

Memo.

Ecology Technical Report to inform the S42a report for the Taumatotara Wind Farm	To: Chris Dawson BBO
	From: Dr Leigh Bull
	Project No.: BG2301
Date: 12 October 2023	

1. The purpose of this memorandum is to provide a technical report in relation to ecological matters to assist with the preparation of a Section 42a report for the proposal to vary the existing consents for the Taumatotara Wind Farm.
2. This memorandum provides a brief summary of the results of the earlier ecological assessments^{1,2,3} for the Taumatotara wind farm, as well as the information that has been requested from the Applicant and received for the latest proposal to vary the consents.
3. A site visit was undertaken on 22 June 2023 to familiarise the author with the site, as well as the ecological features present.

2006 and 2011 Taumatotara Ecological Effects Assessment

4. The ecological assessments^{1,2,3} on which the original resource consents (2006) and subsequent variation (2011) were granted did not undertake any extensive or targeted field investigations. Rather, they identified *Threatened* or *At Risk* species that may occur on the site based on the habitat available or their known presence in the wider landscape, stating^{1,2}:
 - a) *"While the regular occurrence of NZ falcon within the study area is unlikely, this species has been recorded as being present in the locality in the past (Moynihan, 1986). The foraging behaviour of the NZ falcon and its flying characteristics in relation to wind turbines (flight height, distance of flying birds to turbines and turbine blades, and frequency of perching on turbine structures) are unknown and may or may not make this species susceptible to*

¹ Kessels & Associates Ltd (2004). Ecological Assessments of Proposed Wind Farms, Taumatotara West Rd, Taharoa. Report prepared for Ventus Energy Ltd, dated 17 December 2004.

² Kessels & Associates Ltd (2005). Proposed Wind Farm Turbine Sites 18-22: Assessment of Ecological Effects. Report prepared for Ventus Energy Ltd, dated December 2005.

³ Kessels & Associates Ltd (2011). Ecological effects of the proposed tip height extension Taumatotara (T4) wind farm. Letter from Gerry Kessels to Glenn Starr (Ventus Energy Ltd) dated 27 November 2011.

collisions. Nonetheless, combined with the birds rarity and threatened status, even occasional mortalities may be significant."

- b) *"It is likely that long-tailed bats exist in the Aorangi Scenic Reserve and possibly in the forest on the cliffs adjacent to the Taumatotara site (Moynihan, 1986). It is possible that bats could hunt at night for insects in the vicinity of the turbines. However, bats are extremely agile and have the assistance of echolocation to help them to capture prey and avoid obstacles, so the risk of them hitting the structures, blades or power lines is considered to be extremely low."*

- 5. As was the case for most ecological assessments at the time of the original consent, the actual level of effect on those species as a result of the wind farm was never specifically quantified.

Advancement in Wind Farm Ecological Effects Assessments

- 6. Since the original granting of consents, the practice of undertaking ecological assessments for wind farm developments has progressed significantly, both in New Zealand and internationally. Notably, AUSWEA (2018) produced best practice guidelines for ecological assessments for wind farms, which recommends the following approach:
 - a) *a desktop review of available information to identify any potential issues that may prevent the project being approved;*
 - b) *field surveys to map the vegetation and identify flora and fauna species;*
 - c) *species-specific studies to obtain more information about significant flora and fauna (particularly birds and bats) that may be at risk from the development or to avoid them or develop mitigation strategies;*
 - d) *development of avoidance, mitigation and offset strategies to minimise impacts on species if required; and*
 - e) *development and implementation of monitoring programs for the construction and operational phases of the wind farm development.*
- 7. Given the earlier Taumatotara ecological assessments pre-dated these guidelines, they did not follow the above approach. In particular, there was a lack of targeted surveys for Threatened and At Risk species that were identified as possibly present on the site or in the wider area (e.g. long-tailed bat and NZ falcon). As such, species presence, abundance, distribution and patterns of movements across the wind farm site were largely unknown, and therefore the effects were not quantified in a meaningful way.
- 8. Our understanding of potential effects of wind farms on bats has also increased, with the identification of both direct collisions and barotrauma being identified as causes of deaths.^{4,5,6}
- 9. Furthermore, for several years the New Zealand Department of Conservation (DOC) has been developing an advice note on 'Bats and windfarms in New Zealand', which summarises current understanding of the potential impacts of windfarms on New Zealand bats and the potential management responses. The Department has released numerous draft iterations of the advice

⁴ Baerwald et al. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* 18

⁵ Zimmerling & Francis (2016). Bat mortality due to wind turbines in Canada. *Journal of Wildlife Management* 80: 1360-1369

⁶ Lawson et al. (2020). An investigation into the potential for wind turbines to cause barotrauma in bats. *PlosOne* 15: e0242485

note over the ensuing period; however a final version⁷ of the advice note is now available for ecologists and wind farm developers.

Technical Review of the Ecological Effects Assessment for the proposed variation

10. An ecological assessment⁸ was submitted with the current application to reduce the number of turbines on the wind farm by 50%, but increase the overall RSA⁹ by 20%. Despite the lack of targeted field studies for the earlier assessments, and the recommendation of the AUSWEA (2018) guidelines for such studies, no field surveys were undertaken to inform this assessment. Nevertheless, the assessment concluded that *"the potential adverse ecological effects of increasing the maximum turbine tip height from 110m to 172.5m and increasing the rotor diameter from 100m to 155m are likely to be negligible at most. While bird and bat fatalities are unlikely to change with increased blade tip height and rotor diameter, the 50% reduction in turbine numbers is highly likely to reduce fatalities, which would be a positive ecological benefit overall."*
11. The premise of the resulting Section 92 further information request for ecology¹⁰ was that in order to be able to assess potential ecological effects, it is critical to first have an understanding of what species are present and how they are utilising the sites (i.e. as per the AUSWEA (2018) best practice guidelines).
12. The assessment of ecological effects undertaken for the application to vary the Taumatotara wind farm did not follow these best practice guidelines, and did not contain the necessary information to be able to effectively determine the impacts of the proposal. As such the additional information was requested primarily related to the *Threatened* and *At Risk* species previously identified as potentially on site.
13. The applicant provided separate responses to this request for avifauna¹¹ and bats¹², in which it was concluded that the proposal would not have a measurable effect on bird, and highly likely to reduce bat fatalities. However, it remained unclear how it could be determined that this was the case when again no field investigations had been undertaken to even identify exactly what Threatened or At Risk species were present on the site, let alone how they were using the site.
14. In relation to bats, a key basis for the conclusion was the comparison of existing potential habitat at turbines 12-22 vs 1-11. The report¹² stated *"What is immediately obvious from aerial image mapping is that the intact native forestry fragments (which is likely to provide relatively high quality areas of bat habitat) are much larger around the (consented) Turbine 12 – 22 turbine block which is proposed to be surrendered as part of this application (Appendix 1). There is also cliff and rocky outcrops along the western flank of turbines 17 to 22 which may form attractive bat habitat. Comparisons of habitat strongly suggest that current or future bat habitats are more likely adjacent to turbine block 12 to 22."*

⁷ New Zealand Bat Recovery Group Information Sheet – "Bats and wind farms in New Zealand". Version 5.0 dated October 2023

⁸ Ecology New Zealand (2020). Taumatotara (T4) wind farm: Ecological assessment of increased turbine height, increased rotor diameter and reduced number of turbines. Report prepared for Ventus, dated 30 June 2020.

⁹ Rotor sweep area

¹⁰ Boffa Miskell (2020). Taumatotara wind farm Ecology Assessment – Further request for information. Memorandum prepared for Waitomo District Council, dated 7 August 2020.

¹¹ Appendix 4A: Ecology – Avifauna (Dr John Craig)

¹² Appendix 4B: Ecology – Bats (Ecology NZ, memorandum dated 9 December 2020)

15. In response to the request to undertake bat surveys on the site, the report¹² stated *"Rather than collecting bat monitoring data (which is of limited use in collision risk modelling) as requested in the s92 request, I would favour instead applying a condition of consent requiring the use of bat detection and deterrent technology (e.g., NRG Bat Deterrent System)".* In addition, the report recommended that *"consent condition that requires that the applicant establish a pest control programme over a minimum area commensurate with the scale of the project (e.g., 200 hectares of native forest habitat) with the primary objective of protecting key bat habitats on-site and possibly adjoining properties with suitable habitat for protection."*
16. Based on the information provided by the applicant's ecologists, it remained my opinion that there was still insufficient site-specific information on which to determine the ecological effects of the proposed turbine changes on avifauna and bats that may be present on the site. As such, a further request¹³ was made to collect the following data:
- a) For bats, the presence or absence of activity at each of the turbine sites; and
 - b) For avifauna, presence/absence of species, and their distribution across the site in relation to preferred habitats.
17. In addition to requesting the collection of data, concerns were raised (and expanded below) regarding:
- a) the proposed use of technology which hasn't been trialled in New Zealand as a means to mitigate potential bat collisions; and
 - b) the basis on which it had been determined that the proposed pest control programme over 200 ha, presumably as an offset measure, was adequate to address any potential effects on bats. Given no data had been collected regarding bats on the site, and therefore at risk of collision, how was it possible to determine if the scale of the proposed offset is appropriate, or even required?
18. In terms of bat detection and deterrent technology (e.g. NRG Bat Deterrent System), while it could be an attractive option, it would depend on if New Zealand's bat species are susceptible to the method. I am aware of a number of studies^{14,15} evaluating the effectiveness of bat deterrent systems that report highly species-specific differences, with reductions in bat fatalities only being reported for some species. Such deterrent systems have not been used or tested on New Zealand bats, and as such there is no information or evidence regarding their effectiveness for this Nationally Critical species. Furthermore, acoustic deterrent technology has not eliminated all fatalities for any of the susceptible species. I therefore consider that the application of this technology would be experimental only, with a risk that it is ineffective. These points are also raised in DOC's draft and final⁷ advice note on bats and wind farms in New Zealand.
19. Avifauna and bat field surveys were then conducted by the applicant's ecologists, and the results provided¹⁶. In regard to birds, point count data was collected but no targeted falcon surveys were

¹³ Boffa Miskell (2020). Taumatotara wind farm Ecology Assessment – Further request for information. Memorandum prepared for Waitomo District Council, dated 7 August 2020.

¹⁴ Weaver, S. P., Hein, C. D., Simpson, T. R., Evans, J. W., & Castro-Arellano, I. (2020). Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines. *Global Ecology and Conservation*, e01099.

¹⁵ Arnett, E. B., Hein, C. D., Schirmacher, M. R., Huso, M. M., & Szewczak, J. M. (2013). Evaluating the effectiveness of an ultrasonic acoustic deterrent for reducing bat fatalities at wind turbines. *PLoS one*, 8(6), e65794.

¹⁶ Ecology New Zealand (2021). Taumatotara (T4) Wind Farm – Further s92 response - Bats. Memorandum prepared for Ventus, dated 30 10 April 2021.

conducted. For bats, 17 bat recorders (ABMs) were deployed across the site, two of which malfunctioned. The results of that monitoring record bat activity at 12 of the 15 sites, with varying abundances (ranging from an average of 12.7 to 0.1 passes per night). Nevertheless, the report concluded that *“Rather than indicating any further assessment or design work is required, the findings in relation to bats support the package of mitigation (i.e., use of bat deterrent technology at turbine sites), monitoring (of the local bat population), and compensation (i.e., predator control in adjacent bush blocks; Appendix 2) measures put forward by the applicant.”*

20. It is my professional opinion that with the data presented, the above conclusions for bats are not supported by the data.
21. Furthermore, the data was collected for a maximum period of 19 nights from 23 February 2021 to 15 March 2021. This represents a very short monitoring period which only covers one period of bat activity. DOC’s advice note⁷ states *“To determine presence of bats, developers should undertake a minimum of three surveys to cover spring, summer and autumn, which may need to be over several years, because habitat use patterns and flight ranges vary over time. Absence of bats in one season does not mean that they will not be present in others.”*
22. On reviewing¹⁷ the results of the avifauna field surveys, it was my professional opinion that observations made while undertaking other ecological investigations over a period of two days were both insufficient in survey effort and lacking in targeted methodology to adequately assess the implications of the proposed wind farm variation on NZ falcon. As such, I have recommended several consent conditions to address these concerns.
23. In regard to bats, I remained in disagreement with the Applicant’s Ecologist regarding the potential level of effects on bats resulting from the proposed variation. Of particular concern was the finding that the highest levels of bat activity were not recorded at the sites previously identified by the Applicant’s ecologist as most likely containing bats (refer to paragraph 13 above); rather two of the highest levels of bat activity were recorded within the northern part of the wind farm, where it is proposed to increase the RSA by 20%. These findings serve to highlight the importance of undertaking field investigations to validate (or otherwise) assumptions.
24. Furthermore, I disagreed with the continued approach to move directly to an offset / compensation package for any such effects. It appeared from the information provided that no consideration had been given to the potential use of curtailment protocols to reduce the potential to disturb, kill or injure bats. I note DOC recommends the consideration of curtailment in their draft and final advice note⁷ on bats and wind farms in New Zealand.
25. In addition to not following the effects management hierarchy, insufficient evidence was provided regarding the appropriateness of the “mitigation package” that was being offered; that being the use of bat deterrent technology at turbine sites, monitoring of the local bat population and predator control in adjacent bush blocks for a limited period of time (refer to paragraph 14 above).

¹⁷ Boffa Miskell (2021). Taumatotara wind farm – Review of additional ecological surveys. Memorandum dated 6 May 2021.

26. The Applicant then provided a further ecological assessment¹⁸ using the data previously collected, the conclusions of which were unchanged from those provided in earlier reports. However, the following three measures were proposed to be added to the existing consent conditions:
- a) Monitoring and deterrent devices – Placement of bat detectors on four turbines (1, 4, 7 and 11) for 12 months. Following that, one bat deterrent device shall be deployed to the turbine that recorded the highest bat activity and operated for a period of 2 years.
 - b) Bat population survey – A principal sum of **up to** \$10,000 per year for 5 years to support an investigation of bat populations in the geographical area running from Marokopa, Te Anga, Te Waitere and Taharoa.
 - c) Pest control – Over a minimum of 20 ha of the two larger forest areas in the surrounding landscape to create biodiversity gains.
27. Notably, the area over which pest control was proposed decreased from 200 ha (originally reported in Ecology NZ, memorandum dated 9 December 2020¹²) to 20 ha, but with no explanation as to the reason for this. Given the Applicant's Ecologists had not changed their conclusions in regard to the level of effects, it was unclear what this change is based on, and as such this query was put to the Applicant as part of a further¹⁹ s92.
28. In his response²⁰ to that s92, the Applicant's Planner stated "*It was not offered as a remedy to reduce adverse effects because we don't believe there are any*". This statement adds further confusion given this measure is specifically identified in Section 7.2 of the most recent Ecological Assessment¹⁸ as a measure to remedy, whereas it had been called mitigation and an offset in other communications.
29. Furthermore, in his response, the Applicant's Planner notes that TWFL had met with DOC and have agreed to consider different techniques the project could contribute to for improving/maintaining the population of long tailed bats. These techniques include:
- Surveys to determine localised prevalence of bats;
 - Detection at each turbine;
 - Deterrent mechanisms;
 - Curtailment;
 - Pest control.
30. While it is pleasing to hear that TWFL had started these discussions with DOC, as noted by the Applicant's Planner, "*The exact nature and scope of these techniques have not yet been discussed and agreed but we believe these could provide a win-win for any local bat population and if so such measures could lead to some agreement with DOC.*"
31. Most recently²¹, further changes to the Taumatotara wind farm layout and rotor dimensions have been proposed by the Applicant²², with the removal of three more turbines (2, 4 and 9), an increase in rotor diameter from 155 m to 163 m, and a corresponding increase in tip height from 172.5 to 180.5 m (while still maintaining 17.5 m ground clearance).

¹⁸ Taumatotara wind farm ecological assessment of the existing 22 turbine consented activity plus the proposed tip height variation in response to s92 requests. Prepared by Dr John Craig and Simon Chapman, dated 10 August 2021.

¹⁹ Letter from WDC to Glenn Starr dated 3 July 2023.

²⁰ Letter from Craig Shearer to Alex Bell dated 6 July 2023.

²¹ 'Update on progress – Taumatotara Windfarm Limited (T4) consent variation application'. Letter from Gillian Chappell to Chris Dawson dated 15 September 2023

²² Outlined in a letter from Gill Chappell dated 15 September 2023.

32. In addition, the Applicant is proposing the removal of acoustic deterrent devices on the basis that these were negatively viewed by DOC.²³
33. The Applicant's Ecologist prepared a memo²⁴ reviewing the proposed changes, concluding that *"the reduction in number of wind turbines and their total rotor sweep will further avoid and minimise the effects of the Taumatotara Wind Farm beyond the Variation Application currently being assessed"*.
34. However, given no further details were provided at that stage, a request was made to the Applicant for a map showing the locations of the bat survey sites, turbine locations and distances of turbines from the Significant Natural Areas (SNAs) in order to better understand the proposed changes in an ecological context; this map was provided on 29 September 2023 and is included in Appendix 1 of this report. Information in the table on that map is replicated below and ordered based on highest to lowest average number of bat passes. The turbines which are proposed to be removed are identified in red text, and do not include the turbines at which the highest levels of bat activity were recorded (those being turbines 1, 11 and 7).
35. Furthermore, while curtailment was previously identified in s92 response letter²⁰ from the Applicant's Planner as a technique that the project would consider, there was no mention of this method in the most recent information provided. As reported in DOC's advice note⁷ *"To date, overseas strategies that curtail turbine activity when bats are present, or predicted to be present, only reduce mortality of bats rather than stopping it. Some curtailment strategies have been successful at reducing bat mortality by c.50 – c.85%. However, successful strategies are often species, site, or even turbine, specific"*, while acknowledging that *"No-one has tested curtailment strategies for New Zealand bats, but the rich overseas literature shows us there are options for curtailment to reduce risk to bats."*

Turbine	Distance (m) to SNA	Bat detector	Bat detect distance (m)	Ave passes / night
6	127	4	151	Failed
1	469	1	245	8.75
11	104	9	108	6.15
7	19	5	40	0.94
2	220	2	124	0.93
3	49	2	128	0.93
4	38	3	145	0.73
5	98	3	88	0.73
10	125	8	217	0.54
8	86	6	100	0.4
9	267	7	159	0

Summary

36. The original (2006 and 2011) assessments only alluded to bats being present in the wider area, furthermore they considered the risk of bats hitting the structures, blades or power lines was extremely low.

²³ Refer to letter from Glenn Starr to Waitomo District Council dated 14 September 2023.

²⁴ Ecology New Zealand (2023). Taumatotara (T4) wind farm. Report prepared for Ventus Energy (NZ) Ltd, dated 15 September 2023.

37. The first ecological assessment for the current application only undertook a desktop approach (no field data) which then elicited my initial s92 recommendations.
38. Through the s92 process, long-tailed data has been collected showing the presence of this species across the site. However, the survey was only undertaken during one of the key periods of bat activity.
39. Still no appropriate / targeted NZ falcon surveys have been undertaken.
40. In addition, studies arising since the time of the original assessment have shown that bats populations can be impacted by wind farm developments.
41. It remains my opinion that effects to bats and falcon of the proposed changes to the windfarm cannot be appropriately judged, and that the effects management regime cannot be adequately considered. On this basis, turbine curtailment should be given due consideration as a requirement to manage potential effects on bats.

Recommendations

Adequacy of information

42. The actual level of effect on Threatened and At Risk species associated with the original 2006 consents and 2011 variation for the Taumatotara wind farm were never specifically quantified (refer to paragraph 4 above).
43. Through the s92 process, long-tailed data (albeit limited) have been collected for the Taumatotara site, with the results showing the presence of this species across the site in varying abundances.
44. As such, it was expected that the Applicant's Ecologist would use these data to quantify the level of effect on bats as a result of the original consented wind farm design in order to then compare it to the level of effect on bats associated with the current proposal. This analysis would then allow a quantifiable comparison of effects between the consented and proposed wind farms. Rather, the information provided to date has made generic and unsubstantiated statements about the level of effects and benefits arising from the current proposal.
45. While targeted baseline data is yet to be collected for NZ falcon, I believe this can be dealt with via a consent condition as outlined below.

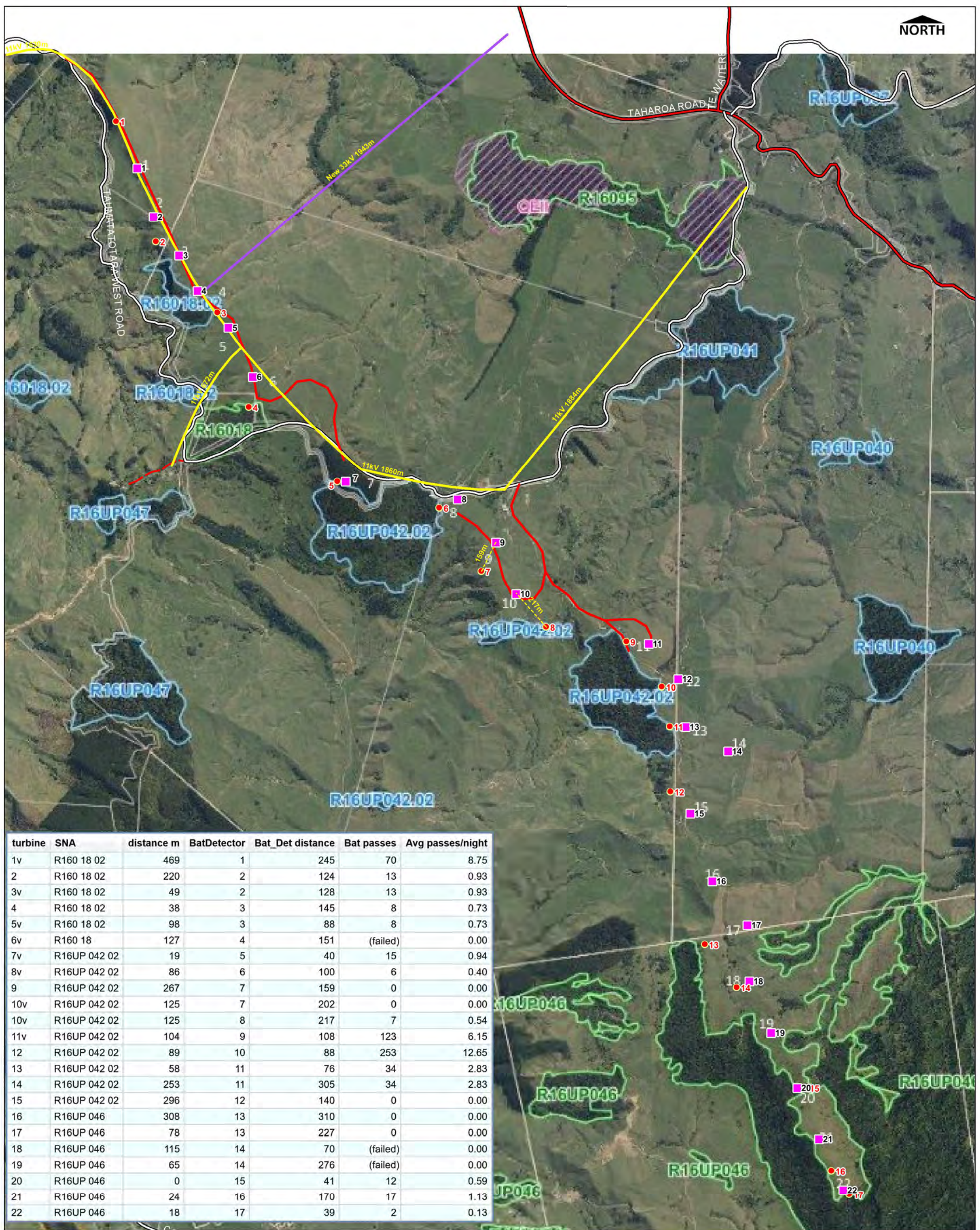
Proposed consent conditions

46. The latest set of proposed consent conditions, dated 15 September 2023, were put forward by the Applicant in their most recent changes (refer to paragraph 29 above). Given the residual uncertainty around the level of potential effect on both NZ falcon and bats at the site, I do not agree in full with the Applicant's proposed conditions on the following basis:
 - a) They do not include a baseline study for NZ falcon.
 - b) They do not include the collection of baseline data for bats over the three key activity periods (spring, summer and autumn):
 - c) They do not provide for a standardised post-construction mortality monitoring, rather just ad-hoc observations of bird and bat strike.
 - d) They exclude the option for any modification or restriction of the operations of the wind turbines, even if a significant adverse effect is detected. Therefore, they do not allow for

the possibility of the application of turbine curtailment to minimise potential effects on bats.

47. Accordingly, I provided specific recommendations pertaining to the individual conditions directly into the condition set to address the above listed concerns.

Appendix 1 – Ecological Monitoring and SNA map



turbine	SNA	distance m	BatDetector	Bat_Det distance	Bat passes	Avg passes/night
1v	R160 18 02	469	1	245	70	8.75
2	R160 18 02	220	2	124	13	0.93
3v	R160 18 02	49	2	128	13	0.93
4	R160 18 02	38	3	145	8	0.73
5v	R160 18 02	98	3	88	8	0.73
6v	R160 18	127	4	151	(failed)	0.00
7v	R16UP 042 02	19	5	40	15	0.94
8v	R16UP 042 02	86	6	100	6	0.40
9	R16UP 042 02	267	7	159	0	0.00
10v	R16UP 042 02	125	7	202	0	0.00
10v	R16UP 042 02	125	8	217	7	0.54
11v	R16UP 042 02	104	9	108	123	6.15
12	R16UP 042 02	89	10	88	253	12.65
13	R16UP 042 02	58	11	76	34	2.83
14	R16UP 042 02	253	11	305	34	2.83
15	R16UP 042 02	296	12	140	0	0.00
16	R16UP 046	308	13	310	0	0.00
17	R16UP 046	78	13	227	0	0.00
18	R16UP 046	115	14	70	(failed)	0.00
19	R16UP 046	65	14	276	(failed)	0.00
20	R16UP 046	0	15	41	12	0.59
21	R16UP 046	24	16	170	17	1.13
22	R16UP 046	18	17	39	2	0.13

Taumatatotara Windfarm
Ecological Monitoring
and SNA map
 Site Plan - 22 turbine version
 Scale 1:17 000 (A3)

LEGEND

- Turbine (Note: Turbine# with v is Proposed variation)
- Bat Detector
- Existing 11kV line
- New 33kV line
- Track
- Metalled Road
- Sealed Road

Photo Ref: Aerial Surveys Ltd flown 10/03/18
 Cadastral Ref: LandOnline 02/11/19
 Manawatu Aerial Photo Services RN 28/09/23

Appendix 2 - Reviewer Qualifications & Experience

The author of this memo holds the following relevant qualifications and experience appropriate to undertake this review:

- Bachelor of Science (Zoology), MSc with Honours (Ecology) and PhD (Ecology), with specialisation in the area of ornithology.
- 20 years of working as a practicing ecologist, including within the Biodiversity Recovery Unit of the Department of Conservation (DOC).
- Co-author of the DOC New Zealand threat classification list (2007²⁵) as well as reviewing and production of a number of DOC threatened species recovery plans.
- Undertaken a number of ecological scoping exercises for Meridian Energy Ltd for potential wind farm sites.
- Field investigations to inform ecological assessments for Mt Munro, Titiokura, Hawkes Bay, Central Wind and Waipipi wind farms.
- Preparation of ecological assessments for the resource consent applications for Mt Munro and Central Wind wind farms.
- Preparation of ecological assessments for consent variations for Titiokura and Hawkes Bay wind farms.
- Design of construction avifauna monitoring programme for Titiokura and Hawkes Bay wind farms.
- Design and implementation of post-construction avifauna monitoring and mortality searches for West Wind, Te Uku and Waipipi wind farms.
- Lead author of a scientific journal article²⁶ which was the first published record of post-construction avifauna monitoring at a New Zealand wind farm site.

²⁵ Hitchmough, R., Bull, L.S., Cromarty, P. (2007). New Zealand Threat Classification System lists-2005. DOC stand-alone publication 236. Department of Conservation, Wellington. 194p.

²⁶ Bull, L. S., Fuller, S., & Sim, D. (2013). Post-construction avian mortality monitoring at Project West Wind. *New Zealand Journal of Zoology*, 40(1), 28–46.