Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Appendix 6b: Air Quality technical expert advice - lake lowering

Re: Fast Track Approvals Act 2024 (FTAA) Technical Advice

Date	17/11/2025
To	Jeremy Ecker, Consent Planner
From	Suzanne Cawood, Senior Environmental Scientist, Beca Limited Mathew Noonan, Senior Associate – Environmental Science, Beca Limited
Project advice provided for	RMA253705 - Meridian Energy Limited - Lake Pūkaki Hydrostorage and Dam Resilience Works
Documents referred to	Draft Air Quality Assessment Draft - Lake Pūkaki Hydro Storage and Dam Resilience Works Air Quality Assessment – Lake Shore Wind Erosion for Meridian Energy Limited (Meridian), prepared by GHD Limited (GHD), 10 October 2025 ('**Draft Air Quality Report'**) Substantive Application Appendix F - Lake Pūkaki Hydro Storage and Dam Resilience Works Air Quality Assessment – Lake Shore Wind Erosion for Meridian Energy Limited (Meridian), prepared by GHD Limited (GHD), 05 November 2025 ('**Updated Air Quality Report'**) Appendix R – Environment Canterbury Feedback Table Lake Pūkaki Hydro storage and dam resilience works, Substantive Application under the Fast-Track Approvals Act 2024, Meridian Energy Limited, 05 November 2025
Qualifications and Experience	Matthew Noonan – BSc Pure Mathematics, BE (1st Class) Mechanical Engineering, MSc (1st Class) Environmental Science, University of Auckland, Post Graduate Certificate in Biostatistics, University of Sydney. 26 years of experience in Air quality Suzanne Cawood – BSc (Hons) and MSc geography, University of the Witwatersrand. 12 years of experience in Air quality.
Code of Conduct	Each expert confirms that they have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless they state otherwise, the opinions they express are within each of their area of expertise, and have not omitted to consider material facts that might alter or detract from the opinions that they express.

Overview of this review

Separate Air Quality assessments have been prepared for proposed rip-rap placement construction activities (Substantive Application - Appendix G) and for the lowering of the lake level below 518m RL (Substantive Application - Appendix F). This review only considers the air quality impact assessment for the lowering of lake levels (Appendix F). The review of the discharges to air construction activities are in a separate report

Beca has reviewed the draft Air Quality assessment (**Draft Air Quality Report'**) on behalf Environment Canterbury (ECan) and provided feedback to the applicant. It is noted that there have been changes made to the Updated Air Quality Report in alignment with discussions with GHD.

Executive summary/overview

1. Meridian is seeking approvals for a period of three years under the Fast Track Approvals Act (FTAA) to enable access to water stored in Lake Pūkaki below 518m RL, without a Security of Supply Alert or Official Conservation Campaign being initiated by the System Operator. Meridian is seeking to access water up to 513m RL during this period.
2. The lowering of the lake will expose more of the shoreline which has the potential to generate additional dust during dry windy conditions. The dust emitted from the additional exposed area can have potential health and amenity effects.
3. The level at which the lake will be lowered below 518m RL and the duration of this lowering, will depend on hydrological and meteorological factors. These factors will, in turn, influence the potential for dust to be generated. In the Air Quality assessment, the frequency and duration of these events have been based on lake levels predicted by Meridian.
4. Potential Air Quality effects of the proposal have been assessed primarily in terms of likelihood of a 'dust storm' event occurring when lake levels are below 518m during the proposed 3-year consent period. A FIDOL (frequency, intensity duration, offensiveness, location) analysis has been presented in the report. In the assessment, a 'dust storm' had been defined as an event when wind speed exceeds 10m/s for a period of at least 2 hours.
5. Overall, the assessment concludes that lowering of the lake has the potential to increase the potential for dust storms. However, based on Meridian's lake level model predictions, these events are likely to occur infrequently and for a short duration.
6. GHD has also concluded that there no practicable measures to actively control dust emissions during a 'dust storm' event. A draft Air Quality Management Plan has been provided in the Updated Air Quality Report.
7. Beca's previous review of the Draft Air Quality Report identified a number of concerns as summarised in Table 1. Some of these concerns have been resolved by the removal of the dust dispersion modelling assessment in the Updated Air Quality Report
8. Additional concerns associated with the Updated Air Quality Report are shown in Table 2. While it is noted that there is still reference to the previous dust dispersion modelling, it has been assumed that these are artifacts.

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Table 1: outstanding areas of contention identified in the Draft Air Quality Report			
Outstanding area of contention	**Reason for significance**	**Proposed Solution**	**Concern Resolved Resolution**
Although not a source of contention, further clarification would be useful to understand when the proposal would increase the probability that lake levels will be dropped below 518m RLand the duration of events compared to operations authorised by PC1 and PC3. It is noted that since (at least) 2014, lake levels have not dropped below 522m RL.	It would be useful to gain a greater understanding of how often increased dust emissions may occur and the duration of these events. Also whether there will be changes in the operation of the lake which may increase the probably of these events occurring.	Clarification on what the proposed changes in operation will have on the likelihood of the lake level dropping below 518m compared to existing operations. Identify any additional factors that increase the probability of the lake levels dropping below 518m.	**Resolved** – no additional information was provided in the Updated Air Quality Report. However, it is accepted that the information provided is all that was available to GHD. It would, however, have been useful to have more information which would have strengthened the FIDOL assessment presented in the report.
There are inconsistencies in the report as to under what wind conditions the dust will be generated and the dust generation rate.	The criteria used to assess when dust is expected to be generated from wind erosion varies between the qualitative and quantitative assessments. Currently, there is a lack of consistency within the report.	Ensure that there is consistency within the report. Provide the calculations used to derive the wind thresholds when dust is expected to be generated (rather than just the friction velocity threshold).	**Partially resolved** – the inconsistencies in the report have to an extent been resolved by the removal of the dispersion modelling results from the assessment. However, it is still uncertain what wind speed criteria has been used to determine when dust will be emitted from exposed surfaces. This will influence the frequency at which dust generation events may occur, and therefore potential exposures.

The potential for the proposal to have dust nuisance effects has not been assessed in the proposal. The potential for dust emissions to have an adverse nuisance effect at sensitive receptors is expected to be the primary Air Quality concern of the proposal. However, only a very limited assessment of dust amenity effects has been undertaken. The dust nuisance effect of the proposal at nearby sensitive receptors has not been considered in the report.	Dust nuisance (amenity) effects are expected to the primary Air Quality issue of concern. These effects have not been assessed, which is significant omission.	An assessment of potential dust nuisance effects should be undertaken. The assessment should be consistent with Schedule 2 of the Canterbury Air Regional Plan (CARP) and the MfE's '*Good Practice Guide for Assessing and Managing Dust*' (GPG Dust). Both guidance documents recommend dust effects are considered in terms of the FIDOL factors and include dust mitigation procedures if appropriate. It would be useful if the distribution and duration that lake levels would be expected to drop, below 518m RL, was expanded on in the assessment.	**Resolved** – A FIDOL assessment has been provided in the AQA Report submitted with the Substantive Application. There are concerns with the FIDOL assessment, however these have been addressed in Table 2 below.
There are numerous concerns with the dispersion modelling assessment. These concerns include both the suitability of dispersion	The assessment has relied primarily on dispersion modelling to assess the Air Quality effects of the proposal. The result of our initial review means we have a low level of confidence in the model predictions and the	We recommend that the suitability of dispersion modelling as an assessment method is reconsidered given the level of uncertainty in the predictions. If modelling is to be used for assessment, then the model	**Largely Resolved** – No dispersion modelling is included in the Updated Air Quality Report, although there are still artifacts of the previous modelling in the text However, the exception is Figures 24 and 25 which present predicted TSP (Total Suspended

modelling as an assessment method in this case, the validity of the input parameters used in the model and the modelling methodology.	conclusions which can be validly drawn from them. It should be noted that the MfE GPG Dust does not recommend the use of dispersion modelling to assess the impact of dust emission sources when there is a high level of uncertainty or variability in source emission rates, such as that associated with dust generated by wind erosion.	inputs and assumptions should be reassessed. The modelling should be undertaken in accordance with dispersion modelling guidelines provided by the Ministry for the Environment.	Particulate) concentrations. While these figures are not referred to in the text, we still have concerns with any reliance on dispersion modelling predictions when assessing potential dust effects. No TSP modelling results were presented in the Draft Air Quality Report (only PM_{10} and $PM_{2.5}$)
Insufficient information is provided regarding the results of the dispersion model predictions. The maximum PM_{10} and $PM_{2.5}$ concentrations predicted at sensitive receptors have not been provided in the report.	As the predicted concentrations at nearby sensitive receptors has not been provided, we are unable to assess the predicted impacts the proposal will have at these locations. It is at these locations where people would be most likely to be exposed to any dust emissions. The report indicates that the National Environmental Standard for Air Quality (NESAQ) for PM_{10} is predicted to be exceeded at some sensitive receptors. These results suggest the effect of the activity may not be negligible.	The results of the model predictions of dust at the surrounding sensitive receptors should be provided in a table. The predictions for the 'baseline' and the proposal scenario should be provided. Such information would be expected in a resource consent application.	**Resolved** – No dispersion modelling is presented in the Updated Air Quality Report. However, compliance of emissions with NESAQ and other relevant health based ambient air criteria is not discussed in the Updated Air Quality Report.
We disagree with some of the conclusions represented on	Based on the information provided, the modelling results indicate that PM_{10} and $PM_{2.5}$ concentrations would	It is recommended that the assessment conclusions are	**Resolved** – The Updated Air Quality Report conclusions have changed from those presented in the Draft Air Quality Report.

p66, Section 12. Including the following: *"The quantitative assessment indicates that there are unlikely to be any adverse effects on people and the environment. Whilst there is a likelihood of increased potential for dust events, the lateral extent and intensity of these events is expected to be limited to those areas along the lake and near the delta."*	exceed NESAQ and ECan CARP ambient criteria concentrations at some sensitive receptors. The modelling results would therefore suggest that the proposal could have an adverse effect on people if the lake level was to be dropped below 518m.	reconsidered and further analysis provided if required.	However, we still have some concerns about the conclusions which have been reached in the Updated Air Quality Report.
While not a point of contention, the report has relied on evidence from Jeff Bluett (2012) prepared for Meridian Energy's Plan Change 1, which in turn references a 1995 report by McGovern for ECNZ. The latter does not appear to be publicly available.	It is currently not possible to check the assumptions made in the report against these information sources.	It is recommended that both of these reports are provided by the applicant, given the reliance on this information in the assessment.	**Unresolved** – the Updated Air Quality Report places great reliance on the Bluett (2012) report. There is some uncertainty as to how well the Bluett's 2012 assessment applies to the proposal in term of proposed management of lake levels.

Table 2: outstanding areas of contention identified in the Updated Air Quality Report		
Outstanding area of contention	**Reason for significance**	**Proposed Solution**
The potential health effects of the proposed dust emissions have not been assessed, particularly in term of exposure of the public to fine particulate matter (PM_{10} and $PM_{2.5}$). Whether emissions would be compliant with health based ambient air quality criteria has not been assessed.	Discharges of dust have the potential to have an adverse health effects. The report notes approximately 57% of the dust generated will be in the form of PM_{10}, and 23% in the form of $PM_{2.5}$ Therefore, emissions of fine particulate matter may not be negligible during some wind conditions. The impact of these emissions is uncertain. It is noted in the report that residential dwellings are located within 17m of the shoreline and therefore, could potentially be exposed to high levels of PM_{10} and $PM_{2.5.}$ The previous dispersion modelling presented in the Draft Air Quality Report suggests exceedance of guidelines could potentially occur at locations close to the lake.	The potential health effects of the proposal should be assessed. It is also recommended that the health effects of exposure to respirable silica is considered for completeness purposes, (although it is noted that ambient concentrations are very unlikely to exceed guideline levels).

The compliance of expected dust emissions against the National Environmental Standards for Air Quality has not been considered in the assessment.	The National Environmental Standards for Air Quality (NESAQ) specify a minimum ambient air standard for PM_{10}. It is uncertain if this standard would be exceeded at nearby dwellings. If exceedance of the NESAQ at locations that people are likely to be exposed, then granting a resource consent would potentially be problematic.	Assess discharges against the NESAQ ambient Air Quality criteria.
Potential dust effects have been assessed in terms of FIDOL factors (Frequency, Intensity, Duration, Offensiveness, and Location) in Section 9 of report. The Canterbury Regional Air Plan (CARP) recommends the potential for dust nuisance effects to be assessed in terms of these factors. However, we have a number of concerns assessment and therefore conclusions which can be drawn from the assessment. A. Wind speed conditions considered The FIDOL assessment only considers effects in terms of 'dust storms' , which are defined as being events for a period when wind speed exceeds 10m/s for more than 2-hours. However, dust can be generated from exposed surfaces any time that wind speeds exceed 5.5 - 7.5 m/s, even if these events occur for a short period of time (e.g. 5-10 minutes). These other wind speed conditions have not been considered in the FIDOL assessment. The FIDOL assessment therefore does not account for these conditions.	A. The assessment will underestimate the frequency and duration at which dust effects may occur. This will in turn underestimate the potential dust impacts of the proposal. The full impacts of the proposal have not been considered. B. The level of information provided makes it difficult to come to a firm conclusion as to the impacts of the proposal. C.	It is recommended the FIDOL assessments be reviewed and updated.

We also have concerns with how the frequency of 'dust storms' was calculated (in Section 7.5 of the report) as discussed below. B. Level of detail provided in the FIDOL assessment While we don't necessarily disagree with the assessment of the Intensity, Duration and Location factors presented in the report, in our opinion insufficient information has been provided. iThe FIDOL factors are discussed only in very general terms. The impacts that the proposal would have on specific sensitive receptors, in particular the dwelling located near the lake which would be most impacted, are not assessed. Overall, the there is still a high degree of uncertainty of the Air Quality impacts of the proposal. C. Conclusions The FIDOL assessment essentially concludes that the risk of a 'dust storm event' occurring is low, primarily as the likelihood of the lake being lowered below 518m is also considered low. We disagree with the basis of this assessment. The activity being proposed is the lowering of lake below 518m. The key consideration is the Air Quality effects of the proposal when the lake is operating under these conditions - not the likelihood of it occurring. The Meridian modelling presented in the report suggests that the lake level could be below the consented level of 518m, for up to 7 months which suggests that risk of adverse dust effects occurring could be significant. However,, even when the frequency of an event occurring is taken into consideration, the predicted lake levels (Figure 1 of the report) indicate that there is more than a 5% probability per year that lake levels would drop below 518m for more 2.5 -3 months. This would	We disagree that the conclusions reach by the FIDOL assessment are fully supported by the information provided in the report.	

suggest there is a reasonably high probability that dust storms could occur over the 3-year period.		
Section 10 provides a qualitive assessment of the relative impacts of lowering the lake level from 518m to 513m on dust emissions. The analysis is based largely on the percentage increase in shoreline surface area with the lowering of the lake. This assessment has not considered the impacts on the west side of the lake where a number of dwellings are located (identified in Section 8.2) within 100m of the shoreline and therefore could potentially be impacted by emissions. It is uncertain how much of this analysis has been used to inform the FIDOL assessment (Section 9).	The assessment has not assessed the potential impacts of the proposal on all of the identified sensitive receptors.	Further detail is required.
The report presents dust (TSP)dispersion modelling results in in Figures 24 and 25 of the Updated Air Quality report. The methodology of modelling, or the relevance of the predictions, is not discussed in the report. We have concerns with dispersion modelling results presented in the Draft Air Quality Report and a low level of confidence in these predictions. It is assumed a similar methodology has been used in the Updated Air Quality Report	The modelling results are not considered to provide an accurate assessment of effects. The limitations of the modelling used in the Draft Air Quality Report have been previously described .	The modelling predictions should be either removed from the assessment, or further justification for the modelling assumptions provided.
Section 7.5 of the report provides a frequency analysis of 'dust storm' events. It is uncertain how much of this analysis has informed the FIDOL assessment presented in Section 9 of report. There are several uncertainties in analysis as presented in the report, including.	It is uncertain how much GHD has relied upon these assumptions in the FIDOL analysis	Review assumptions and provide clarifications.

i. The assumption of the probability of a dust storm occurring between May to October is stated as being 0.4%. The data presented in Section 7.5 would indicate it is much higher at approximately 5.9%. ii. It is also uncertain why the period of May to October has been considered. The Meridian modelling indicates that lake levels are more likely to drop below 518m between September and January when the probability of a 'dust storm' is higher according to Figure 28.		
We disagree with some of GHB's conclusions based on the information provided that, although the dust severity may increase with the increased lake surface area exposed, the frequency of any event would of infrequent and of short duration. Our concerns are: i. The likelihood of dust generation events has not been fully accounted for in the assessment. The assessment has largely focused on 'dust storm events' rather than considering all wind speed conditions when dust may be generated. ii. The impacts of dust events has not been assessed in any detail, particularly at the dwellings located close to the shoreline, and receptors on the western side of the lake. iii. The likelihood that lake levels will drop below 518m in any year, for a period of 2.5-3 months, appears to be approximately 5% per year, based on the Meridian Lake modelling output presented in Figure 1 of the report. This would suggest that there is approximately a 15% probability over the 3-year period that this would occur- and consequently a higher risk than suggested by the GHD report iv. Irrespective of the probability of lake levels dropping below 518m,the primary concern is what would the Air Quality effects be when the lake does drop below 518m (this the 'activity' which is being proposed).	The potential impact of the proposal has been underestimated.	A review of the conclusions is required.

Agreement with the applicant

9. We have a number of concerns with the air quality assessment in regard to the dust generated from exposure of more of the shoreline as a result of the lowering of the lake levels. These concerns limit the degree of agreement we have with the application based on the information provided.
10. We agree with the applicant that lowering the lake levels has the potential to generate dust which could adversely affect air quality. However, we consider there is still uncertainty regarding the air quality impacts of the proposal. We also disagree with GHD's assessment of the risk of these events occurring based on the information provided.
11. We also agree with the applicant that implementing active dust control methods along the entire perimeter of the lake would not be practicable. Even localised controls, such as wetting surfaces, may be difficult to implement.

Benefits of the project

12. No air quality benefits of the proposal have been identified by the applicant. The wider benefits of the project are outside the scope of this review.

Outstanding areas of contention and significance of these.

13. The areas of outstanding contention are detailed in Table 1 and Table 2. The main concerns are that not all of the potential effects of the proposal have been fully assessed.
14. Based on the information provided, we currently disagree with the GHD conclusion that the low frequency and duration of any dust storm event will minimise the potential air quality impacts of the proposal.

Solutions and/or Conditions sought

15. Currently, we have some concerns with the assessment presented in the Updated Air Quality Report and therefore, the conclusions which can be reached from that analysis.
16. We would recommend that a Dust Management Plan is required as a consent condition, and that this plan should be independently reviewed.

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Environment Canterbury 11 March 2026

Via email

Attention: Jeremy Ecker

Lake Pukaki - Dust Management Plan Review

Environment Canterbury has requested Beca to review the Dust Management Plan[1] (DMP) presented by Meridian for the Rock Armouring works at Lake Pukaki. This document has been read in conjunction with Meridian Energy's Air Quality Assessments (Appendix F[2] and G[3] of their substantive Fast Track Application).

Beca has reviewed the DMP and considers the DMP is not detailed enough to provide assurance that the proposed dust control activities are sufficient to mitigate dust effects off site. Additionally, the actions proposed in the management plan are often discretionary leaving the contractor to decide if dust mitigation measures are required. The Air Quality Assessment has determined that dust does need to be managed and therefore the dust control measures stated in the DMP required to achieve the desired effect of no offensive or objectionable dust beyond the site boundary should be compulsory. The DMP should state which activities are the minimum mitigation measures that must occur on site and which additional dust control activities would be required to manage dust further under specific site activities or environmental conditions.

Some of the main concerns with the DMP include the following:

1. Lake Lowering and wind blown dust: The DMP only addresses the rip-rap placement and no management of the dust emissions from (a) the lowering of the lake and subsequent wind blown dust likely to occur from the additional exposed lake shore and (b) the wind blown dust from the construction site. The applicant needs to provide additional measures for how these emission sources are proposed to be managed/mitigated. Specific dust mitigation measures need to be stated in the DMP to control effects on receptors that are in close proximity to exposed areas of the shore or construction activities.

[1] GHD, 2026, Dust Management Plan (DRAFT) | Lake Pukaki Dam Resilience Work, prepared for Meridian Energy, dated the 27th January 2026.

[2] Appendix F - Lake Pukaki Hydro Storage and Dam Resilience Works | Air Quality Assessment – Lake Shore Wind Erosion, prepared for Meridian Energy, prepared by GHD, dated the 5th November 2025.

[3] Appendix G – Lake Pukaki Hydro Storage and Dam Resilience Works | Air Quality Assessment – Rip-rap Placement, prepared for Meridian Energy, prepared by GHD, dated the 5th November 2025.

2. Construction set up and break down: In the DMP, the list of dust emission sources needs to include the construction set up and break down activities that may cause dust, including the construction of haul roads, work benches etc.
3. Site boundary: there is no defined site boundary that would define where the applicant needs to achieve no offensive or objectionable dust beyond the site boundary.
4. Dust Monitoring: the applicant has only mentioned monitoring will occur "*Should it become evident that continuous monitoring is required at the site*". No additional guidance is provided in the DMP as to how the applicant determines whether it is evident that monitoring should occur. We would recommend that monitoring is conducted at the start of the project, before or when construction activities begin. Beca considers the modelling assessment does not agree with the applicant's predicted impact and therefore monitoring will provide clarity as to the actual site effects and provide feedback to the applicant on the adequacy of the dust mitigation activities undertaken on site. In addition, should the dust monitoring results exceed trigger levels/ambient standards, additional actions may be required such as stopping all dust generating activities until additional mitigation measures have been put in place.
5. Adverse Weather/High Winds: The DMP current mentions that no dust generating activities should occur during '*adverse weather conditions*' but does not provide the contractor/site staff with any guidance as to what these conditions are or how they are to determine these conditions. Additionally, there is reference to high winds but no specification as to what is a high wind speed or how the contractor should determine this. Is this just based on visual inspection, or read from weather sites? Beca recommends a site anemometer be installed to provide accurate information to the contractor on wind conditions.
6. Watering for dust suppression: As with the point above, the DMP states '*Regular watering of access roads will be undertaken if rainfall is insufficient*' however, no guidance is provided as to what is deemed insufficient rainfall. The DMP needs to provide more detail on this matter. Furthermore, the DMP should provide clear instructions on when and how frequently the watering of access roads and other dust emission sources is implemented.
7. Water Storage: The DMP does not provide any information on how much water needs to be stored on site for dust suppression. Calculations need to be undertaken to determine this value, and the water storage requirement should

be stipulated in the DMP. It should be clear to the contractors and individuals on site how much water must be maintained on site.

8. Out of Hours Dust Management: There are no indication in the DMP of how dust emissions will be managed when there is no one on site. The site is located within metres of a main road around the lake that is used at all times. The DMP must propose measures to control dust or respond to complaints out of production hours to ensure that dust beyond the site boundary is not offensive or objectionable, or cause a hazard to drivers on this road.

Yours sincerely

Suzanne Cawood

Senior Environmental Scientist

on behalf of

Beca Limited