IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications by Meridian Energy Limited to Manawatū-Whanganui Regional Council, Greater Wellington Regional Council, Tararua District Council and Masterton District Council for resource consents to enable the construction, operation, and maintenance of a new wind farm on Mount Munro, located approximately 5km south of Eketāhuna

SECTION 87F REPORT OF JOHN McKENSEY - LIGHTING

MANAWATŪ-WHANGANUI REGIONAL COUNCIL, GREATER WELLINGTON REGIONAL COUNCIL, TARARUA DISTRICT COUNCIL AND MASTERTON DISTRICT COUNCIL

15 March 2024

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A. OUTLINE OF REPORT

1 This report, required by section 87F of the Resource Management Act 1991 (**RMA**), addresses the issues set out in sections 104 to 112 of the RMA, to the extent that they are relevant to the applications lodged with the Manawatū-Whanganui Regional Council (**Horizons**), Greater Wellington Regional Council (**GWRC**), Tararua District Council (**TDC**) and Masterton District Council (**MDC**).

2 The resource consents applied for, by Meridian Energy Limited (**Meridian or the Applicant**), are required to authorise the construction, operation and maintenance and improvement of a new wind farm on Mount Munro, located approximately 5km south of Eketāhuna. The project is known as the Mt Munro windfarm project (the **Mt Munro Project**).

3 In this report I address lighting effects associated with the Mt Munro Project, which is the subject of resource consent applications lodged with Horizons and GWRC (the **Regional Councils**) and TDC and MDC (the **District Councils**) (the **Application**).

4 While this report is pursuant to section 87F of the RMA, I have in accordance with section 42A(1A) and (1B) attempted to minimise the repetition of information included in the application and where I have considered it appropriate, adopt that information.

B. QUALIFICATIONS / EXPERIENCE

5 My name is John McKensey. I am an Executive Engineer at LDP Ltd. I have been in that position since 2014.

6 My role involves providing expert advice regarding environmental lighting effects, guiding, overseeing, and reviewing the technical work of all LDP employees, as well as design and observation for projects.

7 I hold a Bachelor of Engineering (Electrical) degree from the Queensland Institute of Technology. I have completed the Consulting Engineering Practice and Management programme at the University of Melbourne.

8 I am a member of the following organisations:

(a) Member, Illuminating Society of Australia and New Zealand Inc (MIES);

(b) Member, Engineering New Zealand (CMEngNZ);

(c) Member, Institution of Engineers Australia (MIE Aust);

(d) Member, International Dark Sky Association;

(e) Member, Resource Management Law Association;

(f) International Professional Engineer, Australia (IntPE[Aust]);

(g) National Engineers Register, Australia (NER); and

(h) Chartered professional Engineer, Australia (CPEng [Aust])

9 I have over 40 years' experience in lighting design, providing consultancy services for a wide range of clients including local authorities, developers, road controlling authorities and infrastructure sectors. My experience includes:

(a) Lighting advisor to Auckland Council during the Proposed Auckland Unitary Plan process;

(b) Lighting advisor to Christchurch City Council during the Replacement District Plan process;

(c) Author or co-author of five local government codes of practice with respect to exterior lighting, each containing environmental considerations;

(d) Author of the Auckland Council Sportsfield Lighting Guidelines;

(e) Lighting advisor to Auckland Transport; and

(f) Lighting advisor to Waka Kotahi NZ Transport Agency.

10 I also have over 20 years' experience advising as to environmental lighting effects. I have provided consultancy services for private client applicants and local government regarding the assessment of lighting effects for a wide variety of activities. In particular, I have prepared lighting assessment of effects for exterior lighting installations for the following projects:

(a) Daytime reflected light and cyclic shadowing effects from an operating residential wind turbine for Invercargill City Council;

(b) Lighting advice to Hamilton City Council (HCC) to inform the Peacocke Structure Plan, which included consideration of the effects of lighting on residents, motorists and the New Zealand long-tailed bat (LTB);

(c) Amberfield, Hamilton. Lighting advice to both Weston Lea (as appellant) and the HCC (as respondent), under common privilege, regarding environmental lighting effects to inform Resource Consent conditions. This included consideration of the effects of lighting on residents, motorists and the LTB;

(d) Waikato Expressway Cambridge to Tamahere (for NZTA), which included consideration of the effects of lighting on residents, motorists and the LTB;

(e) Kennedy Point Marina Waiheke (for the applicant), which included consideration of the effects of lighting on residents, motorists, navigation and biota (Little Penguin);

(f) Tekapo Drainage Canal (for the applicant), which included consideration of lighting effects on Mt John Observatory;

(g) Lake Pukaki Development (for the applicant), which was to be located in an intrinsically dark environment;

(h) Proposed Peacocke Sports Park (for BBO / HCC), including considerations for the LTB; and

(i) Review of the proposed Broadwater Retirement Village, Peacocke, for HCC, which included consideration of the effects of lighting on residents, motorists and the LTB.

11 I have also reviewed lighting effects for local government in regard to sportsfields, signage and digital billboards, roads, pathways and carparks and private development exterior lighting for buildings, quarry, greenhouse and service stations. I have provided lighting advice to local government for the Devonport Domain, Vauxhall Park, Stanmore Bay League Fields, Waitakere Stadium, Replacement Wynyard Crossing Bridge and Auckland Harbour Bridge Skypath.

12 I have previously prepared and presented evidence in the Environment Court and for Independent Hearings Panels for lighting effects for a number of clients including local government across a range of projects and plan changes.

13 I am familiar with site and surrounding area. I visited the site along with other experts of the Regional Councils and District Councils on 21 June 2023.

C. CODE OF CONDUCT

14 I confirm that I 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 I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express.

15 I have all the information necessary to assess the application within the scope of my expertise and am not aware of any gaps in the information or my knowledge.

D. EXECUTIVE SUMMARY

16 The key conclusions of my report include:

(a) The proposed lighting is appropriate for the nature of the development;

(b) Lighting effects will satisfy statutory requirements and best practice recommended by relevant standards;

(c) Lighting effects will be satisfactorily managed to minimise effects; and

(d) Lighting effects will be low – very low or less than minor.

17 Overall, I consider that lighting effects will be low to very low, or less than minor, with the exception of the Aviation Obstruction Warning Lights, for which I consider that lighting effects will be low to moderate, or minor.

E. SCOPE OF REPORT

18 My report focuses on issues related to lighting effects for the lighting associated with the Mt Munro Project. It covers the following topics:

(a) Background;

(b) Overview of lighting effects;

(c) Review of effects;

(d) Submissions; and

(e) Conditions.

19 I have reviewed and relied on the information provided by:

(a) Resource Consent Application & Assessment of Environmental Effects (Meridian Energy Ltd), dated 22 May 2023 (**AEE**);

(b) Appendix 7A of the AEE – Assessment of Environmental Effects for Proposed Lighting, Stephenson & Turner, 9 September 2023 (the **S&T Report**);

(c) Response to Section 92 information request (Incite Ltd), dated 7 September 2023 (**RFI#1 Response 1**); and

(d) Submissions.

20 My report addresses artificial lighting. I understand that Ms Claire West will address daylight effects such as shadow flicker. I also understand that Mr Lambie addresses lighting effects on wildlife. I have reviewed the reports of Ms West and Mr Lambie in preparing this report.

F. BACKGROUND

21 The Mt Munro Project involves the construction, operation and maintenance of 20 wind turbines and ancillary infrastructure and works including, among other things, earthworks, underground internal cable network, access roads, a new overhead transmission line to connect the wind farm to the national grid and an associated new terminal substation.

22 The existing environment is described in Section 2 of the S&T Report. I agree with the description provided. Of particular relevance to lighting effects are the following matters:

(a) Rural and township dwelling lights;

(b) Township street lights;

(c) Headlights on moving vehicles – particularly on SH2;

(d) Headlights and flashing amber warning lights on farm vehicles; and

(e) Aviation Warning Lights on existing wind turbines on the Tararua Ranges

G. OVERVIEW OF LIGHTING EFFECTS

23 The AEE contained limited information regarding proposed lighting and associated effects. However, in response to RFI#1[1] the Applicant provided a

[1] Additional Information Request for Application APP-2022203902.00, 6 July 2023, para 35-37.

detailed report prepared by Stephenson & Turner (referred to as the S&T Report above).

24 I am of the view that the S&T Report adequately addresses the matters raised in the RFI#1. Specifically, it confirms the extent of proposed lighting and includes a lighting concept design with calculated lighting effects, analysis of compliance with relevant statutory provisions and an analysis of lighting effects.

Proposed lighting

25 Given the complexity of the Mt Munro Project and to aid understanding, I summarise below the proposed lighting and calculated effects as described in greater detail in the S&T Report.

Construction Lighting

26 I have considered the proposed lighting during construction and note:

(a) Internal roads: No lighting.

(b) Vehicle headlight sweep:

i. The movement of construction vehicles along SH2 at night will be minimal, with any related headlight sweep effects similar to those presently encountered by properties adjacent to SH2.

ii. The majority of construction vehicle movement will be Monday to Saturday 7am to 7pm. As such, related vehicle movements when headlights are required will be minimal.

iii. Concrete pours will typically be continuous over 15 hour periods and over-dimension turbine component delivery will typically occur at night. This means there could be headlight sweep effects in relation to these activities.

iv. Concrete mixer and pump trucks may return to base at night via Old Coach Road at the completion of pouring activities.

Such movements may include other nearby roads such as SH2, Faulkner Road, etc, but any such movements will be infrequent with lighting effects similar to those presently experienced on those roads.

v. Old Coach Road is the only public road of particular note that is expected to carry construction vehicles, other than SH2 and the Opaki-Kaiparoro Road up to the Mt Munro Road intersection. The S&T Report identifies 2 dwellings that could potentially be affected – 47 Old Coach Road (ID24) and 168 Old Coach Road (ID21) but considers both locations sufficiently screened by vegetation and/or topography to render any such effects to be less than minor. I agree with that opinion. I discuss headlight sweep further below.

(c) Security Building: Motion sensor controlled (security) lighting only

(d) Main Laydown Area: Floodlights with no upward light for use during unloading/loading materials at night (designed to 30 lux average with infrequent use). Only motion sensor controlled (security) lighting will be used otherwise.

(e) Concrete Batching Plant (**CBP**): Floodlights with no upward light for use during batching operations at night (designed to 30 lux average – approximately 30 days total usage). There will be associated vehicle mounted lighting (headlights & flashing amber warning lights). Only motion sensor controlled (security) lighting will be used otherwise.

(f) Turbine Laydown Area: Activities include concrete pours and subsequent plant erection for the wind turbines and meteorological mast. Lighting will include temporary mobile telescopic lighting, vehicle headlights and vehicle mounted spotlights and flashing safety warning lights. The S&T Report provides greater detail, but anticipates up to 60 nights of lighting usage over 3 years.

Operational Lighting

27 Proposed operational lighting includes;

(a) SH2 Intersection: No lighting.

(b) Internal roads: No lighting.

(c) Vehicle headlight sweep: Night time vehicle use will be limited to maintenance vehicles. I agree with the S&T Report that any such effects along SH2 would be low.

(d) Operation & Maintenance Building: Motion sensor controlled exterior mounted wall lights only.

(e) Site substation: Pole mounted floodlighting (30 lux average) only for use during site operations and maintenance. Only motion sensor controlled (security) lighting will be used otherwise.

(f) Terminal substation: Pole mounted floodlighting (30 lux average) only for use during site operations and maintenance. Only motion sensor controlled (security) lighting will be used otherwise. Trucks and machinery will be present at times with headlights and flashing amber warning lights.

(g) Aviation Warning:

i. Wind turbines: 9 of the 20 wind turbines will have Aviation Warning Lights (**AWL**). The affected units are shown in the S&T Report – page 19 – figure 1. Each unit will have 3 x low intensity static (non-flashing) red AWL at half the Nacelle height.

ii. Each unit will also have 1 x medium intensity flashing red AWL on top of the Nacelle (with a second back-up light in case of failure). The flashing lights will be synchronised across all 9 units and will flash 40-60 times per minute.

iii. In my opinion, the proposed aviation warning lighting is reasonable. However, the exact details will be subject to approval from the CAA.

Calculated effects

28 The S&T Report and associated appendices provides indicative obtrusive light performance, calculated based upon the S&T Concept Lighting Design. I agree with the parameters stated as the basis for compliance as used in the calculations, and I have reiterated the most important of those in the conditions proposed later in this report.

29 The worst-case scenarios are summarised in Table 1.

PARAMETER	LIMIT	CALCULATED
Spill light – horizontal at boundary	≤8 lux (per District Plans)	7 lux
Spill light – vertical at window	≤1 lux, during curfew [NOTE 1] (per AS/NZS 4282)	0 lux
Luminous Intensity (Glare) at dwelling	≤1,000 candelas, during curfew [NOTE 1] (per AS/NZS 4282)	478 candelas
Upward Light Ratio (Sky glow)	≤0.01 (per AS/NZS 4282)	0 [NOTE 2]
Threshold Increment (Glare to motorists)	≤20% (per AS/NZS 4282)	2 %

***Table 1**. Concept Design Calculated Obtrusive Light Values*

NOTE:

1. Curfew times recommended in AS/NZS 4282 are 11.00pm to 7:00am. Higher limits are recommended for non-curfew times, so the curfew limits are the more conservative.

2. All luminaires in the design have zero upward tilt and no light emitted above horizontal.

H. REVIEW OF ASSESSMENT OF EFFECTS

30 I generally agree with the S&T Report, that the lighting effects will be less than minor. This is so for both the Construction and Operational phases. The one exception relates to Aviation Obstruction Warning Lights, which I discuss further below. Given the extent of agreement with the S&T Report, I only address matters which I consider necessitate further comment.

Lighting standards/requirements

31 The majority of the site lies within the Tararua District, with a portion to the south east being within the Masterton District. I agree with the S&T Report, that the lighting as proposed can satisfy the permitted lighting requirements within the applicable District Plans. This includes:

(a) Tararua District Operative Plan (**TODP**) – Standard 5.4.7.2(b); and

(b) Wairarapa Combined District Plan (**WCDP**) – Rule 21.1.11 (*).

32 Both of the standards/rules mentioned above require illuminance at the site boundary to be no greater than 8 lux. The S&T Report demonstrates that this can be achieved.

33 I note that the WCDP is presently under review and the Proposed Wairarapa Combined District Plan (**PWCDP**) includes a revised standard for outdoor artificial light and glare under Standard LIGHT-S1. The light spill limit remains the same as the current Rule 21.1.11 at 8 lux.

34 While the S&T Report has considered the WCDP, it has not addressed the draft PWCDP. The PWCDP Standard LIGHT-S1 requires all outdoor lighting to have a colour temperature no greater than 3000K (i.e. 3000 Kelvin). The operative WCDP is silent in this regard.

35 The S&T Report proposes 4000K for certain activities (i.e. the CBP) – in order to better monitor the concrete mix colour). Since this will be an infrequent temporary activity and not present during the Operation Phase, I am of the view that 4000K is appropriate for this activity.

36 The PWCDP includes a caveat that "*the provisions do not apply to specific activities or lighting which have a functional need or operational need, such as navigational aids and vehicle lights*".[2] I am of the opinion that the CBP has an operational need for 4000K.

37 In addition, as the PWCDP is not yet in effect (and could possibly be subject to change), the use of 4000K is permitted at this time. This may change prior to commencement of works, but if it does and if LIGHT-S1 comes into effect as presently drafted, then I would support the use of 4000K for the CBP. I have proposed a condition to reflect this approach.

Headlight sweep

38 As noted earlier in the report, the S&T Report expresses a view that the dwellings along Old Coach Road will be suitably screened by vegetation and/or location relative to the road, such that headlight sweep effects would be less than minor. I agree with that view.

39 There are two areas where the S&T Report does not address headlight sweep, which I have considered further below.

Construction Phase: Headlight Sweep

40 The S&T Report does not address headlight sweep from vehicles using public roads other than SH2 & Old Coach Road.

41 There will be a short section of Opaki-Kaiparoro Road from SH2 to the Terminal Substation with construction traffic. However, there appear to be no dwellings directly opposite the SH2 intersection, nor opposite the proposed substation, so headlight sweep effects will not be a concern for activities on Opaki-Kaiparoro Road.

42 Some construction access is also required from Opaki-Kaiparoro Road for construction of the transmission line. However, this has not been indicated

[2] Proposed Wairarapa Combined District Plan - LIGHT (https://assets-global.website-files.com/615b81c9bbf626f0003ff5c3/656535efbfdb733f670cfac2_Full%20Proposed%20Plan%20website_reduced%20file%20size.pdf) – Page 309 – Paragraph 3.

as a night time activity as part of the Application, so no headlight sweep effects are expected.

43 Further afield, trucks will collect aggregate from quarries (Hirock x3 Quarry and Kieran Oliver Contracting Quarry). However, this is noted by the Applicant as a daytime activity, so no headlight sweep effects are expected.

44 I consider the potential effects for each of the above situations to be nil to very low, or less than minor.

Operational Phase: Headlight Sweep

45 The S&T Report does not address headlight sweep from vehicles using the internal access roads, nor public roads other than SH2. However, it would appear that night time vehicle use is likely to be infrequent and the observations made in relation to the Construction Phase are equally applicable to the Operational Phase of the Mt Munro Project.

46 I consider the effects for headlight sweep in these circumstances to be nil to very low, or less than minor.

Aviation Warning Lights

47 Aviation Obstruction Warning Lights will operate continuously on some of the turbines to meet CAA requirements. These will involve low and medium intensity warning lights. These lights are discussed in section 6.7 of the S&T Report. In terms of lighting effects, I note the following characteristics;

(a) Low Intensity Aviation Lights will be located at half the nacelle height on any turbine with a tip height greater than 150m – 3 lights evenly distributed around the diameter of the turbine pylon. They will generate static red light with a low brightness (32 candelas) during all hours of day and night.

(b) Medium Intensity Aviation Lights will be located on top of the turbine nacelle – 1 light on each of 9 of the 20 turbines (plus a standby light in each case in case of failure). The locations are

detailed in the S&T Report.[3] They will flash, synchronously across all lights, at a rate of 40-60 times per minute and generate a maximum of 20,000 candelas during day time and 2,000 candelas during night time. These maximum figures occur at or above 0 degrees elevation from the light and reduce progressively at lower/steeper observation angles. In my opinion, the day time effect will be negligible compared to ambient daylight. At night, at 1.5 degrees below horizontal, the brightness falls to 800 candelas and continues to diminish at steeper angles. Further details are provided in the S&T Report.[4]

48 The proposed Low Intensity Aviation lights have a luminous intensity of 32 candelas at all time and are static (i.e. not flashing). AS/NZS 4282[5] does not apply to emergency warning or navigation lights. However, the maximum luminous intensity at night for other types of lighting is recommended by AS/NZS 4282 to be no more than 1,000 candelas for Environmental Zone A2 (Low district brightness, such as sparsely inhabited rural and semi-rural areas). It recommends no more than 2,000 candelas for Environmental Zone A3 (Medium district brightness, such as suburban areas in towns and cities). Hence, in my opinion, the obtrusive light effects from the Low Intensity Aviation Lights will be negligible.

49 The S&T Report states, with respect to the Medium Intensity Aviation Warning Lights, that: [6]

> Their precision engineered reflective prism optics provide a highly accurate light beam which ensures light output is tightly focused beam spreads, limiting upward and downward lighting to the minimums required by CAA and thus providing reduced light pollution.

50 The light intensities provided within the S&T Report are only provided for horizontal and downward angles. Therefore, the upward light spill for the

3 Page 19 – Figure 1.
4 Page 22 – Table 2.
5 AS/NZS 4282:2023 Control of the obtrusive effects of outdoor lighting.
6 At page 21.

warning lights is not clarified, beyond the general statement above. However in my view, upward light spill is less problematic in terms of obtrusive effects. As stated in the S&T Report, the spill will also be governed by CAA requirements.

51 While Aviation Warning Lights are unavoidable to satisfy CAA air safety regulations, some additional limits can be applied to minimise obtrusive light effects. I am of the opinion that the characteristics of the Lights proposed by the Applicant will suitably limit the effects and as such I have proposed a condition to align with that proposal.

52 Generally speaking, I am of the view that lighting effects will be adequately constrained. However, the Aviation Obstruction Warning Lights could be considered by some observers to intrude upon enjoyment of night time views. This is a subjective matter and I have also heard views expressed that they can be a positive addition. In my view, the lights would be a low-moderate negative addition to the environment. However, due to CAA Regulations, they are an unavoidable component if the Wind Farm is consented. Taking into account their operation, with the application of conditions as I have proposed, I consider the Aviation Obstruction Warning Lights could represent a low-moderate or minor effect.

Summary of effects

53 My conclusions include;

(a) The proposed lighting is appropriate for the nature of the development;

(b) Lighting effects will satisfy statutory requirements and best practice recommended by relevant standards;

(c) Lighting effects will be satisfactorily managed to minimise effects; and

(d) Overall I consider that lighting effects will be low to very low, or less than minor, with the exception of the Aviation Obstruction Warning

Lights, for which I consider that lighting effects will be low to moderate, or minor.

I. SUBMISSIONS

54 I have considered the matters pertaining to lighting effects raised by submitters. As I identified at the outset of my report, my review pertains to artificial lighting effects.

55 Since there are common themes raised by submitters, I have addressed the concerns by theme rather than as individual submissions.

(a) Light Pollution

Submissions	8, 13, 17, 24, 34, 35, 37, 41, 47, 48, 49, 57, 61 & 70
Concerns raised	General concerns raised in relation to potential light pollution. No specific details raised.
Analysis	Light pollution typically relates to 3 main topics – light spill, glare and sky glow. • Light spill: The maximum light spill will be within the statutory limits. There will be no measurable spill light at any residential window. • Glare: The lighting as proposed by the applicant will adequately control glare effects such that the maximum luminous intensity will be less than the limit recommended in AS/NZS 4282. • Sky glow: There will be very little permanent lighting and as such the sky glow that can be associated with outdoor lighting will be negligible. Hence, in my opinion, light pollution effects will be negligible.

(b) Night Sky Quality

Submissions	8, 11, 13, 34, 37, 41, 47, 48, 49 & 56
Concerns raised	General concerns raised to potential effects on the night sky, effects on night time views and potential effects on a nearby dark sky reserve.

Analysis	Views of the night sky are typically only of concern from otherwise dark viewing locations. For example, an observer in an illuminated room looking out to the night sky, will typically only see bright objects such as the moon, bright planets and a few bright stars. The proposed lighting will make no discernible difference to the visibility of such views. The nature of the proposed lighting, when considered from otherwise dark viewing locations in the surrounding area will result in lighting effects that are indistinguishable from ambient light. Hence, again, the proposed lighting will make no discernible difference to the visibility of such views. The only potentially visible change in relation to existing views will be the introduction of the Aviation Warning Lights. The visibility of such lights will vary depending on the observer location, but there will typically be negligible-low effects in relation to the clarity of views beyond the Aviation Lights. The closest point of the Wairarapa Dark Sky Reserve (**WDSR**) to the application site is several kilometres distant. The light pollution effects from the Project site will be negligible close to the Project site and effectively nil when considered from within the WDSR. In addition, when assessing the viability of a Dark Sky Reserve, only artificial lighting within the reserve area is typically considered. Hence, the application will not impact the WDSR.

(c) Flashing Aviation Lights

Submissions	8, 11, 21, 34, 37, 47, 48 & 56
Concerns raised	General pollution and disturbance of sleep
Analysis	As already discussed above at (a), direct light pollution effects such as light spill, glare and sky glow will be negligible. Direct views of the flashing lights is a subjective matter that some people may consider positive and others negative. Such views are only relevant when looking towards the lights. However, when looking past the lights toward the night sky, the flashing lights will interfere with such views. Views in other directions and especially viewing through instruments such as a telescope or binoculars, when the flashing lights are not in the field of view, will not be affected. The flashing lights are a considerable distance from the closest residential locations and as such light spill will be indistinguishable from natural ambient light. Glare will also be minimal. Glare and/or the flashing appearance will be

	mitigated to a significant extent by distance, viewing angles, screening effects of vegetation and topography and the like. However, the use of local screening such as curtains would ensure remaining effects, if any, are suitably mitigated to avoid sleep disturbance.

(d) Environmental Impact of Lights

Submissions	8, 13 & 21
Concerns raised	General concerns expressed in relation to potential environmental impacts
Analysis	Effects to residents and people in general are addressed in sections (a), (b) & (c). Effects on motorists have been calculated by the applicant and will be negligible in my opinion. Effects on wildlife are addressed in section (f). In my opinion, environmental effects of the lighting will be low to very low.

(e) Health Effects of Lights – Sleep Disturbance

Submissions	6, 7, 56 & 68
Concerns raised	General concerns about various elements including lighting, to potentially cause sleep disturbance
Analysis	This has been addressed in section (c) above.

(f) Effects of Lights to Wildlife

Submissions	8, 13, 21, 47, 57 & 61
Concerns raised	General concerns regarding possible effects on wildlife such as birds, insects (including moths), bats, reptiles (including lizards). Potential for Aviation Warning Lights to attract moths.
Analysis	The common approach to artificial lighting effects when considering wildlife is to limit such analyses to endangered species that are nocturnal. A secondary group of potential

	concern would be marine turtles, seabirds and migratory shorebirds. No such species have been identified as a significant concern in this instance. Regardless, most wildlife, have limited or no vision under red light.[7] Hence, in my opinion, the Aviation Lights will pose no significant threat to wildlife.

J. CONDITIONS

56 I have reviewed the draft conditions relating to lighting as proffered by the applicant and am of the opinion that they are insufficient and/or not ideally worded to adequately manage potential lighting effects from the Mt Munro Project. I have provided alternative conditions below.

57 However, I have reviewed the draft conditions with regard to the proposed Lighting Management Plan (**LMP**) and consider them to be satisfactory.

58 If the consent is granted, I recommend that the following conditions be imposed;

Lighting

Construction

1 Prior to construction, a Construction Effects Management Plan (CEMP) shall be provided, including a LMP. The LMP must capture all of the associate lighting requirements in the Conditions of Consent.

2 Lighting for construction shall comply with Section 5 the S&T Report in terms of the extent, types, installation details and operational constraints of lighting.

3 Signage and active management shall be implemented to ensure that all vehicles, directly associated with the Application, operating within the

[7] National Light Pollution Guidelines for Wildlife – Australian Government – page 5 – figure 2 (https://www.agriculture.gov.au/sites/default/files/documents/national-light-pollution-guidelines-wildlife.pdf)

site boundaries and along the length of Old Coach Road, shall have headlights dipped to low beam at all times between dusk and dawn

4 All outdoor lighting shall have a colour temperature not exceeding 3000K, with the exception of the Concrete Batching Plant which shall have a colour temperature not exceeding 4000K.

Operational

5 Prior to construction, a detailed lighting design shall be submitted with sufficient detail to prove compliance with the conditions of consent. Obtrusive light calculations for spill light and glare shall be undertaken for the initial lumen output of the luminaires, a Maintenance Factor of 1.0 and with no depreciation for dirt or the like.

6 The lighting design shall satisfy the rules contained in;

(a) Tararua District Plan – Standard 5.4.7.2(b);

(b) Wairarapa Combined District Plan – Rule 21.1.11;

(c) Civil Aviation Authority:

i. CAA requirements for marking of wind farm turbines and obstacle lighting; and

ii. Any lighting installed to satisfy the CAA requirements shall be the practical minimum necessary to achieve the CAA requirements, with the least obtrusive light effects.

iii. The night time (dusk to dawn) luminous intensity of the Aviation Warning Lights shall not exceed the figures stated in the following table below by more than 10%;

AVIATION WARNING LIGHT TYPE	DECLINATION ANGLE (ZERO IS HORIZONTAL THROUGH THE LUMINAIRE) – DEGREES (^{O})	MAXIMUM NIGHT TIME LUMINOUS INTENSITY BETWEEN DUSK AND DAWN – CANDELAS (cd)
LOW INTENSITY	Any	32
MEDIUM INTENSITY	0	2000
	-1.5	800
	-3	200
	-5	60

7 All luminaires, other than aviation obstacle warning lights, shall be selected, designed, shielded and/or mounted in such a manner to ensure that they emit no direct light above the luminaire.

8 All fixed outdoor lighting (i.e. lighting other than vehicle mounted lighting), except aviation obstacle warning lights, shall have a colour temperature not exceeding 3000K.

9 All fixed lighting shall be designed to comply with the recommended light spill and luminous intensity limits set out in AS/NZS 4282:2023 (Control of the obtrusive effects of outdoor lighting). The applicable receiving environment shall be zone A2 (low district brightness).

10 Lighting for operation shall comply with Section 6 the S&T Report in terms of the extent, types, installation details and operational constraints of lighting.

11 Within 1 month of completion, a report shall be provided by a suitably experienced lighting practitioner confirming that the lighting has been installed in accordance with the conditions of consent.

John McKensey

15 March 2024