IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	Of a Board of Inquiry appointed under section 146 of the Resource Management Act 1991 to consider an application by Mighty River Power Limited for resource consents to construct, operate and maintain a wind farm at Turitea.

STATEMENT OF EVIDENCE OF HELEN ISOBEL GABITES

REPRESENTING FRIENDS OF TURITEA RESERVE

Contents

Introduction

1. My name is Helen Isobel Gabites.

2. I am a landscape ecology consultant with a Master of Science degree in Paleoecology and Geology, and a Bachelor of Science degree with Honours in Plant Ecology and Soil Science, both from Victoria University of Wellington. I have been involved in ecological work for nearly twenty years; not as a research scientist but twelve years as a consultant, otherwise in the employment of the Commission for the Environment (1986-7), Department of Conservation *(DoC)* (1987-9, 1992-3) and the landscape architecture and planning firm Boffa Miskell Ltd (1999 – 2004).

3. In recent years I have undertaken assessments of ecological effects, and peer reviews, for a wide range of developments including wind farms, subdivisions, plan change applications, as well as undertaking substantial projects relating to ecodomain delineation and freshwater catchment management for local and regional authorities and DOC. I have undertaken assessments of Sites of Ecological Significance for Porirua City Council[1].

4. In 2002 as a preliminary to PNCC's Greening Strategy, Boffa Miskell was commissioned to identify key native ecosystems in the District. My primary contribution to this work was to map and describe the Ecodomains in the District[2].

5. Allied to my professional work has been the authorship of five natural history titles for public readership.

6. Of particular relevance has been my AEE work for the developers of four wind farm proposals in the North Island: Te Rere Hau Stage 1 (Manawatu), Hawkes Bay Wind Farm (Mangaharuru Range), Horowhenua Energy (near Shannon) and Motorimu (near Linton). Each project has entailed an increasingly sophisticated requirement for pre-development monitoring and assessment, and in my submission I draw on the knowledge gained in this process, and the monitoring protocols I have helped develop.

7. The consented Hawkes Bay Wind Farm is located adjacent to Boundary Stream Mainland Island, giving me ample opportunity to understand the context of high bird populations including threatened and keystone species; a situation which could potentially arise with a Turitea Ecopark. This is one of the on-the-

[1] With Boffa Miskell Ltd.

[2] Ecological Processes in Palmerston North City, May 2002. A report for PNCC, Boffa Miskell Ltd.

ground experiences which leads me to have significant concerns with regard to the Turitea Wind Farm application by Mighty River Power.

8. While I professionally endorse the development of sustainable energy sources that may contribute to a de-acceleration of the climate changes threatening the sustainability of New Zealand's natural heritage, I would not endorse developments which in themselves threaten that heritage. My ecological interest lies in applying best practise principles to maintain site-specific ecological benefits, rather than solely seeking net environmental benefits of wind energy generation.

9. During the assessments for local wind farms I have spent weeks, throughout all seasons, observing bird populations and behaviour in the wind farm air space in sites that are primarily pastoral, with bush remnants or adjacent forests, and feel qualified to comment on comparisons with this site.

10. I was approached by Friends of Turitea Reserve to assist with their submission in opposition. I agreed to this on the understanding that my opinions may not necessarily reflect that of the organisation and that I would offer an independent assessment of the Application which they may use as evidence as required.

11. I confirm that I have read and understand the Environment Court Code of Conduct for Expert Witnesses and I comply with that code in presenting this submission. I consider that this submission is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Summary of concerns

12. The Mighty River Power consent application for 127 Turbines is centred on a Water Catchment Reserve and adjacent forested areas which, since 1881 when the Reserve was gazetted for "Growth and Preservation of Timber", have been afforded higher levels of conservation management than most parts of the Tararua and Ruahine Ranges.

13. Regeneration following disturbances (caused by fire, storm, severe browse and logging occurring up to the first half of the 20th century) has progressed with a high level of ecological integrity, albeit slowly in the windy, wet conditions prevailing. As such, all the native vegetation within the proposal area, representing a range of successional and regeneration phases on old organic soils, has high ecological significance and wildlife habitat value. Scarce

and threatened species of flora and fauna are present, including at sites designated for turbines.

14. In addition to the Turitea catchment being maintained in a relatively weed-free and low pest population state, we have the benefit of nearly fifty years of scientific investigation, mapping and routine monitoring of flora and fauna of the site making it an enormously important educational resource for natural history students and resource managers.

15. An estimated 25ha of native vegetation is planned to be removed from Reserve land and 3 ha from private land, based on road widths, turbine pads and transmission pylon pads required, although this maybe an underestimate. There will be further swales, batters and spill from earthworks beyond this minimum and dieback along exposed bush edges.

16. Of this area only 8 ha is able to be revegetated (according to the Ecological Assessment Report) and I am concerned that the procedures proposed will in any way mitigate the losses incurred – and I will comment on this in more detail later.

17. To my knowledge this is the first wind farm proposal to require the removal of a large area of native shrubland and forest (although some have required destruction of tussockland and smaller remnants of shrubland or individual trees). Further, it also proposes to support an *increase* of wildlife populations in the catchment in future by funding a higher level of predator and browser control, thereby potentially exposing more wildlife to the hazards of wind farm operation.

18. Faced with such a wide-ranging proposal with the potential for adverse ecological impacts, I would expect the design process and the AEE to be accordingly more discerning than most, and yet I get the impression that little effort has been made to avoid potential or adverse effects. There appears instead to be a heavy reliance on human intervention and expenditure to counteract the anticipated adverse effects, which raises questions of the sustainability of the development.

19. In a context of cumulative effects of wind farms in proximity to the Manawatu Gorge it is increasingly important that preferred habitats of the bird species most put at risk by wind farm operation be set aside as refuges from industrial hazards and as habitat for displaced populations. Like the Manawatu Gorge itself, the high ecological values of the Turitea Reserve and its proximity to existing and proposed wind farms make it well suited to this purpose.

20. The Turitea wind farm layout, on the other hand, completely encircles prime terrestrial habitat which also includes waterbodies that act as attractants to waterfowl.

21. Unfortunately, in New Zealand, we are not yet monitoring post-operational effects on wildlife and so are forced to base mitigation of effects on conservative risk minimisation and avoidance strategies. To suggest that 'risks are minimal' because few birds have been reported killed on wind farms is mischievous, as without surveys and investigations we have no way of reaching this conclusion.

22. What *has* been accepted on a number of New Zealand wind farm sites, is that where the combined risk factors for keystone and threatened species are high (such as high concentrations of flights within rotor sweep, flight corridors, proximity of turbines to breeding and feeding habitat, behaviour which regularly puts birds within the blade strike zone, flocking species, known bat colonies), avoidance strategies such as setbacks or relocation or removal of turbines is accepted practise. There may be other strategies that can be exercised, such as turbine turn-off during high risk periods of the day or the year, but these have not yet, to my knowledge, been fully explored[3].

23. It appears that the AEE does not provide us with a seasonal picture of bird behaviour within the wind farm airspace on which to base a low risk turbine layout design.

24. My conclusion, on reading the AEE and Application evidence, is that localised adverse impacts on old native ecosystems will be significant across the upper ridgelines of Turitea Reserve, but the only redress sought is mitigation through new plantings in environments which differ from the ones being impacted, or reversion on barren ground which will progress differently to 'natural' succession. This, in my opinion, does not represent sustainable development; it does not represent best practise for ecologically sensitive design, and undermines the effort other ecological consultants have been putting in to ensure wind farm developments are sensitive to their location and individual site values.

25. In the following sections I wish to clarify the natural values which are being put at risk or being destroyed, and in doing so to highlight some of the shortcomings of the AEE.

[3] This has been mooted for the Contact Energy's Hauauru ma raki proposed development and I have also mooted it as an option for Horowhenua Energy's site.

The site

26. My familiarity with the site is limited to three visits along the extent of the water catchment access road along the ridgelines in the company of Palmerston North City staff and other submitters; and two evening visits to the end of the public road for bird observations. While this does not represent a thorough examination of the site and every turbine location, it has given me a good understanding of the dynamics and condition of the vegetation, the terrain and altitudinal variation in environmental conditions and linkages with other forest habitat.

27. I have also made myself familiar with DSIR reports and the 2006 Turitea Water Catchment Reserve Management Plan.

Landuse

28. The existing road allows access to the five main landuse types that will be affected by wind farm construction: (i) **pasture**, including de-stocked wet basin areas, (ii) mature pine **plantation** (planted either into cleared native vegetation or in its second rotation), (iii) **ex-plantation** clear-felled surfaces (exposed for up to $2^1/_2$ years), (iv) a mosaic of **native** vegetation associations and (v) **roads, verges and cuttings** with vegetation associations relating to localised catastrophic disturbance and edge effects.

29. (i) **PASTURE** This land-use is highly compatible with wind farm development but a portion of the site (Browns Flat) comprises one of the characteristic high altitude, shallow basins found in the hills between Ohau and the Manawatu Gorge. Drainage systems are low gradient and rainfall-dependent and therefore vulnerable to sedimentation from surface runoff. Four turbines which had originally been proposed for this basin have been removed (T 49, 50, 51 and 53) so direct impacts of roading, creek crossings and turbine pads in the basin are avoided.

30. Particular care will be required however to protect the basin drainage systems from earthworks on the surrounding spurs (T054 and 040 and disposal fill sites in particular) and I would expect requirements of rank grass growth and extra precautionary surface protection measures as a matter of course.

31. (ii) **PINE PLANTATION** The 20 ha of remaining plantation was planted in the 1970s, either replacing a previous rotation or was planted into cleared broadleaf scrub. The latter areas in particular have relatively prolific native undergrowth of ferns, vines and understorey trees and shrubs, encouraged by high light penetration into remaining blocks of pine. Small-fruit bearing trees

and shrubs attract birds such as silver eye, blackbird, bellbird and tui during fruiting season. The pine canopy provides feeding and breeding habitat for insectivorous bird species (fantail, tomtit, grey warbler, whitehead, silver eye, shining cuckoo, morepork) and for falcon and roosting for kereru.

32. It can be seen in the (iii) clear-felled **EX-PLANTATION** areas that, once exposed, most of these previously sheltered, shade-tolerant species become stressed or die, although their seeds provide a flush of young growth after several years, from which a minimal selection of the hardier, light-demanding species will regenerate. The felling earthworks disturb, dehydrate and consolidate the topsoil, encouraging the rapid spread of exotic adventive weeds and pasture grasses. Wilding pines rapidly regenerate. Breeding birds are displaced, and the predominant wildlife species are harrier hawk, rabbit, and exposure-tolerant invertebrates.

33. Such highly modified areas are compatible with wind farm operation, but unless they are developed into pasture they will grow a vegetation cover (probably a mix of wilding pines, native bush and exotic weed species) that could in time impede wind farm operations. Only 20 ha of plantation remains but most will need to be felled to allow for wind farm operation. The Applicant proposes to allow regeneration rather than convert to pasture.

34. (iv) The mosaic of **NATIVE VEGETATION ASSOCIATIONS** on the upper ridges of the Turitea Reserve result from both degeneration and regeneration of forest cover as a result of multiple systemic *and* catastrophic disturbances over a long period of time. Practically all the foothill forests of the western Tararua Ranges in Horowhenua and Palmerston North City Districts have experienced "mass degradation of tall forests that once covered mid-upper altitude slopes"[4]. Forest on privately owned land is still actively degrading whereas publically owned areas such as Turitea Reserve and Ngawhakarara Ecological Area near Shannon have received pest control that has arrested decline.

35. The composition and structure of the original Turitea forest has been altered to the extent that many spurs were reduced to native 'turf' 50 years ago. The recovery of ecosystem health since hunting was stepped up in the 1970s and, more recently, co-ordinated possum control (which began in 2004), has culminated today in a healthy mosaic of shrubland-grassland, shrubland, single tier broadleaf forest with remnant podocarps and tawa.

36. Associations also vary in composition due to altitudinal variation and relative shelter from prevailing westerlies.

[4] From Plant Checklist for the Ngawhakarara Ecological Area, NZ Forest Service, 1986.

37. Regeneration under the closed canopies is vigorous, but overall growth on ridges is impeded by strong winds, such that over the last fifty years although spurs once grassed are now shrubland, it has been difficult to discern a change in the height of the broadleaf cover[5]. Emergent miro appears to have lost reproductive vigour. Clearly, in these conditions, it is the dense, closed canopy that is critical to ecosystem health.

38. It is important to recognise that much of the vegetation we see today is not 'secondary' growth but a forest that has lost many of its emergent and canopy trees, exposing understorey species. Even where the understorey tier was also damaged, shrubland has developed on the old organic forest soils and rotting stumps can be found throughout even the low stature vegetation. This continuity of ground cover has important implications for the 'significance' of the ecosystem as I will discuss shortly.

39. The canopy along the ridgelines is remarkably diverse, commonly with 15 to 20 tree species and several tree fern and cabbage tree species in the canopy and there is an abundance of ground ferns, lianes and climbers even in the lowest stature scrub. On my brief visits I noted 41 species of tree and shrub within 10m of the road – over half the total tree and shrub species recorded for the entire catchment, most of which is sheltered low-altitude valley forest expected to support a higher diversity. I noted in total 89 vascular species during road-side viewing and I am told the Palmerston North Botanical Society identified a further 30 or so during their detailed investigations.[6] This level of diversity indicates a high level of ecosystem integrity.

40. (v) We can learn a lot about development impacts by studying the **road verges and batters** associated with the water catchment access road. The road was created approximately 35 years ago, and around 10 years ago extensive areas of toetoe that had colonised the verges were re-cleared[7].

41. As illustrated in the Figs 1 and 2, where the surface was reduced to hard rock or skeletal, compacted soil, revegetation in exposed sites results in a low ground cover of lichens, mosses, club moss, snowberry and grasses – even after a decade – and in sheltered sites ground ferns and toetoe. Of interest is the colonisation by *Dracophyllum* above approximately 580 m.

42. Where deeper loessal soils have been disturbed, a colonising association is dominated by exotic or native grasses and we know that prior to its clearance

[5] Pers comm.. Mark Johnston, PNCC

[6] Pers comm.. Adrian Cookson, FOTR

[7] Pers comm.. Mark Johnston, PNCC

by catchment staff toetoe had continued to dominate these road verges for 25 years.

Significance

43. So is the vegetation in Turitea Catchment significant?

44. Ninety percent of Palmerston North City's indigenous vegetation is in the Turitea Reserve[8] and the range in altitude and aspect provides a seamless ecological gradient of associations adjacent to the extensive forests of the Tararua Ranges. As such the Reserve has high local significance. In a University town a site with primary forest in close proximity that has been surveyed and monitored over 50 years is an invaluable educational asset.

45. Horizons Regional Council classifies the Reserve as a High Value Conservation Area and the long term protection and pest management undertaken in the reserve bestows high regional significance.

46. The presence of breeding populations of endangered species including falcon, kereru (removed from the Threatened Species list only in 2009), *Brachyglottis kirkii, Raukaua edgerleyi* (removed from the Threatened Species list only in 2009) bestows national significance on the Reserve.

47. In 2001 I developed a methodology for ranking Sites of Ecological Significance which, although based on the standard criteria commonly used (as described in Mr Shaw's WBS7), distinguishes between vegetation which represents a continuum on the same site, and vegetation which is reversion from cleared land. I developed a flowchart which expressed simply the ranking process for non-ecologists. This work was accepted and applied by Porirua City in their SES assessment and has been accepted and applied by other councils for particular projects since. I attach the relevant flowchart (Fig.3) as being the one being applicable to the Turitea Reserve.

48. Evaluating significance continues to be a vexed issue for ecologists. Some evaluations of ecological significance are biased towards scarcity value within an ecological district. Firstly, ecological districts have been superceded by Ecodomains (or LENZ units) as a comparative framework. Secondly, I prefer not to prioritise based on scarcity, but to recognise the intrinsic values, which are by necessity related to factors such as connectivity, vigour, diversity, resilience.

[8] Turitea Management Plan Part 2.

49. My methodology reflects a recognition that vegetation associations are in a state of flux, often resulting from specific disturbances, and that basing a value system on a static, 'mature' equilibrium state is not realistic.

50. In summary my evaluation is that the mosaic of associations through Turitea Reserve rank as 'of greatest significance' and 'highly significant'.

51. I have read the site evaluations of ecological value presented by Mr Shaw in his evidence (WBS8). Although applying his criteria I would rate the pastoral sites as low (not low-moderate), based on my observations and site visits, I am in general accord with his assessments of other sites.

52. I therefore find it confusing that Mr Pollock summarises Mr Shaw's evidence by saying it "indicates that the project will not affect any area that constitutes 'significant indigenous vegetation or significant habitats of indigenous fauna'[9]. These comments contradict Mr Shaw's assessment.

53. He goes on to say that "As assessed by Mr Shaw, the majority of the wind farm (that is, the turbines and associated access tracks and pads) can be sited, constructed and operated with resulting adverse effects on terrestrial ecology that are considered by him to be acceptable. However, a number of turbines are assessed as having effects on terrestrial ecology that are significant and which must be remedied or mitigated in order to be considered acceptable." This downplays the number of turbines having a significant effect according to Mr Shaw (24 of the 41 turbines within native vegetation in the Reserve). It also concerns me that Mr Pollock does not consider avoidance to be an option.

54. With regard to ecological matters addressed in Parts 6 and 7 of the Resource Management Act, it is required that the wind farm design process gives regard to the protection of significant indigenous vegetation and habitats of indigenous fauna, and to the intrinsic values of ecosystems, the maintenance or enhancement of the quality of the environment, any finite characteristics of natural and physical resources and the protection of the habitat of trout and salmon.

55. Further, the RPS [Obj 9] is "to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna

56. That the PNC District Plan does not list in its Schedule of " . . . significant indigenous vegetation" (Appendix 17C) the 90% of its original indigenous vegetation cover remaining, which is contained in Turitea Water Catchment

9 Evidence of GF Pollock Page 23

Reserve (thereby not making it subject to the Rules and Objectives of Section 17) is something I do not understand.

57. But, that Palmerston North City, in its criteria for selection of a power generating company, only highlighted the requirement for "Environmental risk management policies and procedures, in particular water contamination" and not the protection of its natural ecological heritage, is of concern.

58. It is clear that there has been a very long tradition of disregard for indigenous shrubland or broadleaf forest. The Council's primary strategy for conservation management, as manifest in the Ecopark concept being promoted for Turitea Reserve, is focussed entirely on lowland tall podocarp forest, and it is prepared to sacrifice the ecological values of mid-to high-altitude shrubland, tussockland and broadleaf forest in the interests of development of energy generation infrastructure.

59. It is an indictment on PNCC that the Tararua District Council's District Plan does include objectives to "protect important natural features (including areas of indigenous vegetation and habitats of indigenous fauna) and landscapes in the District which are of local, regional or national significance" which are in reality an extension of the Turitea Catchment.

60. However, the Turitea Water Catchment Management Plan requires that a wind farm be constructed without undue adverse effects on the other values of the Reserve. I do not agree with Mr Pollock's assessment that not only does a mitigation package address the adverse effects (his evidence, p58) but that the Reserve is not to be protected or preserved from all change.

61. To date the main human-induced changes to the vegetation in the Reserve have been the creation of roads, the conversion of scrubland to plantation forest, and the flooding of lowland forest. Each of these have whittled away the natural habitats and had downstream adverse effects on ecosystems.

62. To encourage further losses to occur is, in my opinion, in the context of this being an area of high ecological values, an 'undue' and 'inappropriate' effect'. I disagree with Mr Shaw's claim that the proposal will not have inappropriate adverse effects on these areas.

63. The criteria for "no-go" areas which Mighty River Power set itself in its initial scoping[10] were to avoid sites in the lower valleys and areas adjacent to reservoirs (which I suggest were never going to have wind generation potential

[10] Evidence of Mark Henry, Mighty River Power

anyway), steep sites requiring significant earthworks, and "areas of ecologically **sensitive** vegetation". (I consider it a failing that areas frequented by endangered and keystone birds did not warrant avoidance, and there might have been a more rigorous appraisal of bird behaviour through the site if this had been included).

Design process

"Sensitive vegetation"

64. Thus, I had expected to see discussion in the AEE of what constitutes "sensitive". It is worth pointing out that PNCC did not require MRP to avoid areas of high ecological **significance**, as they have not formally identified these sites, (even though the Water Catchment Management Plan regards the entire catchment as "highly significant").

65. We have the evidence of the last 50 years at least to determine that the vegetation is, indeed, sensitive to disturbance. On the higher ridgelines, above approximately 560 metres, the soils, often skeletal along the ridgelines, have a rich, humic topsoil developed under forest, which is extremely old. Once removed, dehydrated or compacted we see that regeneration is extremely slow – slower than at the lower altitude of South Range Road or on lowland plains. In the best case native grasses and herbs will dominate for decades before shrub and broadleaf species succeed. In the worst case it appears it could take a decade before this process even begins.

66. On scrub edges that have merely been disturbed, regeneration or advance is hampered by dense swards of exotic grasses and toetoe which colonise preferentially. On edges of scrub >2 metres in height, physical damage by wind is evident several metres into the stand, and weed invasion is enhanced.

67. In all cases invasion by exotic weeds is a contemporary and growing issue, and one to which low stature shrubland and grassland is more 'sensitive' than tall forest. On each of my visits I found invasions of conservation weeds along possum line tracks, road verges, cut-over ex-plantation and within the first few metres of forest edges throughout the Reserve.

Edge effects

68. Another way to determine 'sensitivity' is to assess edge effects. Mr Shaw discusses edge effects in his evidence. He concludes that:

69. "Wind-shorn low stature vegetation developed in windy conditions may be affected up to 5 metres from the new edge on flatter sites; less on steeper sites", and

70. "Rehabilitation planting of road verges will mitigate effects, and will result in a net gain of indigenous vegetation".

71. While I agree with the former point, I would further point out the impact on vegetation >2 metres in hight is particularly severe and difficult to 'heal' (as Figure 4 illustrates), and that there are a number of roads, turbine and pylon pads proposed within vegetation as tall as 7m.

72. I do not agree with the second point. Where removal of native vegetation occurs alongside roads or to create roads, subsequent rehabilitation with native vegetation cannot result in net gains. Further, it results in a different and species-diminished and often weed-infested vegetation.

73. I also would make the point that the primary natural coloniser of most road verges is toetoe. As Figure 5 illustrates the effect of roads and tracks lined with toetoe results in a very prominent visual feature which may remain for decades.

Effects on Vegetation

Direct destruction

74. Twelve of twenty internal connection 220kV pylons appear to be located within native vegetation in Turitea Reserve. Each requires a construction area of 15m x 15m cleared from the bush or shrubland, which is the footprint of, say, a standard four bedroom Lockwood house. This is a total of approx. 0.3ha.

75. It is not indicated in the Application which of these will be accessed only by helicopter, but Plans provided by Mr James (CDJ01) suggest six of the twelve will be adjacent to the new roads being cut to turbines (none are on the existing ridgeline road). The timeframe for works (CDJ12) indicates that the pylons are installed before the turbines are erected, so their pads must be in addition to clearance required for turbine access.

76. I have not found indicated on any plans whether any of the other pylons will have access roads cut to them, but take it on trust that pylons close to T0023, T0022, T0017 and T0062 are intended to be erected by helicopter as no access roads are shown.

77. As an aside, Mr James notes in his evidence that "final pylon positions will be chosen . . . so as to avoid impacting on tawa forest or mature trees of other

species". As all the relevant sites on eastern aspects are within closed canopy mature broadleaf forest (up to 6m tall) and also containing tawa and he is likely to find it hard to implement his objectives.

78. Each turbine located within native vegetation in the Turitea Reserve requires a nominal 55m x 25m flat surface during construction. As shown in CDJ15, once there are also batters and cuts it would be expected that the space cleared of vegetation is more like 60m x 35m. I understand 43 turbines are proposed to be within native vegetation in the Turitea Reserve, amounting to 9ha of clearance.

79. A further 13 turbines are to be erected in cut-over pine plantation and although I have not included these in my summation I do note that by the time construction begins colonising native vegetation will have become established on these sites also.

80. 12km of new roading is required in Turitea Reserve (plus the widening of 11km existing). As clearly illustrated in CDJ02 the road surface needs to be 10m wide, plus swales, plus any cuts or batters required, amounting to a minimum of 12.4m width but as much as 7m wider than that depending on the topography. So that estimated 12km of roading will require a minimum of 14.8ha clearance.

81. If we assume that the existing roadway is approx 5m wide and 11 km needs to be widened to a minimum of 12.4m, this adds a further 8.1ha of vegetation removal.

82. So far, then, we have a minimum of **32ha** native vegetation being destroyed, but a large stretch of ridgeline (between T027 and T034) which will require a far greater width of clearance to accommodate gabions, cuts and batters.

83. All these roads will require grit traps for sediment control so at intervals there will be further bulldozer intrusions into bush and shrubland edges similar to what we see along the road at present.

84. In summary I believe the estimates provided of 25ha of vegetation removal inside Turitea Reserve is a serious underestimation. Figure 6 illustrates the earthworks undertaken at Te Apiti with an aerial of Turitea at the same scale for reference.

85. I understand that in the course of excavation it is intended that "all well established native plants or clumps of native plants within the limits of the earthworks will be carefully excavated and set aside" (AEE, Appendix E). Is it realistic to expect that truckloads of plant material will be carted up to 3 km to barren ground? Or will they be stockpiled on top of existing native vegetation

closer to the excavations? This is a substantial trucking operation to be taken account of.

86. Mr Shaw makes reference to a requirement that vegetation adjacent to turbines should be no taller than 5 metres. It is not clear how far from the turbine this zone needs to extend, but clearly this will impact on those turbines which are located within forest recorded as being 5-7 metres in height. There is also no indication that I can find in the Application of maximum vegetation heights in the vicinity of power lines and pylons.

87. The expectation is that buried 33kV cabling from each turbine will run along the roadways (although no guarantees are given that this will always be the route). Each requires a channel 500mm wide and one metre deep and obviously access for the trenching vehicle, so if any trenching is done away from the access roads this will cause further vegetation destruction.

88. If the number of cable channels required exceeds the final road widths I assume that roadside vegetation growth would be restricted, to avoid root penetration of the trenches.

89. I have had the opportunity to briefly investigate designated access roads for Turbines 39 and 40. Within just a few metres the threatened species *Raukaua edgerleyi* was plentiful and at both areas the canopy was 5 to 6m. If this is typical of the intrusions into the more sheltered, east aspect sites then the adverse effects of clearance will be significant.

90. Other canopy species present such as tawa and miro are, like raukaua, mid to late successional stage species. To replace such losses through 'mitigation planting packages' will entail at least 30 to 40 years before closed broadleaf canopy conditions become suitable for their growth.

Pine felling

91. I understand that it is the intention of PNCC to fell pines within the Turitea Reserve, when and if the market prices allow. No direct mention is made of felling of pines to allow for turbine erection, but there are several sites where this would be required.

92. The plantations along South Range Road have substantial native undergrowth and support a wide range of birdlife (my own observations included kereru, tui, blackbird, fantail, silvereye, riroriro, whitehead and magpie). By virtue of the way they were planted in the 1970s, and the high levels of light penetration now, there are mature broadleaf trees as well as tree ferns, ground ferns, climbers, scramblers and cabbage tree species within these plantations and I

consider them to make a substantial contribution to the indigenous ecosystems of the Reserve.

93. I suggest that leaving these plantations intact and able to senesce naturally, would benefit the reserve and proposed mitigation more than planting of cut-over barren ground.

Cuttings, batters

94. Exposed rock is not a natural feature of these landforms. The current ridgeline road has already introduced such surfaces into the Reserve, especially on steeper stretches and the 'zig-zag' up onto the southern ridgeline.

95. Proposed roading, turbine and pylon pads will increase the amount of cut substantially. I cannot give an estimate of how much, as until detailed geotech investigations of each turbine site are undertaken it is not known how deep excavations need to go to reach a suitable platform. But, it can be assumed that all pads and all new roads will introduce new batters and/or cut faces. Many of these areas will be remote from the kinds of native species that might colonise freshly exposed faces (such as lichens, clubmoss, light-demanding herbs) which would slow any natural colonisation process.

96. The Applicant intends to hydroseed such faces, which is likely to be problematic, as it is difficult to hydroseed and stabilise such faces in high rainfall, high wind zones.

97. I believe it is important within the Turitea Reserve to minimise the introduction of exotic species and to maximise the establishment of native vegetation on exposed ground. I am aware of the trials undertaken by Landscare Research for Meridian's West Wind to hydroseed cuts with mixes of native colonising species. This met with qualified success (60 – 80% coverage in six months on trial plots).[11] This effectively fast-tracks establishment of native colonisers which would be a suitable approach to take in areas where those species may not already be present.

98. If Turitea wind farm were to proceed within the Reserve I would strongly recommend that all hydroseeding of cut faces and batters introduce suitable native species as a condition of consent. However, I recognise that trials would need to be undertaken to determine the likely success rate in this environment. It is also my opinion that the introduction of this 'foreign' habitat on such a

[11] Hydroseeding Ttrial, Makara Wind Farm Development Project, C. Ross, Landcare Research Contract Report: LC0607/087

large scale is counter to the objectives of the Turitea Water Catchment Management Plan.

Weeds

99. On each of my site visits I noted weed invasion along roads, into possum-trapping tracks, within the first metre or two of shrubland and forest, and across the ex-plantation clear-felled sites. Of note are the conservation and agricultural weeds: Himalyan honeysuckle, gorse, blackberry, boneseed, ragwort, wilding pine, montbrettia, tree lucerne, and foxglove. There are also many other less concerning weeds present.

100. In the Turitea Water Catchment Management Plan it is acknowledged that a major source of weeds is from trucks, machinery, 4WD vehicles and imported river shingles for roading.

101. Vigilence is required, but as much of the movement of staff through the catchment is by vehicle, weeds can get well established before being spotted. The ex-plantation areas are rapidly becoming a reservoir of weed species which will be spread by berry-eating birds. Of the weeds I noted, Himalayan honeysuckle and blackberry pose a major threat as they are shade-tolerant, and montbrettia would rapidly invade disturbed road verges.

102. At present it appears that ridgeline roadside weeds are targeted and well controlled by catchment staff although with the increased weed source from plantation areas they will be kept very busy in the future.

103. I am greatly concerned, however, at the extent to which this problem will burgeon when there is a greatly increased 'edge' of disturbed land, a high level of vehicle movement through the reserve, a large volume of imported roading material (it is estimated that on-site resources will only supply one quarter of the material required[12]) and fingers of cleared land extending well into currently remote and closed canopy vegetation associations.

104. The Applicant proposes to monitor weeds annually. I consider this to be inadequate, as it can take only months for species such as Himalayan honeysuckle to fruit and be distributed to new sites and, as noted, individual plants are readily overlooked during a single visit. The Applicant proposes to support inspections for 10 years. I consider that the responsibility should be for the life of the wind farm.

[12] Evidence of C.D. James

105. I prefer, nonetheless, that the Reserve not be exposed to weed invasion at all. In my opinion creating extensive new habitat suitable for weed invasion, plus introducing the vectors for new seed and bulb material, represents an unacceptable level of threat.

Reparation

Rehabilitation

106. Both the evidence of the ecological consultant and the engineer reiterate the need to rapidly sow grass over freshly exposed ground to minimise erosion.

107. This introduces exotic grass species into parts of the Reserve currently free of exotic species. As seen at present, exotic grasses are rapidly invading road verges along the ridgelines and sites of wind farm disturbances. Also where there is any depth of topsoil they are growing densely enough to suppress native regeneration and inhibit the advance of shrubland and bush edges over disturbed ground.

108. The requirement for rapid rehabilitation of native vegetation, therefore, carries with it the expense of extensive planting of native species, if mitigation or remedial works are to be undertaken, as those species would not readily establish by themselves.

109. Whilst I endorse the sequence of planting suggested by the ecological consultant it is clear from field trials to date that the reality of planting in these harsh conditions is quite different from the theory. In addition, the trials, which were largely unsuccessful, did not occur within a sward of exotic grasses. The scale of planting required is prohibitively expensive, and I imagine that we would in fact end up with swathes of toetoe and exotic grass.

Re-establishment

110. The Applicant proposes to manage a natural reversion process across clear-felled plantation land and to assist this process by planting 8 ha (presumably in areas required to be cleared for wind farm operation). All the land concerned is below 480m altitude, whereas the adverse effects of the development largely occur from 480 to 622 metres. Within this change of altitude and increasing exposure to strong winds, there is a noticeable variation in species which raises the question of whether low altitude reversion - on highly disturbed soils - can be considered mitigation for the loss of higher altitude vegetation on undisturbed soils.

111. It is my opinion that the integrity of the Reserve is better served by retaining the remaining pine plantation and allowing it to become senescent naturally, or thinning it in part to encourage a denser understorey of native species.

112. Even so, this native understorey is typical of the lower altitudes of the ridgeline and tall forest canopy and does not replicate the associations found at higher altitudes within the wind farm site.

113. Field trials undertaken by MRP for planting on open ground have to date proven unsuccessful.

Direct transfer

114. I have read the reports supplied by Landcare Research[13] on trial direct transfers of native vegetation alongside the Water Catchment Road and have visited these sites myself. I have also talked to one of the leading experts[14] of direct transfer techniques to better understand the variables involved in a successful operation.

115. I understand that the highest rate of success occurs with purpose-built blades, adequate soil depth, ideal weather conditions (overcast and calm, not wet or sunny), autumn/winter, skilled drivers and direct (not stockpiled) transfers. I would also expect the underlying substrate to have a large bearing on the re-establishment of root systems, although this was not commented on in the Landcare Research reports.

116. I question the chance of getting all these aspects right, and whether the expense of the operation might, in reality, determine whether these optimal conditions are met.

117. After the first year the ground cover on the trial plots was dominated by exotic weeds. A limited number of native species have been able to resprout and germinate in the resulting transfer material, but are competing with exotic species. My impression of the trial transfer plots is that weed invasion is encouraged by the inevitable disturbance of the material shifted, so whereas the consultants record the transfers as being 'successful' I believe this overlooks an important issue regarding the increase of weeds throughout the wind farm.

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[13] Turitea Revegetation Direct Transfer of Native Vegetation Trial, Tararua Range, Manawatu, C Ross and P Berben, Landcare Research Contract Report LC0607/079

Turitea Revegetation: Direct Transfer of Native Vegetation Trial, Tararua Range Manawatu – Vegetation after one year, C Ross and P Berben, Landcare Research NZ Contract Report LC0708/072.

[14] A. Black, GeoTech Ltd

118. I also understand that indirect (i.e. stockpiling) rather than direct transfer will be undertaken, as rehabilitation work cannot commence until infrastructure has been completed for each stage. This requires 'good management . . . particularly to maintain moist soil' [of the temporary storage site][15] which is an additional onus on project management of the construction phase.

Landscape mitigation

119. Private garden mitigation to screen views of turbines has been proposed by Australian landscape architect Mr. Wyatt. For the properties he regards as benefiting from tree planting (listed from page 73 onwards), it appears that between 4 to 6 metres of growth is required to be effective. In one instance he suggests a growth rate of existing cypress hedge trees of 1 to 2 metres per year.

120. I am concerned that the height suitable garden trees would reach to be effective may take longer than the construction period of the wind farm – indeed may take many years to achieve the desired effect.

121. Typical growth rates cited by local nurseries who supply trees range from 3 metres height after three years (for hardy, wind-resilient exotic species such as cedar, macrocarpa hybrids, lawsoniana) to 6 to 7 metres after ten years and much slower growth rates for native trees such as lemonwood, broadleaf, totara (which may also be suitably hardy choices). Cypress growth rates are quoted as half that of Mr Wyatt's opinion.

122. So while I agree that planting may achieve the desired effect, residents should be aware that there will be some years - perhaps 5 to 10 years - before this is likely.

Effects on Wildlife

123. There are a number of aspects of the AEE I believe are inadequate, in particular the lack of information of bird behaviour through the site through the year, which should have been available to feed into the turbine layout design process. There are fundamental questions which should have been posed, and answered, to assist with the assessment of ecological effects, such as:

124. Are there habitats within the windfarm that specifically attract birds?

125. **Yes**. There are large waterbodies attracting waterfowl and shags; mature podocarp/tawa/pigeonwood forest attracting kereru; abundant fuchsia and

[15] Ibid.

cabbage trees at all altitudes attracting tui and bellbird. Risk management should include avoidance of regular flight paths and to avoid encircling such habitats with turbines. This has not been identified as an issue in the AEE.

126. Are there linkages between adjacent forest that specifically attract bird movement?

127. **Yes**. As we can observe in adjacent forested valleys and bush remnants it is expected there will be preferred corridors for kereru movement between valleys containing preferred foods as marked on map in Figure 6. Saddles between forested valleys are the most likely locations, and birds fighting head winds may well traverse these routes at heights within blade sweep or negotiate powerlines and wind mast wires. Sites have not apparently been monitored at appropriate times of day in appropriate seasons. The issue of increased kereru populations in the future has not been addressed.

128. Are there threatened species present and/or likely to be breeding within the wind farm site?

129. **Yes** (both wildlife and plant species). There are also keystone bird species resident. According to protocols developed in Australia and New Zealand this should trigger more detailed monitoring to determine the behaviour or requirements of these species. There is no evidence presented that this has been done for falcon, kaka or *Brachyglottis kirkii*, nor for species which at the time of initial investigations were on the Threatened Species list (e.g. kereru, *Raukaua edgerlei*). It has only been proposed that the epiphytic *Brachyglottis kirkii* be propagated if found in development sites. There should be a clearly stated policy of what action would be taken were the giant land snails *Powelliphanta* found to be under direct threat.

130. What is the likely effect of an increased bird population (particularly if an Ecopark is established) on the risk levels?

131. The AEE Ecological Assessment, and the evidence of Professor John Craig, reiterate some very misleading 'information' about bird fatalities on wind farms, namely that:

132. (i**) 'results from New Zealand wind farms suggest that bird deaths occur in low numbers'**.[16] There have been no methodologies for surveying bird strike developed in New Zealand. My understanding is that all deaths reported so far result from wind farm staff noticing carcasses during their movement around the sites. It is very important that we realise that it will be impossible to record bird strikes within Turitea Reserve where ground cover will obscure carcasses

[16] Evidence of John Craig, page 6, para 13

(alternative methods such as blade strike sensors or radars would need to be introduced). So monitoring to compare pre- and post- construction hazard levels is unlikely to provide fatality information. Publication of monitoring results is a voluntary contribution power companies can make to the wider understanding of effects, and it is encouraging that Mighty River Power is offering to support ongoing student research into such issues. In the meantime, it is mischievous to misrepresent the real situation.

133. (ii) **"bird species present in Turitea Reserve do not . . . behave in ways that would put them at extra risk from the turbines"**[17]. Birds that are at risk are those which (i) have aerial mating displays (ii) travel in flocks (iii) regularly use the air space for hunting (iv) regularly fly within blade sweep heights at night and/or in overcast conditions, (v) are poor fliers unable to take swift evasive action or are easily swept up by thermals and strong winds. On the few site visits I have undertaken to Turitea Reserve I have observed Paradise Shelduck, magpie, tui, kereru, falcon, harrier hawk, mallard and black backed gull – all of which meet one or several of these criteria. There are more species on the bird lists provided which also meet these criteria. I find it extraordinary that Professor Craig has not noticed these species, nor recognised their behaviour puts them in direct conflict with turbines.

134. The aerial display behaviour of tui and kereru commonly occurs within 80m of mature forest edges and falcon and harrier hawk frequent forest edges. On other wind farms I have encouraged (and consent conditions have been agreed to) that turbine blades should be setback 80 to 100m of tall forest (especially podocarp/tawa forest). There are a number of turbines in the layout proposed that have envelopes abutting forest edges, making birds more vulnerable to blade strike.

135. (iii) **restoration of 75 ha of forest will mitigate the few deaths that might be expected**[18]. Restoration of 'forest' is a greenfields approach that is likely to take at least 20-25 years to establish a 'forest' canopy and so will not provide habitat for at-risk forest species for at least half the lifetime of the wind farm consent. It will not provide habitat at all for the waterfowl, hawks and gulls. I do not consider this a valid argument.

136. (iv) **"It is unlikely that these water birds will fly anywhere near the majority of turbines on the ridges.**[19]**"** To reach water in Browns Flat, all water birds must enter a ring of encircling turbines. There is only one, 1.4km wide,

[17] Ibid, page 6, para 14

[18] Ibid, page 6, para 15

[19] Ibid, page7, para 19

gap in the circle of turbines around the reservoirs which allows uninhibited access (from downstream of the dams). Birds travelling from the Wairarapa or waterways within the Tararua and Ruahine Ranges must travel over ridges with turbines. The preference for water birds to move in flocks raises their risk level.

137. (v) "There is no information about [kereru] movements at Turitea, but . . . this behaviour is unlikely on ridges where most of the turbines will be sited.[20]" One thing I have learnt from weeks of observation in nearby hills and valleys is that you need to be observing likely routes between forest remnants on both sides of ridges, at the right season (when certain fruits are ripening) at the right time of day (generally 7am and 7pm) to know whether kereru are commuting over ridgelines and to gain an impression of population numbers. In general they will choose low saddles, but windy weather and the bird's apparent memory for short-cuts to favoured trees, may induce them to fly at higher levels. They also 'scout' for new food sources at high level as fruiting patterns change. I have identified a number of likely 'kereru corridors' in the Turitea catchment and they are very close to a number of turbine sites. It can be assumed that with ongoing, increased levels of predator control, kereru populations will increase resulting in greater saturation of higher level forest and greater commuting between favoured valleys and lowland remnants. I might add that I have generally experienced passionate community-wide responses regarding the safety and protection of this much-loved bird. I am sure the community here would appreciate better information about the level of risk for kereru than has been provided.

138. (vi) "Falcon are already present at other existing and consented wind farms where no recorded falcon-related incidents have occurred. Accordingly, they are not considered to be at risk from turbine strike.[21]" Opinions about the acuity and risk associated with adult falcons does vary amongst specialists who have studied them at length, but I have found that they agree that juvenile falcons will more susceptible to turbine conflict. Thus sites which have suitable breeding habitat for falcons immediately increases the level of risk for this endangered species. In my experience of Manawatu wind farms, while they offer hunting grounds they do not offer breeding grounds. Turitea is different. Known falcon populations combined with known suitable breeding habitat should alert consultants such as Professor Craig that a greater level of scrutiny is required.

[20] Ibid, page 11, para 30

[21] Ibid, page 14, para 42

139. I am interested in the report from Professor Craig that "All [bird] deaths [in the vicinity of other Manawatu wind farms] were introduced magpies, despite native birds such as paradise shelduck, tui, kereru, falcons and harrier hawk using the area." This is extremely significant information as it infers that post-construction surveys are being undertaken and that birds are not being displaced, even paradise shelduck which are so averse to disturbances. This source information is not cited, nor is it clear whether it is based on personal observation, but it is crucial to our understanding of potential effects. If it is possible for this information to be clarified it would be greatly appreciated.

140. Professor Craig also notes that bird mortality searches have only recently begun on New Zealand wind farms (which to my knowledge must be within the last year) and lists some statistics. Again this information is not cited.

141. However the important omission in these reports is that they come from pastoral wind farms, not wind farms located within dense and mature native vegetation.

142. Between Turbines 11 and 23 on the eastern ridgeline there are not only 14 turbines proposed but 7 pylons supporting aerial cables creating, effectively, a one kilometre long hazard for birds moving across and along the ridgeline. This is part of the site where there is podocarp/tawa forest on both sides of the ridge so we we can expect movement of tui, bellbird, kaka and kereru between these areas.

143. The ideal assessment process follows protocols developed in New Zealand and Australia specific to wind farms:

144. Firstly, interpreting the vegetation and landuses of the site with respect to wildlife habitat, and checking for the presence of threatened or rare plant species in areas that may be affected by earthworks;

145. Secondly, ascertaining seasonal variation in wildlife populations present across the site or travelling through the site, by using local knowledge, interpretation of the habitats, and seasonal surveys as time permits; and interpreting whether these populations may be jeopardised either in the short term or during the life of the wind farm; and

146. Thirdly, if threatened or keystone wildlife species are found to be present, undertaking targeted baseline data collection of their populations and behaviour.

147. Fourthly, continuing seasonal general and focussed surveys for a number of years after the wind farm becoming operational to check whether unanticipated adverse effects are occurring.

148. I see no evidence of any of these steps being undertaken except for bats.

Bats

149. Long tailed bats are known to be present in low numbers in the neighbouring Kahuterawa and Tokomaru Valleys, where they have been recorded both within mature native forest and adjacent to pine plantation[22]. Given that they preferentially frequent mature forest and edges (such as roadways) during their active foraging season it is highly likely they are also present in the Turitea catchment.

150. Turbines may present a hazard to bats in a range of circumstances. It is thought that bats commuting regularly to foraging grounds may not utilise their sonar detection and could fail to recognise moving blades. There is also mounting international evidence provided by radar and sonar monitoring techniques that some bat species may actually be attracted to nacelles and/or moving blades.[23]

151. The thought of such a tiny creature becoming a victim of a turbine blade may seem absurd, but if this were to occur on a regular basis to an endangered species with low population numbers the impact will be disproportionately significant.

152. The bat surveying that took place prior to the Applicant's evidence being lodged was undertaken using receivers with a 50 metre range, and only useful under open sky. This limits the survey routes, and may not produce a fair sample of actual bat activity within the wider catchment – especially in the vicinity of turbines adjacent to mature forest below the ridgelines. Automatic detection boxes being utilised currently may have been set too late in the season to detect bat activity.

153. Although no bats have been recorded to date, Turitea Reserve should be considered to have far higher potential as bat habitat than open pasture.

Lighting

154. CAA requires illumination of turbines (no details have been supplied of how many) and it is proposed to shield lights from the ground for visual amenity purposes. This should also prevent morepork and insects being attracted to the lights in clear weather but there is likely to be a loom created in cloudy

[22] Brian Lloyd, ex-DOC bat specialist, pers comm.; Motorimu bat monitoring results (unpublished, Allco Ltd)

[23] Horn et al.2008 Journal of Wildlife Management 72:1

conditions. There is no discussion of potential issues relating to light in the AEE. Although I am of the opinion that on pastoral areas light poses no adverse effect, positioning illumination within a forest environment may introduce a higher risk factor.

Summary

155. Having considered the adverse effects, increased risks, insufficient mitigation and lack of adequate information on which to base a turbine layout design, I am opposed to any development (road widening, new roads, turbine laydown pads and pylons) with native vegetation in Turitea Reserve, or turbines in close proximity to likely kereru, and tui habitat. These are summarised in the following table (refer also Figure 8).

(i) Turbines in pasture (**bold** if roads or envelopes encroach into watercourses: sedimentation issues)	47, 48, 52, 54, 55, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, **78, 82, 83**, 84, 85, 86, 87, 88, 89, 90, 91, 92, 94, **95**, 96, 97, 98 (encroaching into bush), 99, 100, 101, 102, **103**, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, **115**, 116, **117**, 118, **119,** 120, 121, 1**22, 123,** 124, 125, 127, 128, 129, 130, 131, 132, **133**
Opposed	Blade sweep may be within 80m of mature podocarp/tawa forest putting tui, bellbird, falcon and kereru at risk: **67, 69, 70, 71, 73, 76, 77, 98, 133** In likely bird corridor: **97, 108, 109**
(ii) Turbines in clear-felled plantation areas	01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 38
Opposed	Blade sweep may be within 80m of mature podocarp/tawa forest putting

	tui, bellbird and kereru at risk: **13**, **14** In likely bird corridor: **08, 09**
(iii) Turbines within native vegetation (**bold** if requiring new roading or extensive changes to existing road)	11, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, **29, 30, 31**, **32, 33**, 34, 35, 36, 37, **39, 40, 41, 42, 43**, **44**, **45, 46**, 56, 57**, 58, 59, 60, 61, 62, 63, 64, 65, 66**
Opposed	ALL