Wellington Registry
Te Whanganui-a-Tara Rohe

ENV-WLG-2024-001

In the Environment Court
I Mua I Te Kōti Taiao O Aotearoa

Under the Resource Management Act 1991

and in the matter of the direct referral of an application for resource consents by Meridian Energy Limited in respect of the proposed Mt Munro wind farm under section 87G of the Resource Management Act 1991 (**RMA**).

Meridian Energy Limited
Applicant

and

Tararua District Council, Masterton District Council, Manawatū-Whanganui Regional Council and Greater Wellington Regional Council (**Councils**)
Consent Authorities

and

s 274 Parties

Statement of Evidence of Robert Alan Van de Munckhof on behalf of Meridian Energy Limited

24 May 2024

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INTRODUCTION

1. I am a Principal and Senior Environmental Engineer at Tonkin & Taylor (**T+T**). I hold the qualifications of Bachelor of Engineering in Chemical and Materials from Auckland University. I have over 20 years' experience in environmental management including air quality and have been employed as a specialist in environmental management at T+T since 2005.

2. I have broad experience across the field of air quality including preparing assessments of environmental effects to support resource consent applications, preparation and presentation of evidence to support regional plan development including presenting evidence for a range of clients at the Auckland Unitary Plan hearings on air quality topics.

PURPOSE AND SCOPE OF EVIDENCE

3. I have been engaged by the Applicants to provide evidence on dust and air quality in relation to the construction of the proposed Mt Munro Windfarm (the **Project** or **Mt Munro**). My involvement with the Project began in January 2024, when I was asked to undertake a FIDOL assessment of the effects of dust from the Project, in order to respond to a section 92 request for information made by the Councils on 20 December 2023. This assessment was provided to the Councils on 23 February 2024, and is included in **Appendix A** to this evidence (the **Mt Munro Dust Assessment**, or **my Assessment**). I confirm that I hold the same views and conclusions as expressed in my Assessment, and this evidence summarises that document.

4. In summary, the findings expressed in my Assessment are that:

   (a) The risk of dust effects from construction activities, including the yard/ laydown area, the concrete batching plant and rock crushing activities is low due to the separation distances between the proposed works areas and sensitive activities;

   (b) The main risk of dust effects is associated with construction traffic using Old Coach Road. With the effective application of wet suppression and/ or chemical treatment the effects could be managed but the risk of dust effects cannot be avoided; and

(c) If the section of Old Coach Road from SH2 (State Highway 2) to the site access point was sealed, dust effects from vehicle movements along Old Coach Road would be negligible.

5. In my evidence, I summarise the Assessment, and then respond to:

(a) issues raised in submissions; and

(b) issues raised in the s 87F officer's report.

CODE OF CONDUCT

6. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note 2023. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

THE PROJECT

The Project and Site

7. The Project and Site have been described more fully in the evidence of others, including Mr Bowmar. I discuss matters relevant to air discharges.

8. Since the initial application, it is understood that Old Coach Road will be upgraded to enable construction activities. This is described in the evidence of Mr Shields.

Nature of Air Discharges

9. The main discharge to air associated with the Mt Munro Project will be dust from construction activities and vehicle movements as well as the operation of the proposed concrete batching plant and mobile rock crusher on-site.

10. Potential effects of dust emissions mainly relate to nuisance and soiling effects. Nuisance dust effects are most commonly associated with coarse particles larger than 20 micrometres (µm)1 and can include the following effects:

(a) Soiling of clean surfaces;

(b) Dust deposits on vegetation;

(c) Contamination of roof-collected water supplies; and

(d) Visibility impacts.

11. Dust from construction activities can contain a small component of fine particles (less than 10 micron diameter, referred to as PM_{10}) that can have adverse effects on people's health.

12. Dust deposited on vegetation may also create ecological stress within sensitive plant communities, particularly during long dry periods where dust can coat plant foliage, adversely affecting photosynthesis and other biological functions. Cement dust can also increase plant alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt. These effects generally only occur where there are high dust loadings (e.g. visible dust coating leaves).

13. Typically, the most significant source of dust associated with earthworks and construction projects arises from the movement of vehicles along unpaved surfaces during dry weather. This occurs because of the action of the wheels disturbing dust from the unpaved surface. Dust from vehicle movements can occur irrespective of wind speed conditions but the scale of dust emissions will be dependent on the moisture content and proportion of fine material in the haul road / surface, as well as the number of wheels and weight and speed of vehicles.

[1] 1 µm equals 1/100,000th of a metre

14. Other less significant sources of dust that may be associated with the Project include the following:

(a) Vegetation removal;

(b) Excavator or motor-scraper cutting and shaping of ground;

(c) Pavement construction (grading, compaction etc.);

(d) Forming and compaction of fill and spoil sites; and

(e) Handling and stockpiling of dusty material.

15. In addition, the project includes a concrete batching plant on-site. Dust from the cement silo refilling, if not properly controlled, can be a source of dust.

SENSITIVE RECEPTORS

Identification of Sensitive Receptors

16. Ministry for the Environment good practice guidance[2] describes the sensitivity of different landuse types to dust effects. This identifies hospitals, schools, childcare facilities, rest homes and marae along with residential as having a high sensitivity to dust effects. None of these landuses are located within the vicinity of the site as the wind-farm site is located within a rural area. Rural areas are generally considered to have a low sensitivity to dust effects although dwellings and associated curtilage within these areas will have a high sensitivity to dust effects.

17. Based on the guidance I consider the most sensitive receptors around the site to dust effects are existing dwellings. A plan showing the location of all dwellings within the vicinity of the site was prepared by Boffa Miskell and submitted with the application[3]. The closest neighbours to the site boundary are located on Falkner Road to the

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[2] Ministry for the Environment, Good practice guide for assessing and managing dust, November 2016

[3] Boffa Miskel, Figure 6, revision 1 dated May 2023.

west, Old Coach Road to the north, Crombies Road to the southwest and Hall Road to the south.

Screening of Receptors

18. While dwellings are inherently sensitive to dust effects, the distance from the dust source has an impact on the potential risk of dust effects. Guidance on the assessment of dust from demolition and construction has been prepared by the UK Institute of Air Quality Management (IAQM). This guidance indicates that a detailed dust assessment would only be required where there are “human receptors” (dwellings) within 250 metres from the site and 50 metres from any roads used.

19. For ecological receptors a detailed assessment would only be required where there is a sensitive ecological area within 50 metres from works and construction routes.

20. There are four dwellings located within 250 metres of the site boundary, but these are over 250 metres from any proposed work areas. There are five dwellings located on Old Coach Road which is proposed to be the main access to the site. The length of Old Coach Road from SH 2 is currently unsealed and therefore has the potential for dust to be generated during vehicle movements to and from the site.

21. The Victoria (Australia) EPA (Environmental Protection Authority) has developed recommended separation distances for industrial residual air emissions[4] that includes a recommended separation distance of 100 metres for concrete batching plants where production exceeds 5,000 tonnes per year.

22. There is no specific guidance for rock crushing with the closest activity being “quarrying, screening, stockpiling and conveying of rock” with a recommended separation distance of 250 metres. The locations for the proposed concrete plant and crushing plant are in the middle of the project area over 1,000 metres from any site boundary, well in excess of the recommended separation distances.

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[4] Victorian EPA, Recommended separation distances for industrial residual air emissions, March 2013

23. The ecological assessment for the project has concluded that the existing ecological values associated with the Mt Munro Project area are low. The majority of the area within 50 metres of the proposed works area is pasture with low ecological values identified. Therefore, I consider the ecological sensitivity to dust of areas with 50 metres of the works areas and the main access is low.

24. From this screening assessment based on separation distance I consider that the receptors with the greatest potential to be impacted by dust emissions from construction activities, specifically dust from vehicles on the unsealed road, are the dwellings located along Old Coach Road. I consider all other dwellings have a low risk of being impacted by dust effects because of the significant separation distances between the proposed works areas and the dwellings, which mitigates the risk of dust effects.

METEOROLOGY AND TOPOGRAPHY

25. The occurrence of strong winds during dry weather can exacerbate dust emissions from earthworks operations. Furthermore, the orientation of sensitive locations to dust sources and the degree that they are downwind under strong, dry wind conditions will affect the exposure of identified sensitive locations to potential dust impacts.

26. The proposed wind farm is located on a number of ridges to the east of the Tararua Ranges. Due to the topography and exposed nature of this location, it will be particularly susceptible to sustained periods of high winds, making the location suitable for a wind farm but also providing frequent conditions for the generation of windblown dust from exposed surfaces.

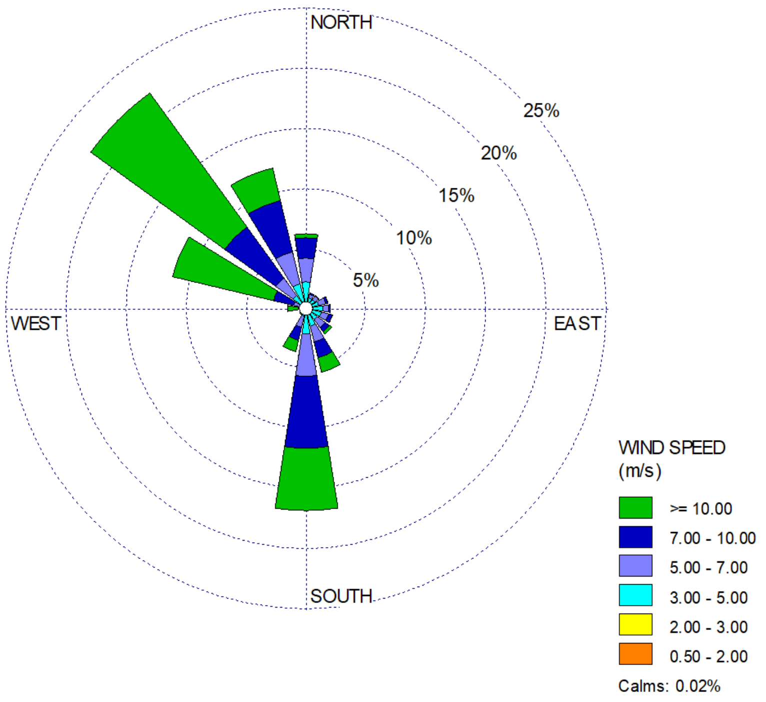
27. Meteorological data has been provided by Meridian for the Site for the period June 2020 to January 2024. A summary of the data for the site is presented as wind roses in Figure 1. Wind roses graphically summarise wind speed and direction data over a period of time. The petals of the wind rose show the direction that winds come from – their length indicating the frequency of winds from that direction. The different colour bands within each petal indicate the frequency of wind

speeds from that direction. The predominant wind directions at the site are from the northwest and directly from the south.

28. Wind entrainment of dust from exposed earthworks areas or stockpiles occurs under higher wind speeds and 7 m/s is commonly used as a threshold wind speed for wind entrainment. Figure 2 is a further wind rose showing only strong winds that are 7 m/s (hourly average) or greater and clearly demonstrates the prevalence of strong winds from the northwest and south, which is the same pattern as for overall winds. There is a high frequency of strong winds at the site, with 65% of the winds greater than 7 m/s.

29. Therefore, areas north and southeast of the areas of proposed works have the greatest potential to be exposed to dust generated from the Project.

Meridian Wind Farm (Mt Munro). 16/06/2020 0:00 – 10/01/2024 5:00.



Meridian Wind Farm (Mt Munro). 16/06/2020 0:00 – 10/01/2024 5:00. Strong winds only

Figure 1: Summary of Meteorological data for the period June 2020 to January 2024

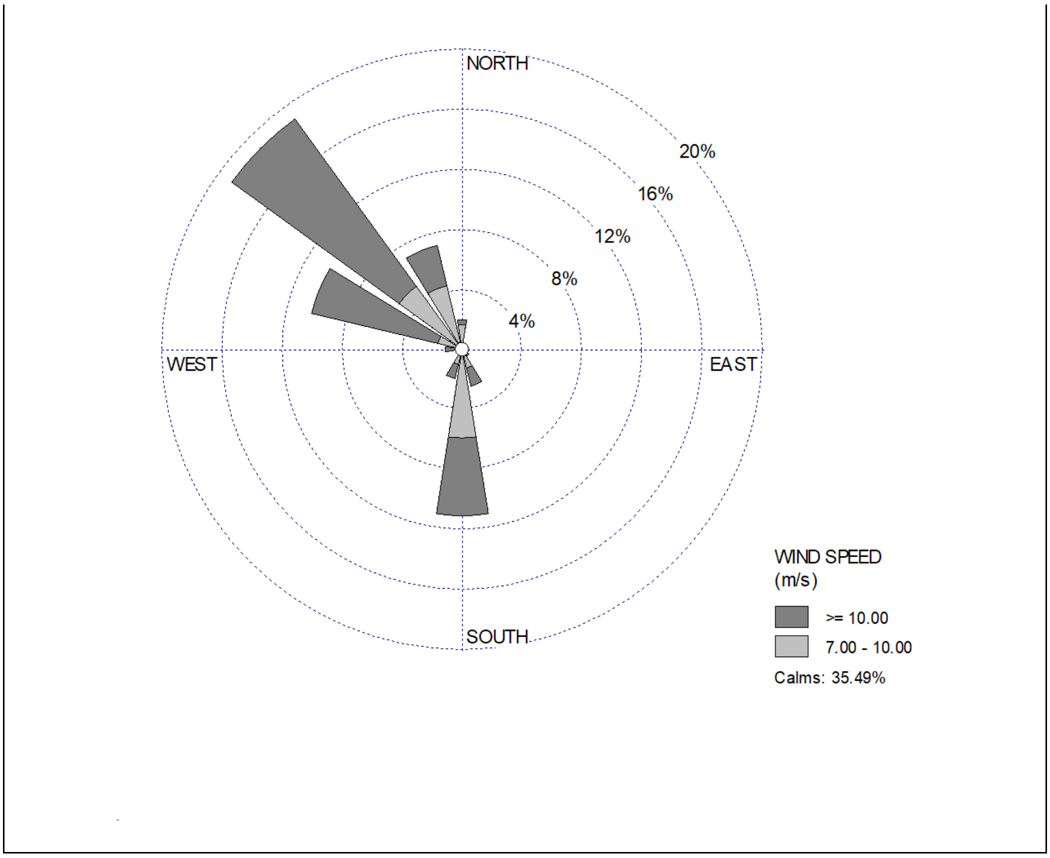


Figure 2: Summary of Meteorological data showing strong winds that are 7 m/s (hourly average) or greater

METHODOLOGY AND LIMITATIONS

30. The Ministry for the Environment guidance states that the emphasis in a dust assessment should be on the appropriate management and control of dust to avoid adverse effects and that a qualitative assessment approach (rather than quantitative techniques such as dispersion modelling) is most appropriate[5].

31. The key consideration when assessing nuisance dust effects is whether the discharge gives rise to an 'offensive or objectionable' effect beyond the proposed designation boundary by considering the FIDOL factors, which are detailed further below.

32. The assessment approach comprised an initial screening assessment to identify potentially affected locations based on the separation

[5] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016

distance between sensitive activities and potential dust sources followed by a more detailed assessment for those locations identified in the initial screening evaluation.

33. The detailed assessment of identified locations evaluated the risk of impacts based on a consideration of five factors, being frequency, intensity, duration, offensiveness and location (the "FIDOL factors") for each location from unmitigated sources of dust.

34. The FIDOL factors provide an objective framework for evaluating dust effects and are described as follows:

(a) **Frequency**: The frequency of exposure to dust impacts experienced at a given location. The frequency of exposure depends on both the frequency of occurrence of discharges and the frequency of weather conditions that could transport any discharge towards a sensitive location.

(b) **Intensity:** The intensity of dust impacts depends on the degree to which dust sources are controlled but also the separation distance between a source and the receptor.

(c) **Duration:** The duration of exposure depends on how long a sensitive location may be exposed to dust from a source.

(d) **Offensiveness:** The offensiveness of dust relates to the nature of the dust in terms of its character or ability to soil or cause abrasion of surfaces.

(e) **Location:** The location factor relates to the sensitivity of the location being assessed, and is typically expressed as low, medium or high.

35. With regard to receptor types, I have attributed the following sensitivities to dust impacts:

(a) Residential dwellings: high sensitivity; and

(b) Pastoral grazing land/forestry: low sensitivity.

36. The FIDOL assessment is informed by a review of exposure of sensitive locations to certain wind conditions to inform the potential frequency and duration of potential effects. This focuses on the occurrence of strong winds during dry weather, as these are typically the most conducive weather conditions for causing significant unmitigated dust emissions from earthworks and construction activities.

ASSESSMENT OF EFFECTS

37. A separate FIDOL assessment has been carried out for the three main project activities as follows:

(a) effects associated with the construction activities and construction yard, including the access roads on-site;

(b) effects associated with vehicles on Old Coach Road; and

(c) effects associated with the on-site concrete batching and aggregate crushing plants.

38. In addition, a FIDOL assessment has been undertaken for the proposed rebuild of Old Coach Road.

Table 1: FIDOL evaluation construction activities

FIDOL Factor	Evaluation
Frequency	Frequency of exposure to dust impacts depends on the frequency of activities that could generate dust and the frequency that a sensitive location (sufficiently close to be impacted) is downwind. As the construction activities will occur over the project construction period including potential stockpiling of materials and open earthworks during dry periods, the frequency of dust generation is assumed to be continuous. When considering the frequency of winds, the predominant wind directions are from the northwest and south, meaning that properties to the north and southeast of the Site are the most frequently downwind.
Intensity	The intensity of impacts depends on the scale of emissions from the dust source and the distance a sensitive location is from that source. Assuming that standard dust control measures are in place and the separation distances from the works areas to dwellings being over 200 metres any dust exposure would be very low or negligible.

FIDOL Factor	Evaluation
Duration	The duration of impacts is a function of the duration that dust generating activities are undertaken and the duration that a sensitive location may be downwind of those activities. As for frequency, it is assumed that potential sources will operate for the duration of works within an area. The duration of wind events is largely linked to the frequency that a given sensitive location is downwind of a dust source.
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. The nature of dust from the site will be largely inert soil and aggregate derived dust, typical of dust generated in the wider receiving environment. As such, the dust will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts.
Location	In terms of location, no receptors were identified as having a moderate or high sensitivity to dust effects due to the separation distances.

39. Overall, based on the FIDOL evaluation, the risk of dust effects from construction activities is low, with separation distances sufficient to mitigate any residual dust from construction activities.

Table 2: FIDOL evaluation concrete batching plant

FIDOL Factor	Evaluation
Frequency	The main potential discharge of dust from the operation of the concrete batching plant is associated with the filling of the cement silo. The concrete batching plant will primarily be used for the construction of the foundations for the turbines and some ancillary activities. Overall, it is expected it would be used on approximately 30 occasions with refilling of the silo required during these periods.
Intensity	The concrete batching plant will be fitted with a silo filter, and refilling interlocked from the cement tanker to the silo. This ensures that during normal operation any discharges are minimal. In the event of filter sock failure, the discharge of cement dust may occur which could have moderate dust effects within 100 metres of the cement silo.
Duration	Discharges to air will only occur during refilling of the cement silo. The duration of filling would not exceed one hour at a time.

FIDOL Factor	Evaluation
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. Cement dust has a high pH and would be considered more offensive in character when compared to other sources of dust such as inert soil and aggregate derived dust.
Location	The concrete batching plants are proposed to be located on the ridgeline in the middle of the site. There are no sensitive receptors within 1km of the plant.

40. Overall, based on the FIDOL evaluation, the risk of dust effects from the concrete batching plant is low, with separation distances sufficient to mitigate any dust from the operation of the concrete batching plant.

Table 3: FIDOL evaluation rock crushing

FIDOL Factor	Evaluation
Frequency	As rock crushing will occur over the site establishment, bulk earthworks and civils phases of the project where suitable material is identified, the frequency of dust generation is assumed to be continuous. When considering the frequency of winds, the predominant wind directions are from the northwest and south, meaning that properties to the north and southeast of the Site are the most frequently downwind.
Intensity	The intensity of impacts depends on the scale of emissions from the dust source and the distance a sensitive location is from that source. Assuming that standard dust control measures are in place and the separation distances from the crushing operations to dwellings being over 250 metres any dust exposure would be very low or negligible.
Duration	Discharges to air will only occur during the operation of the crusher. Depending on the nature of the rock identified, this could be operated throughout the project.
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. The nature of dust from the crusher will be largely aggregate derived dust, typical of dust generated in the wider receiving environment. As such, the dust will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts.
Location	The rock crushing plant is proposed to be located within valleys and gullies away from the property boundaries and not closer than 250 metres from the property boundaries.

41. Overall, based on the FIDOL evaluation, the risk of dust effects from construction activities is **low**, with separation distances sufficient to mitigate any residual dust from rock crushing activities.

Table 4: FIDOL evaluation site access

FIDOL Factor	Evaluation
Frequency	The frequency of dust impacts from the site access road during construction is dependent on the number of vehicle movements. The proposed light traffic movements vary over the project and would be up to a maximum of 40 to 100 movements per day depending on the phase of the works with 80% of these during the morning and evening peak. Heavy vehicle movements are predicted to be between 106 and 522 movements per day, with the highest movements during the civil works, which will occur over 7 months of the 32-month construction programme.
Intensity	Road dust can result in both nuisance and health effects to dwellings adjacent to unsealed roads. The effects are greater the closer dwellings are to the road, with the highest intensity of dust occurring at dwellings closest to the road compared to those set back away from the road (studies have shown that road dust can extend more than 80 metres from the road[6]).
Duration	Each vehicle will result in dust effects over the duration of the movement across the road, assuming each vehicle takes one minute to traverse a section of road and for dust to settle. Dust impacts could occur over the whole duration of the construction works.
Offensiveness	Similar to dust from construction activities, dust from unsealed roads will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts. However, it may contain a higher fraction of very fine material due to the pulverising effect of the wheels on heavy vehicles. As such dust clouds may be more visible and persistent than for construction activities and there is a greater risk of health effects from exposure to fine articulate matter.
Location	There are 5 dwellings located within 120 metres from Old Coach Road that are expected to be sensitive to dust effects from vehicle movements.

[6] Impacts of exposure to dust from unsealed roads, April 2017, NZ Transport Agency research report 590

42. Overall, based on the FIDOL evaluation, the potential effects associated with dust from the vehicle movements along Old Coach Road, without any mitigation or controls would be potentially significant with 5 dwellings likely to be impacted from the proposed traffic movements.

Table 5: FIDOL evaluation rebuild Old Coach Road

FIDOL Factor	Evaluation
Frequency	The rebuild of Old Coach Road will be undertaken over a 9-month period, with works progressing in phases. The frequency of dust impacts from the works is dependent on the nature of the works (e.g. excavation and removal of existing road surface, placement of new subgrade material and vehicle movements). It is likely that the number of heavy vehicle movements per day would be significantly less than those required for the main construction works with 73 vehicles movements per day likely over the first 9 months of the construction period.
Intensity	Both road dust from vehicle movements and dust from the placement and removal of fill and aggregate can result in both nuisance and health effects to dwellings adjacent to unsealed roads. The effects are greater the closer dwellings are to the road. Due to the scale of works, standard controls would limit the intensity of dust generation.
Duration	Each vehicle will result in dust effects over the duration of the movement across the road, assuming each vehicle takes one minute to traverse a section of road and for dust to settle. Dust impacts could occur over the whole duration of the construction works. In addition, dust from the road rebuild are likely when works are being undertaken within the immediate vicinity of properties on Old Coach Road.
Offensiveness	Dust from construction activities will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts. The nature of dust from the site will be largely inert soil and aggregate derived dust, typical of dust generated in the wider receiving environment.
Location	There are 5 dwellings located within 120 metres from Old Coach Road that are expected to be sensitive to dust effects during the construction activities.

43. Based on the FIDOL evaluation, the potential effects associated with dust from vehicle movements along Old Coach Road during the road rebuild works, with the effective implementation of dust controls

measures can be managed to be less than minor. Monitoring of dust is recommended to ensure the controls are sufficient and if necessary, identify the need to implement additional controls. The proposed mitigation measures are discussed further in Section 8 below.

MITIGATION OF DUST EFFECTS

Mitigation: Old Coach Road

44. There are a number of possible mitigation methods that could be used to reduce or avoid dust effects from vehicle movements on Old Coach Road which are discussed below.

Table 6: Evaluation of possible mitigation methods

Possible Method	Effectiveness in Reducing/Avoiding Dust
Wet suppression using water	This can be moderately effective but is dependent on the frequency of water application and availability of sufficient water. A reliable water supply would be required to maintain the road in a damp state.
Reduction/ control of vehicle speeds	By itself, control of vehicle speeds is moderately effective for light vehicles, but is less effective for heavy vehicles unless vehicle speeds are kept very low (< 15 km/hr). Could be used in conjunction with other methods such as wet suppression or chemical treatment.
Chemical treatment of road surface	The effectiveness of chemical treatment varies depending on the type of chemical used and the traffic volumes and types. The most common chemical used is Lignin sulphate, which is moderately effective for roads with light traffic, but requires frequent refreshing particularly following rainfall.
Sealing of the road	Sealing of the road is the most effective solution as this eliminates the source of the dust (being the aggregate road surface). It is also effective for all vehicle types and would be effective over the full duration of works.

45. Overall, the most effective method to control dust would be to seal the road. As the road is required to be upgraded as part of the project, this could be incorporated into the works. Sealing the road would remove the potential dust source and therefore dust impacts from the use of Old Coach Road would be negligible. This would also reduce the overall vehicle movements required as a proportion of the vehicle

movements would be associated with water trucks to suppress dust on the road.

46. The use of either chemical treatment or wet suppression (or both together) along with control of vehicle speeds would reduce the intensity of dust, but would require on-going application of water and/or chemicals and enforcement of vehicle speed limits. The use of wet suppression would be challenging during dry months due to the volume of water required and the speed at which the road can dry out. If chemical treatment was applied, this would require regular application and may not be effective during wet periods. Overall, the use of wet suppression or chemical treatment with speed controls would reduce the intensity of dust, but the risk of dust effects would remain.

47. The assessment of dust effects has identified that the risk of dust effects from construction activities, including the yard/ laydown area and the concrete batching plant and rock crushing, is low due to the separation distances between the proposed works areas and sensitive activities.

48. The main risk of dust effects is associated with construction traffic using Old Coach Road to access the Site. Old Coach Road is unsealed and with the predicted vehicle movements of up to 622 movements per day the effects of road dust on adjacent dwellings off Old Coach Road could be significant without additional controls. With the effective application of wet suppression and/or chemical treatment along with speed limits for vehicles, the effects could be managed. However, the risk of dust effects during particularly hot and windy weather conditions could not be avoided using these methods.

49. If Old Coach Road from SH2 to the Site access point was sealed, dust effects from vehicle movements along Old Coach Road would be negligible. I understand Meridian has agreed to this.

Mitigation: Old Coach Road rebuild

50. There are a number of possible mitigation methods that could be used to reduce or avoid dust effects from vehicle movements and construction activities during the rebuild of Old Coach Road which are discussed below.

Table 7: Evaluation of possible mitigation methods

Possible Method	Effectiveness in Reducing/Avoiding Dust
Wet suppression using water	This can be moderately effective but is dependent on the frequency of water application and availability of sufficient water. A reliable water supply would be required to maintain the road in a damp state.
Reduction/ control of vehicle speeds	By itself, control of vehicle speeds is moderately effective for light vehicles, but is less effective for heavy vehicles unless vehicle speeds are kept very low (< 15 km/hr). Due to the reduced scale of works this could be used in conjunction with other methods such as wet suppression or chemical treatment.
Chemical treatment of road surface	Chemical treatment is typically used on access roads and vehicle routes. Therefore, while it could be used on the areas of the road being used for access to the rebuild works it would not be suitable for the road reconstruction activities.
Weather forecasting and responses	Monitoring weather forecasts for high winds which have an increased risk of dust mobilisation and movement towards sensitive receptor can assist in implementation of controls. This may include increased watering of surfaces, or in certain circumstances, ceasing activities with a high risk of dust impacts.

51. While, no individual method will fully mitigate the potential effects, with the effective implementation of the different methods, the potential risk of dust effects can be managed to ensure no more than minor effects. The different methods and triggers would be outlined within the proposed dust management plan.

52. In addition to the above mitigation measures, monitoring the effectiveness of dust management measures is appropriate. This can identify the need to implement additional controls which may include:

(a) More frequent or intensive watering of surfaces when works are being undertaken close to dwellings;

(b) Reducing or limiting works during periods of high winds;

(c) Disconnection of roof water supplies and provision of water via tanker.

53. Ultimately, the proposed monitoring, review and mitigation should be outlined in the Dust Management Plan. Condition DM2 of the proposed consent conditions currently requires both methods for monitoring dust emissions and possible contingency measures. The implementation of both aspects of the Dust Management Plan provides and adaptive approach to dust management when adjacent to dwellings and appropriate responses.

Residual Effects

54. A set of proffered draft conditions was included by Meridian in section 8 of the Assessment of Environmental Effects (AEE), and has been updated through the s 92 responses, and through further refinement after recommendations through the s 87F Report process. The revised set of proffered draft conditions is attached to the evidence of Mr Anderson, and is discussed in detail in his evidence.

55. I have reviewed these conditions, and I am comfortable that they incorporate the mitigation I have described above.

56. In particular, I note that:

(a) condition DM1 requires no discharge of airborne particular matter that is objectionable to the extent that is causes an adverse effect beyond the boundary of the Project Site; and

(b) condition DM2 requires the preparation of a Dust Management Plan in accordance with the Ministry for the Environment ‘Good Practice Guide for Assessing and Managing Dust’ which I consider is an appropriate method to identify controls and manage potential dust from the proposed works.

RESPONSE TO SUBMISSIONS

57. Many submissions on the application raised concerns about dust effects.

58. The key concerns relevant to discharges to air are primarily related to effects associated with dust including:

(a) Human health effects;

(b) Nuisance effects of dust;

(c) Effects on drinking water suppliers (via roof water collection);

(d) Animal health effects

(e) Dust effects on pasture and crops;

(f) Dust effects on water quality;

(g) Effects of dust from the use of old coach road.

59. A number of submissions also outline concerns related to diesel emissions from vehicles and construction machinery.

60. My evidence has outlined the potential dust effects of the proposed activities, but I also comment on the concerns raised in the submissions.

61. In terms of effects on both human health and dwellings including effects on roof water collection and nuisance effects (as outlined in the FIDOL assessment outlined in Section 7 of my evidence), the risk of dust effects from the proposed works on sensitive land uses including dwellings has been assessed as **low**. The only exception is for dwellings located adjacent to Old Coach Road.

62. If the section of Old Coach Road from SH2 to the Site access point is sealed, I consider any dust effects from vehicle movements would be **negligible**.

63. In terms of effects on pasture and crops, as outlined in paragraph 3.4 of my evidence a detailed assessment of dust effects on ecological receptors would be required where sensitive ecological receptors are located within 50 metres from works and construction routes. While pasture and crops would not be considered sensitive ecological receptors, the main area where pasture would be located within 50 metres of works or construction routes is along Old Coach Road. As for effects on people, any dust effects from vehicle movements on pasture following the sealing of Old Coach Road would be **negligible**.

64. Effects of diesel emissions from vehicles and construction machinery was not explicitly assessed as part of the dust assessment prepared. However, given the separation distances to residences, I consider that diesel emissions from vehicles and equipment would not result in any measurable change in air quality at any sensitive land uses including dwellings.

RESPONSE TO THE S87F REPORT

65. I have reviewed the S87F report prepared by Mr Andrew Curtis. I note that Mr Curtis generally agrees with the dust assessment including that the greatest potential for air quality related effects is associated with vehicles using Old Coach Road. He agrees that if the road is sealed, this source of dust will be eliminated, and air quality effects minimised as far as practicable.

66. While Mr Curtis generally agrees with the assessment and conclusions reached, there are a number of items I wish to comment on. I note that Mr Curtis's recommendations have been incorporated into the proposed conditions of consent which are attached as Appendix 23 to the Section 87F Report. Mr Anderson's evidence includes a set of proffered conditions which are based on the Councils' version, with amendments to reflect areas where Mr Curtis and I disagree.

67. Paragraph 38 of Mr Curtis's report states that he considers that given the exposed location and high recorded wind speed, wind erosion of exposed or unconsolidated surfaces is likely to be a more significant source of dust in this instance. I note that irrespective of which is likely to be the most significant, the assessment has considered all sources

including dust from stockpiles, earthworks and trafficked surfaces and the significance of sources would not impact on the overall conclusions of the FIDOL assessment.

68. At paragraph 50 Mr Curtis comments that while he generally accepts that other activities (aside from dust from the Old Coach Road) are unlikely to result in off-site nuisance effects, he considers it good practice to ensure that dust effects are minimised as far as practicable and notes this could be achieved by developing a site-specific Dust or Air Quality Management Plan.

69. I agree that an Air Quality Management Plan is an appropriate tool to minimise dust effects. I note that Meridian provided an example plan from the Harapaki Wind Farm Development, and that preparation of a plan in accordance Appendix 4 of the Ministry for the Environment's Good Practice Guide for Assessing and Managing Dust is included in the proposed conditions.

70. At paragraphs 56 and 57 Mr Curtis comments on the mobile crusher. While I cannot comment on who is the appropriate party to hold a resource consent for this activity, I note that the dust assessment included a FIDOL assessment of dust effects from the mobile crusher which concluded that the risk of dust effects is low and that separation distances are sufficient to mitigate any residual dust.

71. Paragraphs 58 and 59 relate to the concrete batching plant. While Mr Curtis states that he considers there is little potential for air quality related effects from the concrete batching plant, he recommends a consent condition that requires the development of a site-specific management plan for the concrete batching plant. I do not agree that a site-specific plan is required but agree that inclusion of the concrete batching plant within the overall Air Quality Management Plan is appropriate.

72. In paragraphs 60 to 62, Mr Curtis comments on the operation of generators on the site. In particular, he comments that there are prohibitions on the granting of consent, in some circumstances, if an activity had the potential to cause the exceedance of one of the standards.

73. This only applies if an application for a resource consent is required and:

(a) for discharges of carbon monoxide, oxides of nitrogen and volatile organic compounds the discharge is likely to cause the concentration of that gas in the airshed to breach its ambient air quality standard and is likely to be the principal source of that gas;

(b) for discharges of sulphur dioxide, the discharge is likely to cause the concentration in the airshed to breach its ambient air quality standard;

(c) for discharges of PM_{10}, the discharge would be likely to increase the concentration of PM_{10} by more than 2.5 micrograms in the polluted airshed other than the site on which consent would be exercised.

74. Based on the site location and distance to the site boundaries, I consider it highly unlikely that any generators or stationary engines used at the site would result in a breach of ambient air quality standards.

75. Further, due to the remote nature of the site, it is unclear what cumulative effects would need to be considered as there are no other combustion sources within or adjacent to the site (aside from vehicle emissions and domestic heating).

CONCLUSION

76. Construction activities associated with the Project have the potential to result in dust. Potential effects include nuisance effects due to soiling of surfaces, potential health effects associated with fine particulate and ecological and crop effects in the event of significant dust emissions.

77. The assessment has identified that the risk of dust effects from construction activities, including the yard/ laydown area and the concrete batching plant and rock crushing, is low due to the separation distances between the proposed works areas and sensitive activities and the application of standard dust control measures which will be set

out in a Dust Management Plan required by the proposed consent conditions.

78. The main risk of dust effects is associated with construction traffic using Old Coach Road to access the Site and the rebuild of Old Coach Road. If Old Coach Road is unsealed, and with the predicted vehicle movements of up to 622 movements per day, the effects of road dust on adjacent dwellings off Old Coach Road could be significant.

79. With the effective application of wet suppression and/or chemical treatment along with speed limits for vehicles, the effects could be managed. However, the risk of dust effects during particular hot and windy weather conditions cannot be avoided. If the section of Old Coach Road from SH2 to the Site access point was sealed, dust effects from vehicle movements along Old Coach Road would be negligible.

80. While the rebuild of Old Coach Road has the potential to generate dust, the limited duration of works and smaller works area means that standard dust control measures including the use of wet suppression and minimising dust generating activities during high wind conditions should be effective in minimising the risk of dust effects.

81. Condition DM2 requires monitoring of dust emissions and contingency measures which can be implemented to provide and adaptive approach to dust control where works are adjacent to dwellings on Old Coach Road. With these measures in place, I consider the effects of dust from the rebuild of Old Coach Road to be no more than minor.

Robert Van de Munckhof

24 May 2024

APPENDIX A: MT MUNRO DUST ASSESSMENT DATED 23 FEBRUARY 2024

REPORT

Tonkin+Taylor

Mt Munro Dust Assessment

Prepared for
Meridian Energy
Prepared by
Tonkin & Taylor Ltd
Date
February 2024
Job Number
1016884.004 v2

Together we create and sustain a better world
www.tonkintaylor.co.nz

Document control

Title: Mt Munro Dust Assessment					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
Feb 24	1	Draft	R Van de Munckhof	J Simpson	J Simpson
Feb 24	2	Final	R Van de Munckhof	J Simpson	J Simpson

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1 Introduction

Meridian Energy Limited (Meridian) is proposing a new wind farm project (Mt Munro Project or Site) in the Lower North Island, approximately 5 km south of Eketāhuna. The Site is situated within the Tararua and Masterton Districts and the Horizons and Greater Wellington Regions.

Meridian received a Section 92 request dated 20 December 2023 which requested a FIDOL based dust assessment with particular concerns raised over the concrete batching plant. In addition, submissions received on the application have raised concerns regarding dust from on-site crushing of rock.

Tonkin & Taylor Ltd (T+T) have been engaged to undertake a FIDOL-based dust assessment of the effects associated with the construction of the proposed wind farm, to support the S92 response.

The purpose of this report is to describe the activities and the resulting discharges of dust to air from the proposed construction including vehicle access, construction yards, construction activities and on-site concrete batching plant.

1.1 Project description

1.2 Project location

The proposed windfarm development is situated approximately 5 km south of Ekatahuna, as shown in Figure 1.1 below.

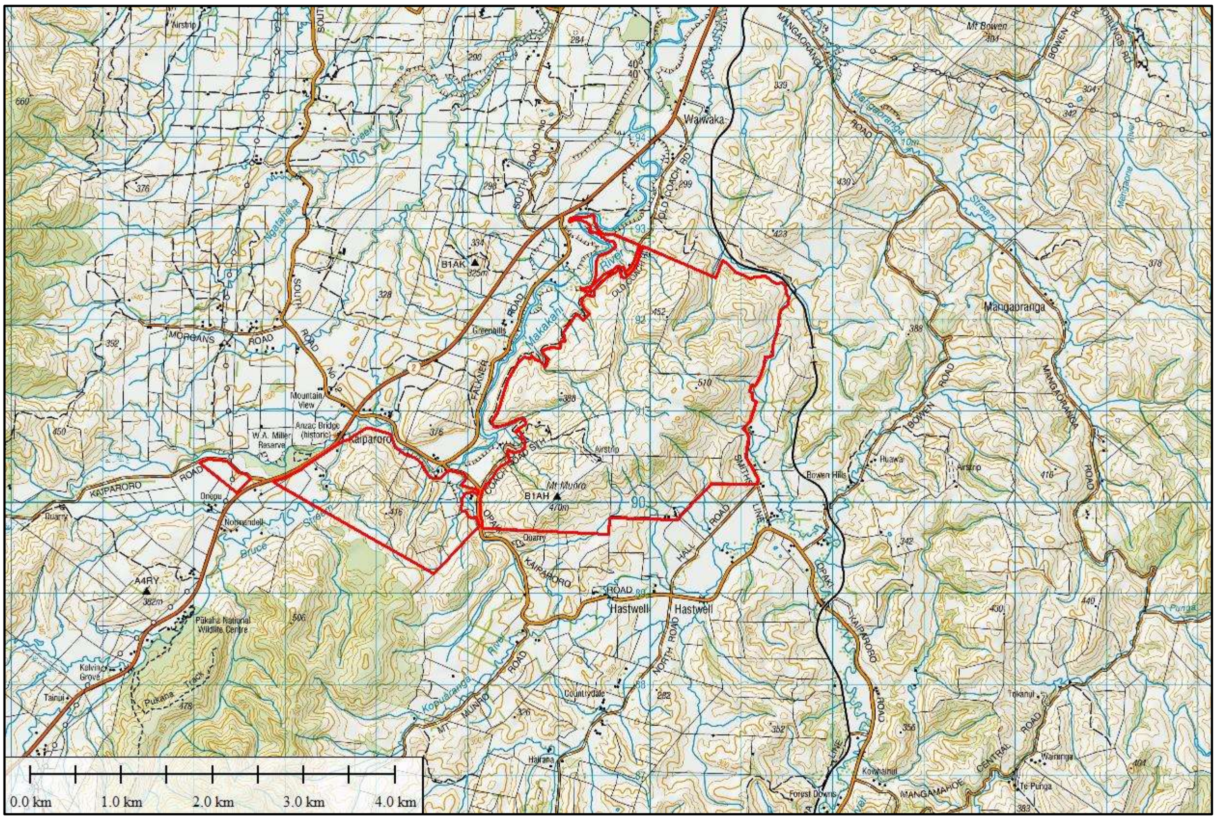

Figure 1.1 Site location shown in red outline (Topomap sourced from Land Information New Zealand (crown copyright reserved))

1.3 Proposed works

The construction of Mt Munro will require the establishment of the following permanent components:

- Wind Turbines – Including, the tower, nacelle and rotor & hub, as well as the foundation and hardstand area.
- Internal Access Roads - Required from the Site Entrance to the Ridge lines, and interconnecting the wind turbines. The access roads are through privately owned farms and typically follow / upgrade existing farm tracks where gradients and alignments permit.
- Electrical Infrastructure – Including but not limited to a 33 kV underground cable network, an onsite substation, a 33 kV or 110 kV overhead transmission line on pylons, and a terminal substation connecting to the 110 KV network on Transpower's network including associated buildings.
- Operation & Maintenance buildings.
- Meteorological (met) Mast for recording wind data (covered in AEE)
- Security fencing and gates.

Construction of these components will require the following activities:

- Construction of Laydown Areas.
- Erection of Temporary site office buildings.
- Erection of a Concrete batching plant.
- Investigation works, including Geotechnical.
- Earthworks.
- Construction of Internal site roads.
- Establishment of Fill disposal areas.
- Establishment of a water supply reservoir for construction activities.
- Environmental control measures.

2 Nature of discharges

The main discharge to air associated with the Mt Munro Project will be dust from construction activities and vehicle movements as well as the operation of the proposed concrete batching plant and mobile rock crusher on-site. Potential effects of dust emissions mainly relate to nuisance and soiling effects. Nuisance dust effects are most commonly associated with coarse particles larger than 20 micrometres (µm)[1] and can include the following effects:

- Soiling of clean surfaces;
- Dust deposits on vegetation;
- Contamination of roof-collected water supplies; and
- Visibility impacts.

Dust from construction activities can include can contain a small component of fine particles (less than 10 micron diameter, referred to as PM_{10}) that can have effects on people's health.

Dust deposited on vegetation may also create ecological stress within the sensitive plant communities, particularly during long dry periods where dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Cement dust can also increase the alkalinity,

[1] 1 µm equals 1/100,000th of a metre

which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt. These effects generally only occur where there are high dust loadings (e.g. visible dust coating leaves).

The key factors influencing the discharge of dust associated with earthworks and construction activities are as follows:

- The amount of fine material in the material being handled. Coarse material with very little fine material content is unlikely to give rise to dust emissions whereas soil or aggregate with a high fines content will pose a greater risk of dust emissions;
- The moisture content of the material. A high moisture content will act to bind dust particles and control emissions;
- Strong winds blowing across exposed surfaces on dry days resulting in entrainment of dusty material; and
- The extent of exposed areas.

Typically, the most significant source of dust associated with earthworks and construction projects arises from the movement of vehicles along unpaved surfaces during dry weather. This occurs because of the action of the wheels disturbing dust from the unpaved surface. Dust from vehicle movements can occur irrespective of wind speed conditions but the scale of dust emissions will be dependent on the moisture content and proportion of fine material in the haul road / surface, as well as the number of wheels and weight and speed of vehicles.

Other less significant sources of dust that may be associated with the Project include the following:

- Vegetation removal;
- Excavator or motor-scraper cutting and shaping of ground;
- Pavement construction (grading, compaction etc.);
- Forming and compaction of fill and spoil sites; and
- Handling and stockpiling of dusty material.

In addition, the project includes a concrete batching plant on-site. Dust from the cement silo refilling, if not properly controlled, can be a source of dust.

3 Receiving environment

3.1 Sensitive receptors

3.1.1 Identification of sensitive receptors

Ministry for the Environment good practice guidance[2] describes the sensitivity of different landuse types to dust effects. This identifies hospitals, schools, childcare facilities, rest homes and marae along with residential as having a high sensitivity to dust effects. None of these landuses are located within the vicinity of the site as the wind-farm site is located within a rural area. Rural areas are generally considered to have a low sensitivity to dust effects although dwellings and associated curtilage within these areas will have a high sensitivity to dust effects.

Therefore, the most sensitive receptors around the site to dust effects are existing dwellings. A plan showing the location of all dwellings within the vicinity of the site was prepared by Boffa Miskel and submitted with the application[3]. The closest neighbours to the site boundary are located on Falkner

[2] Ministry for the environment, Good practice guide for assessing and managing dust, November 2016
[3] Boffa Miskel, Figure 6, revision 1 dated May 2023.

Road to the west, Old Coach Road to the north, Crombies Road to the south west and Hall Road to the south.

3.1.2 Screening assessment of potential effects at sensitive receptors

While, dwellings are inherently sensitive to dust effects, the distance from the dust source has an impact on the potential risk of dust effects. Guidance on the assessment of dust from demolition and construction has been prepared by the UK Institute of Air Quality Management (IAQM).[4] This guidance indicates that a detailed dust assessment would only be required where there are "human receptors" (dwellings) within 250 metres from the site and 50 metres from any roads used. For ecological receptors a detailed assessment would only be required where there is a sensitive ecological area within 50 metres from works and construction routes.

There are four dwellings located within 250 metres of the site boundary but these are over 250 metres from any proposed work areas. There are five dwellings located on Old Coach Road which is proposed to be the main access to the site. The length of Old Coach Road from SH 2 is currently unsealed and therefore has the potential for dust to be generated during vehicle movements to and from the site.

The Victoria (Australia) EPA has developed recommended separation distances for industrial residual air emissions[5] that includes recommended a separation distance of 100 metres for concrete batching plants where production exceeds 5,000 tonnes per year. There is no specific guidance for rock crushing with the closest activity being "quarrying, screening, stockpiling and conveying of rock" with a recommended separation distance of 250 metres. The locations for the proposed concrete plant and crushing plant are in the middle of the project area over 1,000 metres from any site boundary, well in excess of the recommended separation distances.

The ecological assessment for the project[6] has concluded that the existing ecological values associated with the Mt Munro Project area are low. The majority of the area within 50 metres of the proposed works area is pasture with low ecological values identified. Therefore, the ecological sensitivity to dust of areas with 50 metres of the works areas and the main access is low.

From this screening assessment based on separation distance it is concluded that the receptors with the greatest potential to be impacted by dust emissions from construction activities, specifically dust from vehicles on the unsealed road, are the dwellings located along Old Coach Road. All other dwellings are considered to have a low risk of being impacted by dust effects because of the significant separation distances between the proposed works areas and the dwellings, which mitigates the risk of dust effects.

3.2 Meteorology and topography

The occurrence of strong winds during dry weather can exacerbate dust emissions from earthworks operations. Furthermore, the orientation of sensitive locations to dust sources and the degree that they are downwind under strong, dry wind conditions will affect the exposure of identified sensitive locations to potential dust impacts.

The proposed wind farm is located on a number of ridges to the east of the Tararua Ranges. Due to the topography and exposed nature of this location, it will be particularly susceptible to sustained periods of high winds, making the location suitable for a wind farm but also providing frequent conditions for the generation of windblown dust from exposed surfaces.

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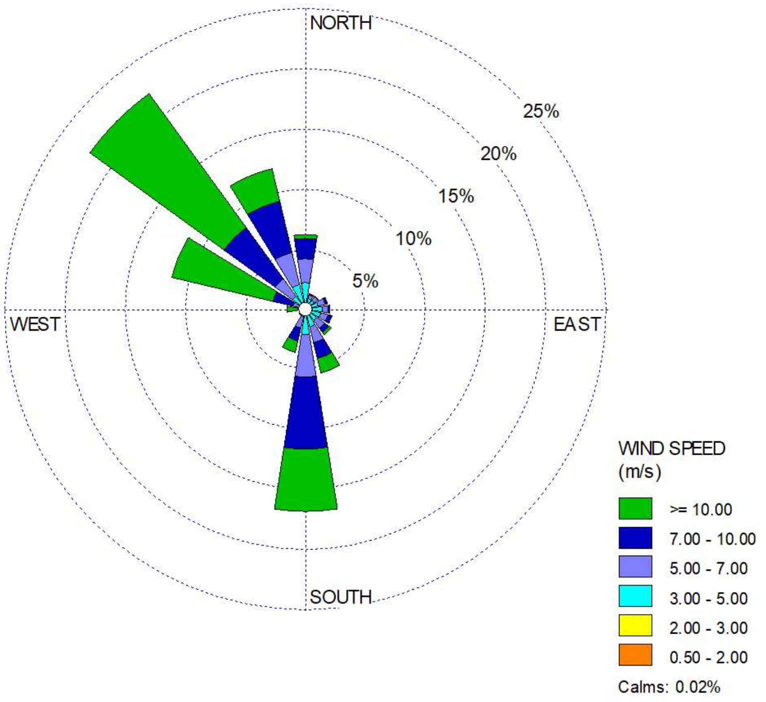
[4] IAQM, Guidance on the assessment of dust from demolition and construction, January 2024 (Version 2.2)
[5] Victorian EPA, Recommended separation distances for industrial residual air emissions, March 2013
[6] Mt Munro Wind Farm, Ecological Assessment, Boffa Miskell, 19 May 2023

Meteorological data has been provided by the Meridian for the Site for the period June 2020 to January 2024. A summary of the data for the site is presented as wind roses in Figure 3.1. Wind roses graphically summarise wind speed and direction data over a period of time. The petals of the wind rose show the direction that winds come from – their length indicating the frequency of winds from that direction. The different colour bands within each petal indicate the frequency of wind speeds from that direction. The predominant wind directions at the site are from the northwest and directly from the south.

Wind entrainment of dust from exposed earthworks areas or stockpiles occurs under higher wind speeds and 7 m/s is commonly used as a threshold wind speed for wind entrainment. Figure 3.2 is a further wind rose showing only strong winds that are 7 m/s (hourly average) or greater and clearly demonstrates the prevalence of strong winds from the northwest and south, which is the same pattern as for overall winds. There is a high frequency of strong winds at the site, with 65% of the winds greater than 7 m/s.

Therefore, areas north and southeast of the areas of proposed works have the greatest potential to be exposed to dust generated from the Project.

Meridian Wind Farm (Mt Munro). 16/06/2020 0:00 – 10/01/2024 5:00.



Meridian Wind Farm (Mt Munro). 16/06/2020 0:00 – 10/01/2024 5:00. Strong winds only

Figure 3.1: Summary of Meteorological data for the period June 2020 to January 2024

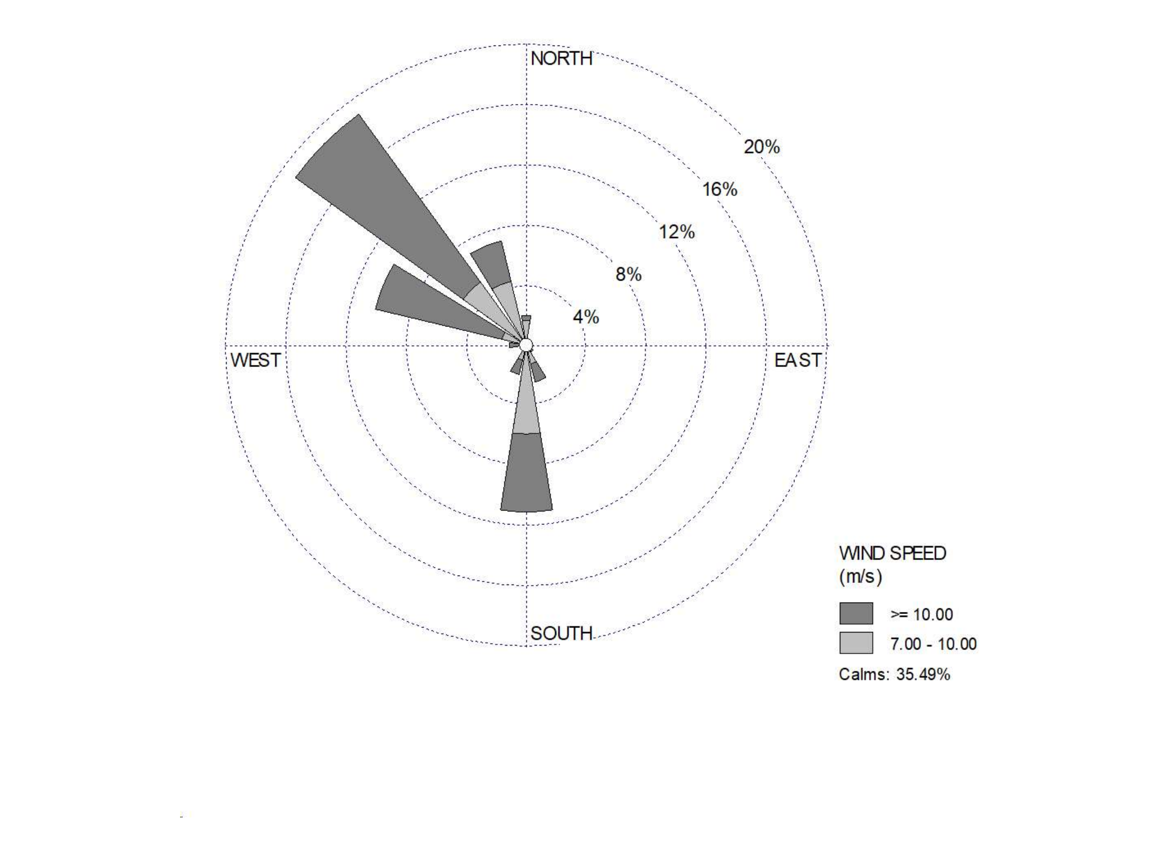


Figure 3.2: Summary of Meteorological data showing strong winds that are 7 m/s (hourly average) or greater

4 Assessment methodology

The Ministry for the Environment guidance states that the emphasis in a dust assessment should be on the appropriate management and control of dust to avoid adverse effects and that a qualitative assessment approach (rather than quantitative techniques such as dispersion modelling) is most appropriate[7]. The key consideration when assessing nuisance dust effects is whether the discharge gives rise to an 'offensive or objectionable' effect beyond the proposed designation boundary by considering the FIDOL factors, which are detailed further below.

The assessment approach comprises an initial screening to identify potentially affected locations based on the separation distance between sensitive activities and potential dust sources (see Section 3.1.2) followed by a more detailed assessment for those locations identified in the initial screening evaluation.

The detailed assessment of identified locations evaluates the risk of impacts based on a consideration of five factors, being frequency, intensity, duration, offensiveness and location (the "**FIDOL factors**") for each location from unmitigated sources of dust.

The FIDOL factors provide an objective framework for evaluating dust effects and are described as follows:

<u>Frequency</u>: The frequency of exposure to dust impacts experienced at a given location. The frequency of exposure depends on both the frequency of occurrence of discharges and the frequency of weather conditions that could transport any discharge towards a sensitive location.

[7] Ministry for the Environment, Good Practice Guide for Assessing and Managing Dust, November 2016

Intensity: The intensity of dust impacts depends on the degree to which dust sources are controlled but also the separation distance between a source and the receptor.

Duration: The duration of exposure depends on how long a sensitive location may be exposed to dust from a source.

Offensiveness: The offensiveness of dust relates to the nature of the dust in terms of its character or ability to soil or cause abrasion of surfaces.

Location: The location factor relates to the sensitivity of the location being assessed, and is typically expressed as low, medium or high. With regard to receptor types, I have attributed the following sensitivities to dust impacts:

- Residential dwellings: high sensitivity; and
- Pastoral grazing land/forestry: low sensitivity.

The FIDOL assessment is informed by a review of exposure of sensitive locations to certain wind conditions to inform the potential frequency and duration of potential effects. This focuses on the occurrence of strong winds during dry weather, as these are typically the most conducive weather conditions for causing significant unmitigated dust emissions from earthworks and construction activities.

5 Assessment of effects

5.1 Introduction

A separate FIDOL assessment has been carried out for the into three main project activities as follows:

- effects associated with the construction activities and construction yard, including the access roads on-site;
- effects associated with vehicles on Old Coach Road; and
- effects associated with the on-site concrete batching plant.

Table 5.1: FIDOL evaluation construction activities

FIDOL Factor	Evaluation
Frequency	Frequency of exposure to dust impacts depends on the frequency of activities that could generate dust and the frequency that a sensitive location (sufficiently close to be impacted) is downwind. As the construction activities will occur over the project construction period including potential stockpiling of materials and open earthworks during dry periods, the frequency of dust generation is assumed to be continuous. When considering the frequency of winds, as shown in Section 3.2, the predominant wind directions are from the northwest and south, meaning that properties to the north and southeast of the Site are the most frequently downwind.
Intensity	The intensity of impacts depends on the scale of emissions from the dust source and the distance a sensitive location is from that source. Assuming that standard dust control measures are in place and the separation distances from the works areas to dwellings being over 200 metres any dust exposure would be very low or negligible.
Duration	The duration of impacts is a function of the duration that dust generating activities are undertaken and the duration that a sensitive location may be downwind of those activities. As for frequency, it is assumed that potential sources will operate for the duration of works within an area. The duration of wind events is largely linked to the frequency that a given sensitive location is downwind of a dust sources.

FIDOL Factor	Evaluation
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. The nature of dust from the site will be largely inert soil and aggregate derived dust, typical of dust generated in the wider receiving environment. As such, the dust will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts.
Location	In terms of location, no receptors were identified as having a moderate or high sensitivity to dust effects due to the separation distances.

Overall, based on the FIDOL evaluation, the risk of dust effects from construction activities is low, with separation distances sufficient to mitigate any residual dust from construction activities.

Table 5.2: FIDOL evaluation concrete batching plan

FIDOL Factor	Evaluation
Frequency	The main potential discharge of dust from the operation of the concrete batching plant is associated with the filling of the cement silo. The concrete batching plant will primarily be used for the construction of the foundations for the turbines and some ancillary activities. Overall, it is expected it would be used on approximately 30 occasions with refilling of the silo required during these periods.
Intensity	The concrete batching plant will be fitted with a silo filter, and refilling interlocked from the cement tanker to the silo. This ensures that during normal operation any discharges are minimal. In the event of filter sock failure, the discharge of cement dust may occur which could have moderate dust effects within 100 metres of the cement silo.
Duration	Discharges to air will only occur during refilling of the cement silo. The duration of filling would not exceed one hour at a time.
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. Cement dust has a high pH and would be considered more offensive in character when compared to other sources of dust such as inert soil and aggregate derived dust.
Location	The concrete batching plant is proposed to be located on the ridgeline in the middle of the site. There are no sensitive receptors within 1km of the plant.

Overall, based on the FIDOL evaluation, the risk of dust effects from the concrete batching plant is low, with separation distances sufficient to mitigate any dust from the operation of the concrete batching plant.

Table 5.3: FIDOL evaluation rock crushing

FIDOL Factor	Evaluation
Frequency	As rock crushing will occur over the site establishment, bulk earthworks and civils phases of project where suitable material is identified, the frequency of dust generation is assumed to be continuous. When considering the frequency of winds, as shown in Section 3.2, the predominant wind directions are from the northwest and south, meaning that properties to the north and southeast of the Site are the most frequently downwind.
Intensity	The intensity of impacts depends on the scale of emissions from the dust source and the distance a sensitive location is from that source. Assuming that standard dust control measures are in place and the separation distances from the crushing operations to dwellings being over 250 metres any dust exposure would be very low or negligible.
Duration	Discharges to air will only occur during the operation of the crusher. Depending on the nature of the rock identified, this could be operated throughout the project.

FIDOL Factor	Evaluation
Offensiveness	The offensiveness factor relates to the nature of the dust that may be generated. The nature of dust from the crusher will be largely aggregate derived dust, typical of dust generated in the wider receiving environment. As such, the dust will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts.
Location	The rock crushing plant is proposed to be located within valleys and gullies away from the property boundaries and not closer than 250 metres from the property boundaries.

Overall, based on the FIDOL evaluation, the risk of dust effects from construction activities is low, with separation distances sufficient to mitigate any residual dust from rock crushing activities.

Table 5.4: FIDOL evaluation site access

FIDOL Factor	Evaluation
Frequency	The frequency of dust impacts from the site access road during construction is dependent on the number of vehicle movements. The proposed light traffic movements vary over the project and would be up to a maximum of 40 to 100 movements per day depending on the phase of the works with 80% of these during the morning and evening peak. Heavy vehicle movements are predicted to be between 106 and 522 movements per day, with the highest movements during the civil works and turbine installation, which will occur over 16 weeks of the 32 week construction programme.
Intensity	Road dust can result in both nuisance and health effects to dwellings adjacent to unsealed roads. The effects are greater the closer dwellings are to the road, with the highest intensity of dust occurring at dwellings closest to the road compared to those set back away from the road (studies have shown that road dust can extend more than 80 metres from the road[8]).
Duration	Each vehicle will result in dust effects over the duration of the movement across the road, assuming each vehicle takes one minute to traverse a section of road and for dust to settle. Dust impacts could occur over the whole duration of the construction works.
Offensiveness	Similar to dust from construction activities, dust from unsealed roads will not be especially offensive in character when compared with the likes of coal dust or other hazardous dusts. However, it may contain a higher fraction of very fine material due to the pulverising effect of the wheels on heavy vehicles. As such dust clouds may be more visible and persistent than for construction activities and there is a greater risk of health effects from exposure to fine articulate matter.
Location	There are 5 dwellings located within 120 metres from Old Coach Road that are expected to be sensitive to dust effects from vehicle movements.

Overall, based on the FIDOL evaluation, the potential effects associated with dust from the vehicle movements along old coach road, without any mitigation or controls would be more than minor with 5 dwellings likely to be impacted from the proposed traffic movements.

5.2 Summary

Based on the FIDOL evaluation of the different activities that could generate dust, the risk of adverse effects of dust from the construction activities and yard areas as well as the concrete batching plant and mobile rock crushing plants is very low. Conversely, without further controls or mitigation, there is a significant risk of adverse dust effects at houses along Old Coach Road from heavy vehicle movements on the unsealed road.

[8] Impacts of exposure to dust from unsealed roads, April 2017, NZ Transport Agency research report 590

6 Mitigation

There are a number of possible mitigation methods that could be used to reduce or avoid dust effects from vehicle movements on Old Coach Road which are discussed below.

Table 6.1: Evaluation of possible mitigation methods

Possible method	Effectiveness in reducing/ avoiding dust
Wet suppression using water.	This can be moderately effective but is dependent on the frequency of water application and availability of sufficient water. A reliable water supply would be required to maintain the road in a damp state.
Reduction/ control of vehicle speeds.	By itself, control of vehicle speeds is moderately effective for light vehicles, but is less effective for heavy vehicles unless vehicle speeds are kept very low (< 15 km/hr). Could be used in conjunction with other methods such as wet suppression or chemical treatment.
Chemical treatment of road surface.	The effectiveness of chemical treatment varies depending on the type of chemical used and the traffic volumes and types. The most common chemical used is Lignin sulphate which is moderately effective for roads with light traffic, but requires frequent refreshing particularly following rainfall.
Sealing of the road	Sealing of the road is the most effective solution as this eliminates the source of the dust (being the aggregate road surface). It is also effective for all vehicle types and would be effective over the full duration of works.

Overall, the most effective method to control dust would be to seal the road. As the road is required to be upgraded as part of the project, this could be incorporated into the works. Sealing the road would remove the potential dust source and therefore dust impacts from the use of Old Coach Road would be negligible. This would also reduce the overall vehicle movements required as a proportion of the vehicle movements would be associated with water trucks to suppress dust on the road.

The use of the either chemical treatment or wet suppression (or both together) along with control of vehicle speeds would reduce the intensity of dust, but would require on-going application of water and/or chemicals and enforcement of vehicle speed limits. The use of wet suppression would be challenging during dry months due the volume of water required and the speed at which the road can dry out. If chemical treatment was applied, this would require regular application and may not be effective during wet periods. Overall, the use of wet suppression or chemical treatment with speed controls would reduce the intensity of dust, but the risk of dust effects would remain.

7 Conclusion and recommendations

The assessment of dust effects has identified that the risk of dust effects from construction activities, including the yard/ laydown area and the concrete batching plant and rock crushing, is low due to the separation distances between the proposed works areas and sensitive activities.

The main risk of dust effects is associated with construction traffic using Old Coach Road to access the Site. Old Coach Road is unsealed and with the predicted vehicle movements of up to 622 movements per day the effects of road dust on adjacent dwellings off Old Coach Road could be significant without additional controls. With the effective application of wet suppression and/or chemical treatment along with speed limits for vehicles, the effects could be managed. However, the risk of dust effects during particular hot and windy weather conditions cannot be avoided. If section of Old Coach Road from SH2 to the Site access point was sealed, dust effects from vehicle movements along Old Coach Road would be negligible.

8 Applicability

This report has been prepared for the exclusive use of our client Meridian Energy , with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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