)	0.04 (0.2%)	1 MacDonald Street	45 Ascot Road – Roof Level

3.3 Discussion and conclusions

Receptors have been modelled at various heights to represent a potential 6-storey residential development in Bayfair. The modelled concentrations at the Bayfair locations, which are at least 1 km from the Site, are much smaller than the worst-case modelled concentrations considered in the Air Quality Assessment. Therefore, the proposed development of high-density residential activities in Bayfair would not alter the conclusions of the Air Quality Assessment in regard to air quality impacts of the proposed plant.