EVIDENCE IN CHIEF OF RICHARD SEATON – INDEX

BOARD OF INQUIRY

HAUAURU MA RAKI WIND FARM PROPOSAL

In the matter	of the Resource Management Act 1991
And	
In the matter	of resource consent applications by Contact Wind Limited in respect of the Hauāuru mā Raki Wind Farm Proposal
And	
In the matter	of notices of requirement and a resource consent application by Contact Energy Limited for transmission infrastructure related to the Hauāuru mā Raki Wind Farm Proposal

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BRIEF OF EVIDENCE IN CHIEF OF RICHARD SEATON

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1. INTRODUCTION

1.1 My name is **Richard Seaton**. I am an ornithologist currently employed by Golder Associates (NZ) Limited. I have been carrying out avian research as a student and professional ecologist for 10 years.

1.2 Since 2002, I have worked as a biodiversity ranger for the Department of Conservation (in Whakapapa, Pureora and Te Kuiti), as an ecologist for Wildland Consultants (in Auckland and the Bay of Plenty) and as an independent consultant ornithologist. Previous to these positions I worked as an ornithologist for the Mauritian Wildlife Foundation and the Peregrine Fund Madagascar.

1.3 I have a BSc Honours in Biology and Geology from the University of Manchester, an MSc in Ecology from Manchester Metropolitan University and a PhD in Zoology from Massey University. My PhD research (2003 – 2007) determined the ecological requirements of New Zealand falcon in plantation forests.

1.4 I have experience researching and working with a wide variety of bird species in the United Kingdom, Mauritius, Madagascar and New Zealand.

1.5 I am a member of the Ornithological Society of New Zealand, the British Trust for Ornithology, the New Zealand Ecological Society and Birds Australia. I have been the chairman of the Raptor Association of New Zealand since 2006 and on the board of trustees of Wingspan Birds Of Prey Trust since 2007.

1.6 I have been involved in assessing the effects of eleven wind farms on birds at sites throughout New Zealand including Te Uku, Waikato (for WEL Networks Ltd), Mt Cass, Cantebury (for Main Power Ltd), Mahinerangi Wind Farm, Otago (for TrustPower Ltd), Project Hayes, Otago (for Meridian Energy Ltd), Waitahora, Tararua District (for Contact Energy Ltd), Puketiro, Wellington (for RES Ltd), Kaiwera Downs, Southland (for Trustpower Ltd), Motorimu, Manawatu (for Allco Energy Ltd) and Te Apiti, Manawatu (for Meridian Energy Ltd). Among other work, I helped develop extensive baseline avifauna studies for the proposed Meridian Energy, Project Central Wind farm, and was involved in formulating appropriate consent conditions; at the consented Te Uku wind farm I developed a falcon monitoring plan to ensure that should the wind farm negatively impact falcons at this site,

these effects would be identified, and appropriate mitigation could be put in place.

1.7 I am the author of six peer reviewed publications on New Zealand falcon, and currently have three further papers submitted to international peer reviewed journals on this species.

1.8 I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2006. My evidence has been prepared in compliance with that Code in the same way as I would if giving evidence in the Environment Court. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Site Experience

1.9 I first visited the Hauāuru mā Raki (HMR) Wind Farm site on 19th August 2008. During this visit, Mr Gerry Kessels and I drove the length of the area proposed for the turbines, and walked to vantage points on the ridges and beach in order to gain a comprehensive overview of the entire site (Mr James produces detailed site plans with his evidence identifying the locations of proposed works). Mr Kessels has identified ecological areas of significance in the area in his **Exhibits GK3**, and in the maps he produces as **Exhibits GK 4 and 5**. I also visited the site again with Mr Kessels on the 19th and 20th of November 2008. On the 19th we walked to a view point on the ridge in the J-block to view key areas of the site. On the 20th I accompanied the avifauna survey team (see section 1.10) at the Limestone Downs property and undertook a morning of bush and farmland bird counts in D-block. During this day, Mr Kessels and I also visited Punga Punga Wetland to view the site and see where the proposed transmission line will pass over this wetland (refer Mr Kessels **Exhibit GK26**).

1.10 The avifauna team comprised a range of experienced ecologists that were co-ordinated by Gerry Kessels, the managing director of Kessels & Associates Ltd, and Ingrid Stirnemann, an experienced ecologist working for Kessels & Associates Ltd. I am confident that the experience of this team was appropriate to gather the required information and that the results they have provided in the associated reports can be relied upon.

1.11 My role in this project has been to take part in discussions on the prioritisation of monitoring and to provide input on the details of the methodologies being employed to assess avifauna at this site. I am familiar with the HMR wind farm site and the avifauna survey and effects assessment programme.

2. SCOPE OF EVIDENCE

2.1 In this statement of evidence, I will focus on describing the potential effects of the HMR wind farm on avifauna. For purposes of clarity the proposed Waikawau Wind Farm Zone, the Matira Wind Farm Zone and the transmission corridors and their environs are collectively referred to as the HMR study area (as defined in Kessels & Associates Ltd. 2008a). In particular I will:

(a) Provide an overview of my evidence;

(b) Summarise the monitoring carried out to date by Kessels & Associates Ltd and outlined in the evidence of Mr Kessels;

(c) Provide an overview of the potential issues relating to wind farms and birds;

(d) Outline the potential effects of wind farm construction at this site on:

- Bush birds,
- Wetland birds,
- Farmland birds,
- Non-migratory shorebirds, and
- Migratory shorebirds.

(e) Make recommendations for further monitoring; and

(f) Outline potential options to avoid, remedy or mitigate any effects of wind farm construction at the HMR site.

3. SUMMARY OF EVIDENCE

3.1 The majority of construction is proposed to occur within areas of modified pasture and little impact due to habitat loss is predicted in these areas.

Some clearance of indigenous vegetation is proposed and will result in the loss of habitat to bush birds. However, overall only 28.1 ha of indigenous vegetation is proposed to be cleared within an overall project area of several thousand hectares. Predator control combined with fencing to exclude stock from areas of bush could potentially result in net gains to native bush birds and so may be the most appropriate method of mitigating this effect.

3.2 Disturbance causing displacement of resident breeding birds may occur during construction but this seems unlikely during the usual operation of the wind farm. However, some displacement of the routes that migratory shorebirds take through the site may result; although in this instance, displacement of the migratory routes may be advantageous as it would reduce collision risk.

3.3 The key bush birds identified as at risk of suffering collision mortality are New Zealand wood pigeon (kereru) and tui. Kereru are a threatened species and like many native birds, including tui, are particularly vulnerable to predation from introduced mammals. Predator control alongside appropriate collision mortality modelling is proposed to ensure any negative effects of wind farm construction on kereru and tui are identified and suitably mitigated.

3.4 The proposed route for the transmission line crosses Punga Punga Wetland and during construction of this there may be some disturbance to breeding birds. Australasian Bittern (bittern), which are a threatened species, are present within the wetland and there is a risk that bittern could collide with the overhead lines. With the installation of suitable bird deflectors on the lines, collision risk will be reduced. The restrictions on construction activity proposed in consent conditions during the breeding season will ensure disturbance to breeding is avoided.

3.5 Several threatened shorebird species, including Northern New Zealand dotterel (NZ dotterel) and black shag, are resident in the vicinity of the HMR site (Appendix 1 of my evidence). Black shags are at greatest risk of suffering turbine strike due to the heights at which they have been recorded flying inland. NZ dotterel are at a lesser risk as they are potentially more restricted to the tidal zone, below where the turbines are proposed. Significant effects on resident shorebirds are not, however, predicted.

3.6 Several species of migratory shorebird have the potential to pass through the proposed wind farm on migration. There is, therefore, a risk that these migratory birds will suffer collision mortality with turbine blades. South Island pied oystercatcher (SIPO) and wrybill are the main species of concern but Caspian tern, white fronted tern and banded dotterel are also potentially at risk from collision with turbine blades. Although to date no large numbers of long distance migrants have been recorded off the west coast of the North Island (Kessels & Associates Ltd. 2008a), the migratory pathways that Eastern bar-tailed godwit (godwits), lesser knot and turnstones take within New Zealand remains largely unknown (Williams et al. 2006) and an unknown proportion of all of these species could potentially pass through the region when moving within New Zealand.

3.7 The applicant is in the process of establishing the numbers and routes that migrant shorebirds take through this region so as to provide a more rigorous basis for risk assessment. These investigations are ongoing and it would be premature to form definite conclusions on the degree of the potential effect that wind farm construction at this site may have.

3.8 The results summarised above and the potential effects of wind farm construction on avifauna in the different habitats at the proposed HMR site are discussed in more detail below.

4. INVESTIGATIONS OF AVIFAUNA IN THE HMR STUDY AREA

4.1 Ecologists from Kessels & Associates Ltd undertook avifauna surveys of the HMR study area. These were undertaken at two levels, increasing in detail as species of concern were identified. I have relied on the surveys and investigations carried out by Kessels & Associates Ltd, and discussed in the evidence of Mr Kessels, to provide me with the information required to assess the site. Below is a summary of the surveys carried out by Kessels & Associates Ltd, these surveys are discussed in more detail further on in this evidence.

Stage One Investigations

(a) A desktop search of all available reports and publications for species recorded in the proposed HMR study area in the wider Waikato Coastal region between Waikato Heads and Raglan.

(b) Five-minute bird counts and line transect counts for non-coastal bird species;

(c) Call-back surveys for wetland birds; and

(d) Line transect surveys for shorebirds.

Stage Two Investigations

(e) Further point count and line transect bird counts, including specific surveys for kereru, tui and morepork;

(f) Call-back surveys for bittern;

(g) Monitoring of resident shorebirds;

(h) Monitoring of shorebirds migrating south; and

(i) Monitoring of shorebirds migrating north.

4.2 In my opinion, the combination of stage one and stage two surveys has enabled the identification of the full suite of avian species usually present within the HMR study area (Appendix 1). There are no bird species absent from the avifauna surveys that I would expect to be normally present at the HMR site.

5. OVERVIEW OF POTENTIAL EFFECTS OF WIND FARMS ON BIRDS

5.1 The risks of wind farm construction to birds can be summarised as:

(a) Habitat loss;

(b) Displacement; and

(c) Collision risk (Powlesland 2009).

5.2 The significance of these effects to each species depends on its biology, distribution and threat status. Generally, those species that are introduced, or common and widespread throughout New Zealand, are of low concern, but each case must be considered carefully before that judgement is made. Effects that result in negative impacts to species that are listed as threatened by the Department of Conservation (Hitchmough et al. 2007) are given a greater weighting as any effects will be potentially more significant to populations of these species.

Habitat Loss

5.3 Clearance or modification of habitat can result in a reduction in area suitable for a species to live in. Where there is the need to clear or modify land in order to construct wind turbines, access roads and associated infrastructure there may be a change in the abundance of certain bird species due to the loss of suitable habitat. The degree to which this is the case depends on the requirements of the species of bird in question and the extent of the habitat clearance or modification.

Displacement

5.4 Displacement may occur if individuals or populations of birds are disturbed from their usual activities by the construction or operation of a wind farm. If birds are displaced from breeding or foraging sites this will result in lower densities of this species occurring in the local area but may not necessarily affect the wider regional population. Of those species that are not displaced, breeding success is rarely affected by wind farm operation (e.g., Meek et al. 1993, Percival 1998, Guyone & Clave 2000). Construction activity may cause more disturbance than the operation of a wind farm, but the time it takes to construct a wind farm is limited and as a result these effects will only be temporary.

5.5 Several groups of birds, including seaducks, waterfowl and gulls have been recorded overseas to alter flight paths around wind farms rather than fly through them. The turbine layout, location and relief of the wind farm can affect how much of a barrier a wind farm presents to bird movement and different bird species will behave differently to this barrier (Powlesland 2009). Turbines spaced at more than 200 m are thought to present less of a barrier to bird movement between individual turbines (Percival 2001). However, it has also been suggested that turbine layouts that have large corridors between tightly spaced clusters may encourage birds to fly through the wind farm between the clusters, rather than between the turbines where they are more at risk from collision (Langston & Pullan 2003). Further literature suggests that a linear formation, parallel to the direction of migration, or a loose cluster of turbines, is the best solution to avoid displacement of migrating birds (Winkelman 1992, cited in Powlesland 2009). Overall, there is no one clear solution to the potential barrier effect of a wind farm to birds and each site and the suite of species present needs to be considered on a case by case basis.

5.6 The significance of any displacement effects vary dependant on the location of a site and the species being effected, as such it is important that any potential effects are considered in the context of the species and the site.

Collision Mortality

5.7 Collision mortality can occur when a bird flies into turbine towers, blades, overhead lines or associated infrastructure. Collision with turning turbine blades is likely to pose the greatest potential for collision mortality. Establishing the usual heights a species will fly at within the area of a proposed wind farm, and the proportion of time they spend within the proposed Rotor Swept Area (RSA – the area through which the turbine blades move), allows an initial assessment of which species present, or that are likely to pass through the site, are at risk of suffering collision.

5.8 Once it is established that a species spends at least some of its time flying within the RSA, the key factor in establishing collision risk is whether a bird will develop avoidance behaviour. There is limited information available on the avoidance behaviour of New Zealand's birds and further research at operational wind farms is required (Powelsland 2009). However, a 95% avoidance rate has been proposed on a precautionary basis for use when modelling the potential occurrence of collisions at proposed wind farms in New Zealand in lieu of any more detailed information (Powlesland 2009).

6. POTENTIAL EFFECTS OF HMR ON <u>BUSH BIRDS</u>

Investigation Method

6.1 Initially, five-minute bird counts were carried out at 46 of the proposed turbine sites, 15 of these bird count stations were in areas of native bush or scrub, and 31 in pasture (Kessels & Associates Ltd 2008a). Mr Kessels has provided summary details of the methodology employed and locations in his **Exhibit GK13**. At least one five-minute bird count was carried out at each of the 46 stations. These counts were carried out between July 2007 and March 2008 and included records of behaviour and estimates of flight height. Three line transects were also carried out within indigenous forest, one in Block C and two in Block H. A desktop literature search for species recorded within the proposed HMR study area and along the coastal strip between Waikato heads and Raglan and approximately 10-20km inland

(hereafter referred to as the Waikato coastal region) was also carried out of to provide a more long term data set on the species revealed in this area.

6.2 A further 255 fifteen-minute bird counts were carried out in November 2008 in order to provide additional data on bird species within the HMR site, but specifically were targeted on increasing the information on tui and kereru. Fifty-one count stations were established at proposed turbine locations and at randomly selected sites throughout the study area (Kessels & Associates 2008b). Again further details are supplied in Mr Kessels' **Exhibit GK13**. Eighteen of the bird count stations were located in areas of bush or scrub. Bird counts were repeated five or six times at each station. Twenty-one additional line transect counts, at seven stations, were also carried out for tui and kereru in key forest and scrub sites near proposed turbines or along proposed access routes. Specific surveys for morepork were carried out along five transect lines on two nights in November 2008 (Kessels & Associates 2008c).

Suitability of method

6.3 In my opinion the methods used for assessing the types and abundances of bird species present in the bush blocks at the HMR site were appropriate and allowed the identification of all the species usually present at this site.

Results

6.4 Desktop studies (Kessels & Associates Ltd. 2008a) combined with onsite surveys showed areas of bush are dominated by common species of birds. Some species of bird are recorded in desktop studies but not during field surveys. For example, tomitit, although being recorded as present in the Waikato coastal region (Appendix 1) were not recorded as present within native bush at the HMR site during onsite studies (Kessels & Associates Ltd. 2008a) and it seems likely that these are absent from the site. The desktop assessment also noted that threatened bush bird species in the Waikato coastal region include long-tailed cuckoo, kaka and kereru (Appendix 1). Although Ornithological Society of New Zealand (OSNZ) records indicate long tailed cuckoo is a migrant through the HMR study area it is not a resident species and was not recorded during any bird counts at the site. Kaka were also not observed onsite and due to limited areas of suitable habitat are unlikely to be anything but occasional vagrants in the study area. Kereru were the only threatened species that were regularly recorded in the study area during regular field surveys.

6.5 OSNZ (Robertson et al. 2007) record New Zealand bush falcons (falcon) being sighted at Kaawa beach. New Zealand falcons are classified as nationally vulnerable (Hitchmough 2007) and the threat of wind farm construction to this species has, as yet, not been fully assessed at any operational wind farm in New Zealand. However, there is potential for falcons to collide with turbine blades and displacement from breeding grounds could potentially occur during construction activity. Although no falcons have been recorded in the study area during onsite surveys they are a relatively cryptic species that are easily overlooked during standard bird counts.

6.6 In my opinion there is no doubt that falcon will be occasional vagrants to the study area, but whether this species breeds in close proximity to the study area cannot as yet be confidently determined. Further investigations into the suitability of the study area for falcon breeding are recommended. If suitable nesting habitat is located a stepped monitoring and mitigation program is recommended (as set out in paragraph 11.6 of this evidence).

6.7 Kereru were the only threatened bush bird species that were regularly recorded in the study area. Kereru are classified under the threat class "Gradual Decline" (Hitchmough et al. 2007), therefore further investigations into the risks posed by wind farm construction and operation were deemed necessary. A Section 92 review undertaken for the relevant District and Regional Councils requested that further risk assessments were also carried out for tui and morepork. The results of these investigations discussed in Mr Kessels' evidence showed that kereru and tui do spend some time flying at a height which would place them at risk from turbine collision should they not be able to avoid the turning turbine blades (Kessels & Associates Ltd. 2008b). Assessing the risk of turbine and line strike to morepork proved problematic as the heights at which they usually fly could not be assessed (Kessels & Associates Ltd. 2008c). However, morepork are a common species and surveys indicated that they are present throughout the site. As a result any potential effects are not expected to be significant to the wider population and any local effects will be mitigated if suitable predator control and habitat enhancement is employed.

6.8 Low recruitment of young into the breeding population due to predation is the largest factor threatening Kereru populations. Introduced mammals impact Kereru populations on two levels:

(a) Direct predation of eggs, young and adults,

(b) Depletion of food resources causing lower breeding success.

6.9 Rats and possum may be the largest cause of food depletion (Clout et al. 1991) but are also likely to predate young squabs and eggs, while cats and stoats have been recorded as predators of adult Kereru (Mander et al. 1998). The habitat loss due to vegetation clearance will reduce the amount of food available to Kereru and so potentially reduce breeding success.

6.10 Kereru are known to be highly prone to collision with buildings and windows (Mander et al. 1998). It therefore seems likely that if they fly at the rotor swept height through the wind farm that some birds will suffer some turbine strike. The proportion of birds that may collide with turbines is difficult to determine but a 95 % avoidance rate is commonly cited as a precautionary value for estimating the avoidance rates of bird species in general. Display behaviour will also potentially put Kereru into rotor swept area putting them at further risk of collision mortality.

6.11 Consent is being requested for turbines with a maximum hub height of 100 m, and a blade length of up to 50 m (full details of the turbine designs proposed are outlined in the evidence of Mr James). To account for the different rotor swept areas (RSA) under the different turbine heights and blade lengths that could be constructed within the consents sought, two scenarios were used to describe risk:

(a) where the RSA was defined as 35 to 125 m; and

(b) where the RSA was defined as 50 to 150 m.

6.12 Kereru were observed flying within the RSA in 26% of observations in the first scenario and 23% of observations in the second scenario. Tui were observed flying within the RSA in 30% of observations in the first scenario and 14% in the second scenario. Both species were observed in breeding display flight up to 50 m over ground within the study area i.e. within the proposed RSA's under both scenarios. The ability of kereru and tui to avoid turbines is currently unknown but in my opinion it is likely that many of the birds flying within the proposed RSA will actively avoid the turbines. Nevertheless, these results do indicate that these species could potentially collide with turbine blades. Should any effects be realised suitable ongoing predator control within local areas of bush is the most appropriate method

of mitigating any losses of birds due to turbine strike (as birds will currently be killed by introduced mammalian predators such as cats etc.).

6.13 Kessels and Associates note in their reports on kereru, tui and morepork that these species may also be at risk from colliding with overhead power lines (Kessels & Associates Ltd. 2008b; Kessels & Associates Ltd. 2008c). I agree that there is potential for line strike to occur over areas of native bush and concur with their recommendation to place bird deflectors on transmission lines where they cross areas of native bush. Suitable consent conditions have been formulated to address this.

6.14 Areas of bush are proposed for clearance for turbines, transmission lines, roading and associated infrastructures in blocks A, C and H (details of these are outlined in Table 23 of the AEE report) (Kessels & Associates Ltd, 2008a). This clearance will result in some habitat loss to bush species. In the case of kereru, one of the largest threats after predation by introduced mammals is depletion of food resources which can cause lower breeding success (Manly et al.1998). This is the case for many of New Zealand's bush birds. Thus if a suitable predator control and habitat enhancement programme is established within local areas of bush, it will be possible to mitigate any effects on bush birds and a net gain could potentially result.

6.15 Although some displacement as a result of disturbance may occur this effect seems unlikely to be significant. Several overseas studies support this illustrating that breeding success of many species nesting near wind farms are rarely affected by the operation of a wind farm (e.g., Meek et al.1993; Percival 1998; Guyone & Clave 2000). Disturbance is much more likely to occur during construction but this effect will only be temporary and therefore this effect will be minor.

Conclusion

6.16 In conclusion most bird species recorded within the bush are either regionally abundant species or are largely restricted to areas of native bush (Appendix 1). Displacement effects are unlikely to be more than minor but some species may be at risk from turbine strike. Kereru and tui have been recorded flying within the proposed RSA and collision mortality is a risk to these species. The ability of kereru and tui to avoid turbine blades is difficult to establish due to the lack of suitable collision mortality monitoring at established wind farms in New Zealand.

6.17 As a result I recommend suitable collision mortality monitoring in order that any effects can be identified and be suitably remedied or mitigated. Suitable predator control and habitat enhancement programmes within local areas of bush are in my opinion the most suitable option for mitigation of any effects. It is likely that any mitigation plan put in place for tui and kereru will also be of benefit to native species in general.

6.18 Further surveys for falcon nesting habitat are required to confirm no breeding falcon are present. A stepped monitoring and mitigation approach is recommended and has been proposed by the applicant for use should nesting habitat be identified.

7. POTENTIAL EFFECTS OF HMR ON WETLAND BIRDS

Investigation Method

7.1 Call back surveys were carried out in July and November 2007 for North island fernbird, spotless crake and marsh crake during investigations for the initial AEE within wetlands in blocks C, D and H (Kessels & Associates Ltd. 2008a). Because of the likelihood of bittern occurring in Punga Punga wetland, and its threatened status (endangered) (Hitchmough 2009), further passive listening surveys for wetland birds were carried out in Punga Punga Wetland at dawn and dusk for two periods of three days in October and November 2008 (Kessels & Associates Ltd. 2008d). The methodology employed is set out in section 3 of Mr Kessels' **Exhibit GK13**. I note that the method used in these surveys followed the methodology described in the Department of Conservation monitoring plan for bittern developed for Whangamarino wetland (Pierce 2004).

Results

7.2 Wetland birds recorded at the project site were generally restricted to locally and nationally abundant species (Appendix 1). However, some threatened species were recorded in Punga Punga Wetland (Kessels & Associates Ltd. 2008d). Additionally spotless crake may be present in some coastal wetland sites in and around the study area (Kessels & Associates Ltd. 2008a), although these locations have not been exactly defined.

7.3 Punga Punga Wetland is a site that has been listed as a key ecological site (Site No. R13/10/F) in the Waikato (Wildlands 1999). Although part of the current transmission line already crosses the wetland it is proposed to

reroute this over another part of the wetland if the wind farm is consented Ms Yorke produces with her evidence a map showing both the existing line and the proposed deviated route in relation to the wetland. No construction is proposed for within the wetland, thus there will be no wetland habitat lost due to the construction of the new transmission line.

7.4 North Island fernbird, Australasian bittern and spotless crake are threatened species (Appendix 1) and were recorded in Punga Punga Wetland (Kessels & Associates Ltd. 2008d).

7.5 Results of the surveys indicated that approximately seven pairs of bittern are breeding in Punga Punga Wetland. Although bittern are found throughout Australasia, in New Zealand they are classified as endangered by the Department of Conservation (Hitchmough 2007). There is a risk that bittern could collide with the proposed transmission lines and mortality is likely should this occur. The current transmission line already poses this threat but there is an opportunity to reduce this risk with the proposed rerouting of the transmission line for the wind farm if suitable bird deflectors are installed.

7.6 Collision with transmission lines is a common cause of mortality of birds the world over. Collisions are thought to occur largely as a result of birds not being able to see the lines. It is therefore possible to reduce collisions by installing bird deflector devices making the lines more visible. Flagging the section of lines passing over the wetland with bird deflectors will make the transmission line more obvious to bittern whether moving locally or further afield between Punga Punga Wetland and other suitable wetland sites. This will also reduce incidences of bird strike on other species of birds present in the local area. However, bittern are known to fly long distances at night (Teal 1989) therefore flagging may not entirely remove the threat and additional mitigation, for example support of a habitat enhancement program, may be appropriate. The applicant proposes such an avoidance and remediation programme in the proposed consent conditions.

7.7 Fernbird are largely restricted to foraging in low scrub and because their flight behaviour is described as weak (Heather & Robertson 1996) in my opinion they are highly unlikely to be at risk from colliding with transmission lines. Spotless crake are similarly restricted to foraging close to the ground well below any transmission lines. However, they will move some distance at night (Heather & Robertson 1996) which could potentially put them at risk

from collision if they fly at a height which could potentially put them at risk from colliding with overhead lines. However, in my opinion this seems unlikely to occur.

7.8 Construction activity noise is also likely to negatively impact breeding activity within the wetland if carried out during the bittern breeding season (September to January). As a result the applicant proposes to restrict construction activity during that period in order to avoid this impact.

Conclusion

7.9 In conclusion, the effects of construction and operation of the wind farm on wetland birds over most of the site are minimal. Rerouting of the transmission line over Punga Punga Wetland poses a collision risk to bittern and spotless crake. The current transmission line already poses this risk and appropriate flagging of the transmission line with bird deterrents will reduce this risk. Disturbance effects to breeding birds will be avoided by limiting construction activity within the breeding season. A mitigation plan that focuses on the enhancement of wetland habitat suitable for bittern is recommended.

8. POTENTIAL EFFECTS OF HMR ON FARMLAND BIRDS

Investigation Methods

8.1 Five-minute bird counts were carried out at 46 turbine locations 31 of which were in areas of pasture. These counts were carried out between July 2007 and March 2008 and included records of behaviour and estimates of flight height.

8.2 Further fifteen-minute bird counts were carried out in November 2008 in order to provide additional data on tui and kereru. General farmland species of interest were also recorded in these counts. Thirty-three stations were established at proposed turbine locations within pasture. Birds counts were repeated 5 to 6 times at each station.

Results

8.3 Farmland bird species were mostly comprised of common species that are widespread locally and nationally (Appendix 1). The New Zealand pipit is the only native species present in farmland that is listed under any threat category and is classified as being in gradual decline (Hitchmough 2007).

Similar species in the same genera overseas have been recorded as suffering collision mortality with turbines (Kingsley & Whittam 2005). New Zealand pipit may spend some time flying at a height which would place them at risk of turbine collision. The proportion of the time New Zealand pipit may spend within the proposed RSA is currently unknown. However, although it is currently not possible to make a definitive conclusion regarding the effect of wind farm construction on New Zealand pipit due to a lack of detailed information on flight heights, in my experience they are a species that spend much of their time on the ground and well below the height of the proposed turbine blades. As a result it seems unlikely that the New Zealand pipit will be at a high risk of suffering collision mortality with turbine blades. Disturbance due to wind farm operation seems unlikely however as no effect on the breeding success or distribution of similar species overseas has been recorded (Thomas 1999, cited in Percival 2005) in my opinion it seems likely that any effects on these species will be minor.

8.4 The decline in the New Zealand pipit has been linked to several factors including interspecific competition with skylark, the sealing of roads, increased traffic densities and road speeds, the spread and increase in density of magpies, increased spraying of roadside verges, avian diseases, accidental poisoning, reduction in breeding habitats, predation and a reduction in over-wintering habitats (Beauchamp 1995).

8.5 Should any effects be realised through ongoing collision monitoring at the site, these effects will be remedied through the targeted pest control program proposed for other species.

8.6 Other species of interest include game species such as pheasant, California quail, mallard duck, grey duck and paradise shelduck. Paradise shelduck, grey duck and mallard duck are the only game species present that will regularly fly at a height which would put them at potential risk from collision with turbine blades. However, these species are common in the region and abundant on site (Kessels & Associates Ltd. 2008a). In my opinion any effects of turbine collision are unlikely to affect population numbers locally or across the wind farm. Additionally, all these game species will undergo an annual hunting period and the effects of this will far outweigh any effects of the proposed wind farm.

Conclusion

8.7 In conclusion, the New Zealand pipit is the only farmland species present that is classified a threatened species. Although a definitive statement on the numbers that may be at risk from suffering collision mortality is not possible, the extent of any effect is expected to be low. Any other effects on farmland birds are deemed minor due to the abundance and low priority of these species.

9. POTENTIAL EFFECTS OF HMR ON RESIDENT SHOREBIRDS

Method

9.1 Line transect surveys were carried out for resident shorebirds at Huriwai River Beach, Kaawa Stream Beach, Waikorea/Waimai Beach, Gibson Beach and Carter's Beach (Kessels & Associates Ltd. 2008a). These surveys were carried out on a total of 17 days between September 2007 and March 2008. Additional, information has been collected on resident shorebirds during intensive beach watches for migratory shorebirds carried out from July 7th - 25th, August 4th - 23rd 2008 and from January 6th - 5th February 2009. Mr Kessels has produced his report of the monitoring undertaken in 2008 as his **Exhibit GK1A** and he has reported on the preliminary observations from the January 2009 monitoring in his evidence.

Results

9.2 Twenty-three species of coastal and wader birds have been identified as present locally (Kessels & Associates Ltd. 2008a). The most commonly observed resident shorebirds were black-backed gull, black shag and variable oystercatcher (Kessels & Associates Ltd. 2008e). Most of the shorebird species resident on the beaches below the site are both common and widespread throughout New Zealand and as such any effects of the HMR wind farm are unlikely to effect the wider regional and national populations of these species. However, several resident shorebird species that were observed at the site are threatened species (Appendix 1) and any potential effects to these species would be of greater significance. These species include NZ dotterel, black shag and little black shag (Appendix 1).

9.3 NZ dotterel are classified as nationally vulnerable (Hitchmough 2007). One pair of this species was confirmed as resident in the area of Kaawa beach

(Kaawa Beach is located on Mr Kessels' **Exhibit GK6**) and this pair is also thought to use the beach north of Opura. A second pair has also been recorded breeding at Waikorea beach (Again this is located on **Exhibit GK6**) by local OSNZ (Kessels & Associates Ltd. 2008a). In a report produced by the Department of Conservation in which the most important breeding sites for NZ dotterel were listed, none of the locations highlighted included any of the beaches below the proposed HMR wind farm (Dowding and Moore 2006). The results of surveys by Kessels & Associates Ltd (Kessels & Associates Ltd. 2008e) corroborate this with the overall the numbers of NZ dotterel being located being relatively small.

9.4 To date, no NZ dotterel have been recorded within the area where the turbines are proposed and it seems likely that resident birds spend the greatest proportion of their time, if not all of their time, on the beaches below the site. Local movements between suitable feeding sites do not require them to cross the study area. Dispersal overland has been recorded, for example, between sites in North Auckland and the Kaipara Harbour (Dowding 2001). However, so far as I am aware there is no indication that NZ dotterel move between the Firth of Thames and the Waikato coastline; a route that would potentially take them through the path of the wind farm. Therefore, although there is a risk that some birds could theoretically pass through the area where turbines are proposed, due to the low numbers of birds involved, it is unlikely that any effects would have a significant impact on the population.

9.5 Black shag and little black shag have both been observed flying over pasture along ridgelines (Kessels and Associates 2008e) and so may be at risk from collision mortality. Due to a lack of observations of little black shag it is very difficult to ascertain the heights at which they fly, however this does suggest that they spend very little time over the study area and any effects on this species will be minor. Only black shags have been observed flying over the wind farm envelope in any great number, with 38% of flights crossing over pasture and 26% crossing ridgelines (Kessels and Associates 2008e). Those black shags observed crossing pasture crossed at more than 35 m above the ground, which places them within the proposed RSA. As a result they are likely to be at a relatively greater risk of collision mortality than other resident shorebirds should they not be able to avoid turbines. Although this impact will possibly have a significant impact on the local population they are widely distributed throughout New Zealand

(Robertson et al.2007), and indeed Australasia (Heather & Robertson 1996), with an estimated 5 – 10,000 pairs estimated nationwide. This, combined with their low threat status, (sparse) (Hitchmough et al. 2007) and the possibility that they will avoid turbines once the wind farm is constructed, in my opinion makes it unlikely that there will be any significant effects resulting from wind farm construction on this species.

9.6 No construction is proposed for the beaches below the site where resident shorebirds reside. As such there will be no effects of habitat loss to these species. Additionally any disturbance or displacement to these birds seems unlikely due to the distance away that construction activity will occur. Further, research overseas largely suggests that operational wind farms are generally not causing any disturbance effects (Percival 2000, 2005) and a recent DoC review on the effects of wind farms (Powelsland 2009) indicates that "there is an increasing body of evidence that wind farms generally do not affect bird distribution".

Conclusion

9.7 In conclusion, most shorebird species present at the site are relatively common and spend most of their time on the beaches below the area where the turbines are proposed. NZ dotterel and black shag are the only threatened species of shorebird identified as potentially at risk. Data collected so far on NZ dotterel indicate that they are largely restricted to the tidal zone below the turbines, placing them at relatively low risk. However, this may not be the case when they disperse away from the site if their flight patterns change and place them at greater risk. Currently the data is not available to definitively state that there is no risk, but indications are that the overall risk is low and that any negative effects would not be significant to the wider population. Black shags are at risk from suffering collision mortality due to the heights and frequency they traverse inland, but again those effects are not predicted to be significant to the regional abundances of this species.

10. POTENTIAL EFFECTS OF HMR ON MIGRATORY BIRDS

Investigation Method

10.1 One period of observations on shorebirds migrating south through the region was carried out in the northern section of the site (described in detail

in Mr Kessels' **Exhibit GK1A**) between the 7th and 25th July and between the 4th and 23rd August (Kessels and Associates Ltd.2008e). A further, more intensive study, using a combination of observers and two radar units positioned at either end of the study area to track movements of shorebirds migrating north, was carried out from the 6th of January to the 5th of February. The methodology employed for this monitoring study is set out in Mr Kessels' **Exhibits 1B and 2**. Proposed consent conditions include provision to continue this monitoring (using radar) for at least another eighteen months (two more periods of south migrations in July/August and one more north in January).

Results

10.2 Migratory shorebirds that have been observed at or passing through the site are: SIPO, wrybill, banded dotterel, Caspian tern, white-fronted tern and godwit and pied stilt (Appendix 1). Further, some black stilt, although not recorded in any surveys, are likely to move along the Waikato coastline on their migration between Kaipara harbour and the South Island.

10.3 Numerically SIPO make up the greatest number of migrating birds in New Zealand, with an estimated population size of 112,000 (Sagar et al. 1999). Many of these breed in the South Island and overwinter in the North Island. As a result large numbers migrate between the North and South Islands in summer and winter and there is a potential for many of these to pass through or nearby the proposed HMR site. Overseas literature indicates that wind farms located on the migratory routes of a large number of birds can have a significant impact on these species (Powlesland 2009).

10.4 Wrybill and banded dotterel are threatened species (Appendix 1) that also migrate between breeding grounds in the south to wintering grounds in the north. Some banded dotterel migrate over to Australia in the winter but the migratory routes taken by both species during migrations within New Zealand are unknown. As a result further investigations into the movements of both species were deemed necessary to fully assess the risk posed of wind farm construction at this site. However, current methods employed to establish the movements of these birds, including radar, are unable to track the movements of such small birds. Radio tracking these species is possibly the only way to establish the movements of these species through the study area, although modelling a range of potential

scenarios of collision risk will also provide some insight into the potential effects on the populations of these species.

10.5 Caspian tern and white-fronted tern have both been observed flying over pasture along ridgelines during onsite surveys (Kessels and Associates 2008e) and so may be at risk from collision mortality with the proposed turbines. Due to a lack of observations of white fronted tern it has not been possible to assess the risk to this species. However, this does indicate that they spend relatively little time over the study area and any effects on this species are expected to be minor. Although the majority of Caspian tern observations (90%) were on the beach, a small number of sightings were over pasture and so Caspian tern may be at risk from suffering collision mortality, particularly with turbines that are sited in close proximity to the coast.

10.6 Long distance international migrants such as godwits, turnstones and lesser knots have not been recorded in large numbers along the western coastline (Kessels & Associates Ltd. 2008a). However, the movements of these migrants within New Zealand are still "the largest gap in the present understanding of wader ecology in New Zealand" (Williams et al. 2006). There is the potential for large numbers of all of these species to pass through the region and Mr Kessels has noted in his evidence that some godwits have already been recorded by the team monitoring the Northern migration of SIPO, mostly offshore but in one case over the southern radar site. Practically, it is very difficult to monitor the migration patterns of these species, and there are limitations to all of the techniques available. The period that the current monitoring of SIPO covers using radar does not cover the period when most arctic migrants are beginning to arrive in New Zealand in September or leaving in March or April. One option might be to extend the monitoring periods to cover these times but modelling risk using a range of hypothetical situations including a worst case scenario may be the most informative option available. Until this data is gathered, or a range of modelled scenarios is developed, it is very difficult to definitively establish the risk posed to these species.

10.7 Migrant shorebirds are largely thought to move along either coast of New Zealand. Where they do cross land they will often select to do so along river valleys and other linear features. Waders overseas have been recorded in some instances to suffer collision strike, but other studies have noted that birds approaching wind turbines generally pass over or through

the turbines, avoiding collision (Sterner et al. 2007). It has been proposed that clusters of turbines separated by wide corridors provide less of a barrier to the movements of birds (Langston & Pullan 2003). The layout of the proposed HMR wind farm broadly fits this template and it seems plausible that migrating birds may select to move along these corridors. Kaawa Valley and Waikorea Valley may provide two such routes through the wind farm, although the route taken by birds once they have entered these valleys may not be entirely clear of turbines and therefore strike risk. However, further monitoring using radar is required to establish whether this occurs and the proportion of birds that may take these routes, opposed to over the ridges.

10.8 I note that Powlesland (2009) states that "even relatively small increases in mortality rates may have a significant impact on some populations of birds, such as threatened species, or long-lived species with low annual productivity and slow maturity (Langston & Pullan 2003), such as many New Zealand waders." Considering this, in my opinion it is important that the proportions of migratory birds passing over and through the areas where the turbines are proposed are established with greater certainty, in order that the numbers at risk can be defined, and the overall effect on populations of each species at risk can be modelled. Results of the surveys carried out in January using radar, and the proposed ongoing monitoring will provide the data required.

10.9 As discussed in Mr Kessels' evidence, initial indications from the results of the radar study are that bad weather conditions, particularly strong offshore winds, cause more birds to come inland. Further analysis of the data is required but this does suggest that during periods of inclement weather that the turbines along the coastline may pose a greater threat to migratory, and resident, shorebirds.

10.10 Initial results reported by Mr Kessels in his evidence of the investigations of shorebirds migrating north using radar are varied and indicate that although the majority of migratory birds migrate along the tidal zone and off shore, a proportion of flocks pass over and through the proposed site. Some SIPO have also been noted as passing through the site down the valleys below where the turbines are proposed, but at the time of writing this evidence further analysis of the data is required before these proportions can be defined.

10.11 Several shorebird species migrate at night. Bright white lights on the top of turbines are thought in some cases to attract birds and cause a trapping effect which increases the chances of collision, particularly on cloudy or foggy nights. These are not proposed in this case.

10.12 Pied stilt are a common species in the region and throughout most of its range in New Zealand. As such, any effects resulting from collision mortality are unlikely to be significant. To my knowledge, black stilt have not been recorded at, or passing through the site. However, a small proportion of birds do migrate up the west coast from the South Island to the Kaipara harbour every year (Heather & Robertson 1996) and these birds must at some point pass up the coast past the study area. Black stilt are classified as critically endangered (Hitchmough et al. 2007). Thus even small effects to this threatened population would be significant. It is not known whether these species migrate along the shoreline or pass inland, and if the latter, how far inland they pass. It seems more likely that they will move along the shoreline below the proposed turbines, but whether there is a risk to these birds, particularly of those turbines sited along the coast needs further investigation. Radio tracking studies of the birds using Kaipara harbour to overwinter may provide some further indication of their movements through this area and the risk posed of wind farm construction at this site.

Conclusion

10.13 In conclusion, further descriptions of migratory shorebird movements are required before the risk to these species can be fully established. Investigations using radar have already been started and ongoing monitoring is proposed in order to address this. The information gathered so far does indicate that while the majority of observed birds fly offshore, some species of migratory shorebird do pass over the study area at a height that places them at risk of turbine collision.

11. RECOMMENDED MONITORING

11.1 The stage one avifauna investigations carried out by Kessels & Associates Ltd. (Kessels & Associates Ltd. a – e) have identified all of the bird species likely to be normally found using the study area. From this list it has been possible to identify those species that are potentially most at risk from wind farm construction and operation, and Kessels & Associates Ltd have

concentrated their investigations on these species. Some further investigations are still required on some species pre-construction and the applicant has addressed this in their proposed consent conditions. In order to ensure that any effects on birdlife resulting from wind farm construction and operation are suitably mitigated, ongoing targeted monitoring of at risk species of birds is necessary. Not all bird species present at the site are at equal risk or are of equal significance and I therefore suggest that any monitoring program is tailored to the specific threats that have been identified in my evidence above. Below, I list these species, outline the further investigations that are necessary pre-construction and propose appropriate ongoing monitoring to be employed should the wind farm be consented.

Collaborative Research

11.2 There is a paucity of research currently available on the effects of wind farms on New Zealand's birds. Thus it is paramount that any monitoring carried out is encouraged into the public domain to allow more informed discussions on this subject to occur in the future. Additionally, much of the monitoring proposed will result in an increase in knowledge in general for many of these species, and where possible this knowledge should be published in an appropriate forum. Considering this, it will be highly appropriate in many cases to investigate options for multi-agency input and funding. A collaborative approach to investigations is recommended. Indeed this is one of the primary recommendations made in a recent literature review on the effects of wind farms on New Zealand's birds (Powlesland 2009).

General birds

11.3 The occurrence of bird mortality as a result of collision with wind turbines has still not been fully investigated in New Zealand. In order to fully establish the extent of any effects on birds at the HMR site, I recommend that an appropriate monitoring program is set up and have had an input into the conditions suggested. In summary, monitoring for two years should begin once each cluster becomes operational and there should also be a two year period of monitoring after the wind farm is completed. Monitoring should involve trained staff searching a 100 m grid around the base of a representative sample of turbines in each cluster five days a week for one month, at least two times a year. An investigation of searcher efficiency

and the rate at which carcasses are scavenged/decompose should also be incorporated in to the monitoring program. I have also recommended that the turbine mortality monitoring periods every year should coincide with the two periods of greatest bird migration (January and July/August).

New Zealand falcon

11.4 There is no doubt that falcons are vagrant to this site and that falcon will occasionally pass through the area proposed for turbine construction. However, it is important to note that currently no falcons are known to be breeding at this site and that if falcons are only occasionally using, or passing through the site, it is unlikely that this species will be significantly affected by wind farm construction and operation. In this instance intensive monitoring would not be required. Additionally, any affects on vagrant falcons will be almost impossible to monitor.

11.5 However, should falcon be found to be breeding within 2 km of the site, the potential for a negative effect is likely to be higher. At this stage it is unclear how suitable the site is for breeding falcons. The assessment of risk to falcon needs to be staged, with the level of detail required increasing as risk is identified:

STAGES

(a) Assessment of the site for suitable breeding habitat;

(b) If suitable breeding habitat is identified surveys for breeding falcons should be undertaken at these sites;

(c) If breeding falcons are located the following should be monitored

Pre-construction:

(i) The nest success of each nest located;

(ii) The habitat-use and proportion of time each adult pair spend within the wind farm envelope;

Post-construction:

(i) The nest success of each nest located;

(ii) The habitat-use and proportion of time each adult pair spend within the wind farm envelope;

(iii) The survival of adult and fledgling falcons using the wind farm envelope.

(d) Additionally, any construction activity within 200 m of an active nest should be restricted during the period that the nest is active. Construction activity can continue with no effect to breeding falcons once the nesting attempt is completed.

11.6 It is important to note that because falcons are found at relatively low densities (when compared with smaller common species) turbine searches will not be adequate to locate any falcons that suffer collision mortality. In order to ensure that each individual falcon that suffers mortality as a result of wind farm operation is identified, radio transmitters must be used in order to assess the survival of each falcon using the site post-construction.

Migratory shorebirds

11.7 As outlined above the primary issue at this site is potentially with migratory birds. Currently however, there is a lack of knowledge available on the numbers of birds migrating through this region and the proportion of birds that may be at risk from wind farm construction at this site.

11.8 As a result it is important in my opinion that further monitoring of migratory shorebirds is completed before the wind farm commences operation to allow any potential effects to be avoided.

Tracking of migratory shorebirds using radar

11.9 This monitoring should comprise at least four seasons (two south bound and one more north bound migration period) of monitoring using two radars. Radars should be sited at either end of the wind farm, with observer stations operating concurrently in order to indentify the composition of the radar tracks as per international best practice. As a minimum, observer stations should be set up on the beach, by the radar and inland of each radar station as described in Mr Kessels revised monitoring methodology (**Exhibit GK1B and 2**). This monitoring is required during day and night.

Tracking of wrybill, banded dotterel and black stilt using radio transmitters

11.10 I also suggest that the use of radio transmitters be investigated to establish the movements of wrybill, banded dotterel and black stilt in order to more fully describe the local movements of these birds.

Modelling of collision risk of Eastern bar-tailed godwit, lesser knot and turnstone

11.11 The collision risk to godwits, turnstone and knots should be modelled using a range of scenarios based on hypothetical numbers likely to be passing or crossing the site.

12. RECOMMENDED MEASURES TO AVOID, REMEDY OR MITIGATE EFFECTS

12.1 In my evidence I have discussed a number of potential risks to different bird species at different locations. In addition to the monitoring I have described, there are a range of measures that can be used to avoid, remedy or mitigate identified potential effects. These are:

12.2 The potential for birds to collide with transmission lines can be reduced by installing bird deflectors in key areas along the transmission lines. These should be installed where transmission lines pass low over areas of bush or wetland.

12.3 Construction activity around Punga Punga Wetland should be avoided during the bittern breeding season (September – January) in order to avoid disturbance to breeding birds.

12.4 Should it be established that migratory shorebirds pass through the site and that there is a significant risk that these birds will be negatively affected, several options are available to avoid these effects:

(a) Do not build turbines in areas where high densities of migratory birds are passing through;

(b) Ensure wide “corridors” with no turbines are available for migrating birds to pass through the wind farm;

(c) Switch off high risk turbines at times of high bird migration;

(d) Switch off high risk turbines at times when high bird migration and inclement weather conditions coincide.

In addition, suitable off-site mitigation may better achieve a net conservation gain. Further research on the movements of migratory birds through the area is required before the suitability of each of these options can be fully discussed.

12.5 Potential options for mitigation include:

(a) The implementation of predator control programs at key breeding and wintering sites for migratory birds,

(b) Intensive, sustained and targeted predator control and habitat enhancement for bush and wetland birds (at Punga Punga Wetland),

(c) Predator control in and habitat enhancement of local areas of bush (particularly for kereru).

(d) Providing funds and facilitating long-term formal legal protection of affected key natural features on private land within the Waikato Wind Farm study area

(e) Long-term funding of a shorebird study group whose objectives are to describe the major pathways of migratory birds around New Zealand (similar to the Department of Conservation "Project River Recovery" funded by Meridian Energy Ltd).

13. KEY CONCLUSIONS

13.1 Most birds resident within the HMR study site are common widespread species and any potential effects of wind farm construction and operation and evidence suggests that effects on these species will not be significant;

13.2 Due to the behaviour and flight heights of kereru and tui they have been identified as potentially being at risk from collision mortality. Additionally, the clearance of areas of bush will reduce the amount of habitat available for these species and other bush birds within the HMR study area. However, with suitable mitigation these effects can be appropriately remedied and in my opinion a significant effect is not likely;

13.3 New Zealand falcons are not expected to occur at this site at high densities. Nevertheless, the extent of suitable falcon breeding habitat has not yet been established in or surrounding the HMR study area. Should New Zealand falcon be present breeding at the site there is a risk that they could be negatively affected by the construction and operation of a wind farm at this site. These effects could potentially be significant to the local population. However, I am confident that suitable options are available to mitigate any effects should they be realised and effects on the wider

regional population seem unlikely. Considering that there is still doubt as to whether this species is present breeding within range of the HMR study area, further investigations are recommended with an ongoing plan to implement monitoring if the need arises.

13.4 Three threatened bird species occur in Punga Punga Wetland, the North Island fernbird, Australasian bittern and spotless crake. These will not be affected by the construction of a wind farm but the proposed rerouting of the transmission line over another part of the wetland may have some minor effects on these species. I am confident that suitable options are available to avoid or remedy these effects;

13.5 Resident shorebirds are largely restricted to the coast below where the turbines are proposed and therefore the risks to these species are viewed as minor. Of those species that have been observed crossing the site, in my opinion any effects are unlikely to be significantly large enough to impact the wider regional populations of these species; and

13.6 As yet the risks to migratory shorebirds cannot be fully established due to a lack of information on the numbers of shorebirds passing through the site and the routes they are taking. As a result these investigations are continuing but at this stage these have not progressed to a stage where any certainty can be provided that the effects will be minor. I have recommended that conditions be included in consents requiring monitoring and assessment of information collected to aid in the further understanding of potential effects on migratory shorebirds.

R Seaton

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APPENDIX 1

A complete list of bird species recorded within the Waikato Wind Farm, their ecological requirements & conservation status. (Modified from table 6 in the Assessment of Ecological Effects, Kessels & Associates Ltd. June 2008).

		Habitat										
Common name	***Genus / species***	**Native Forest**	**Pine plantation**	**Farmland**	**Scrubland**	**Freshwater wetlands**	**Coastal**	**Survey Information**	**Usage**	**Threatened Status**	**Origin**	**Legal Status**
Bellbird	*Anthornis melanura melanura*	√						O	R		E	P
Bittern, Australasian	*Botaurus poiciloptilus*			√		√		O	R	GD	I	P
Black Swan	*Cygnus atratus*			√		√	√	O, WS	S/R		In/I	G
Blackbird	*Turdus merula*	√	√	√				O	R		In	
Chaffinch	*Fringilla coelebs*		√	√	√	√		O	R		In	
Cockatoo, Sulphur-crested	*Cacatua galerita*	√						O	R		In*	
Coot, Australian	*Fulica atra*					√		O	R		I	P
Crake, Spottless	*Porzana tabuensis plumbea*					√		O, P	R	R	I	P
Cuckoo, Shining	*Chrysococcyx lucidus lucidus*	√						O	M		I	P
Dotterel, Banded	*Charadrius bicinctus bicinctus*						√	O	M	GD	E	P
Dotterel, New Zealand	*Charadrius obscurus*						√	O	R/M	T	E	P
Duck, Grey	*Anas superciliosa superciliosa*	√				√		O	R	T/GD		
Falcon, New Zealand 'bush'	*Falco novaeseelandiae*	√	√	√				O	R/S	T/GD	E	P
Fantail, New Zealand	*Rhipidura fuliginosa*	√	√	√	√	√		O	R		E	P
Fernbird	*Bowdleria puncata vealeae*		√		√	√		O	R	R	E	P
Gannet, Australasian	*Morus serrator*						√	O	R		I	P
Godwit, Bar-tailed	*Limosa lapponica*						√	O	M		I	P
Goldfinch	*Carduelis carduelis*			√	√	√		O	R		In	
Greenfinch	*Chloris chloris*			√	√	√		O	R		In	
Gull, Red-billed	*Larus novaehollandiae scopulinus*						√	O	R		E	P
Gull, Black-backed	*Larus dominicanus*			√		√	√	O	R		I	
Harrier, Australasian	*Circus approximans*			√	√	√	√	O	R		I	P
Heron, Reef	*Egretta sacra sacra*						√	O	R	T	I	P
Heron, White-faced	*Ardea novaehollandiae*			√		√	√	O	R		I	P
Kaka, North Island	*Nestor meridionalis*	√						O	R	CR	E	P
Kingfisher, Sacred	*Halcyon sancta*	√	√	√		√		O	R		I	P

Kokako	*Callaeas cinera wilsoni*	√						O	R	CR	E	P
Magpie, Australian	*Gymnorthina hypoleuca*	√	√	√	√	√		O	R		In*[1]	
Mallard	*Anas platyrhynchos*			√		√	√	O, WS	S/R		In	G
Morepork	*Ninox novaeseelandiae*	√	√			√		O, WS	R		E	P
Myna, Common	*Acridotheres tristis*		√	√				O	R		In	
Oystercatcher, South Island Pied	*Haematopus ostralegus finschi*						√	O	R		E	P
Oystercatcher, Variable	*Haematopus unicolour*						√	O	R		E	P
Pheasant, Ring-necked	*Phasianus colchicus*		√	√		√		O, KA	R		In	G
Pigeon, New Zealand	*Hemiphaga novaeseelandiae*	√						O, KA	R/S	GD	E	P
Pipit, New Zealand	*Anthus novaeseelandiae*			√		√	√	O, KA	R	GD	E	P
Plover, Spur-winged	*Lobibyx novaehollandiae*			√		√		O, KA	S		I	P
Pukeko	*Porphyrio porphyrio*			√		√		O, WS	R		I	G/P
Quail, Brown	*Synoicus ypsilophorus*				√	√		O	R		In	G
Quail, California	*Callipepla californica*				√			O	R		In	G
Rail, Banded	*Rallus philippenis*					√		O, P	R	R*, GD	In	P
Redpoll	*Carduelis flammea*		√	√	√		√	O	R		In	
Rosella, Eastern	*Platycercus eximius*	√	√	√				O	R		In	
Shag, Black	*Phalacrocorax carbo novaehollandiae*					√		O	R		I	P
Shag, Little	*Phalacrocorax melanoleucos*					√	√	O	R		E	P
Shag, Little Black	*Phalacrocorax sulcirostris*					√	√	O	R		I	P
Shag, Pied	*Phalacrocorax various various*						√	O	R		I	P
Shelduck, Paradise	*Tadorna variegate*			√		√		O, KA	S/R		E	G/P
Shoveler, New Zealand	*Anas rhynchotis variegata*					√		O	S/R		E	G/P
Silvereye	*Zosterops lateralis*	√	√	√	√			O, KA	S		E	P
Skua, Arctic	*Stercorarias parasiticus*						√	O	M		I	
Skylark	*Alauda arvensis*			√				O, KA	R		In	P
Sparrow, Hedge	*Prunella modularis*			√	√	√	√	O, KA	R		In	
Sparrow, House	*Passer domesticus*			√		√		O, KA	R		In	
Starling	*Sturnus vulgaris*			√		√		O, KA	R		In	
Stilt, Pied	*Himantopus himantopus leucocephalus*						√	O	R		I	P
Swallow, Welcome	*Hirundo tahitica neoxena*			√		√		O, KA	R		I	P
Tern, Caspian	*Sterna caspia*						√	O	R	T	I	P
Tern, White-fronted	*Sterna striata striata*						√	O	R	GD	I	P
Turkey, Wild	*Meleagris gallopavo*			√				O	R		In	P
Thrush, Song	*Turdus philomelos clarkei*			√		√		O, KA	R		In	P
Tomtit, New Zealand	*Petroica macrocephala*	√			√	√		O	R		E	P
Tui	*Proshemadera novaeseelandiae*	√				√		O, KA	R/S		E	P
Warbler, Grey	*Gerygone igata*	√			√	√		O, KA	R		E	P

Yellowhammer	*Emberiza citronella caliginosa*			√		√		O, KA	R		In	

Survey Information: KA = Current survey; WS = Wildlife survey 1986; P = Possible but not formally recorded; O = OSNZ Atlas scheme, 2000-2004

Usage: S = Seasonally; M = Migratory; R = Resident; V = Vagrant

Threatened Status[1]: Blank = not threatened; R = Rare; T = Threatened; GD = Gradual decline; CR = Critically endangered

Origin [1]: E = Endemic; I = Indigenous; In = Introduced

Legal Status: Blank = No status; P = Protected; G = Gamebird

[1] Hitchmough, R.; Bull, L; Cromarty, P. (comp). 2007: New Zealand Threat Classification System lists - 2005. Science & Technical Publishing, Department of Conservation, Wellington.