Mahinerangi Wind Farm Stage 2 - Puke Kapo Hau

Avifauna Assessment

Prepared for Tararua Wind Power Limited

October 2025

Boffa Miskell

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Cover Photo: Looking south across the site from stage II toward the Turbines of Stage 1. © BML

Executive Summary

Project Description

Tararua Wind Power Limited ("TWP"), a fully owned subsidiary of Mercury NZ Limited, is progressing Stage 2 of the Mahinerangi Wind Farm which is to be known as "Puke Kapo Hau" ("the Project", "Puke Kapo Hau" or "MWF Site").

The MWF is located on the eastern foothills of the Lammermoor Range, situated 5 km north of Lake Mahinerangi and approximately 50 km west of Dunedin.

Tararua Wind Power Limited (TWP) holds a land use consent for the construction, operation, and maintenance of the MWF. The resource consents were granted by the Environment Court in 2009 and authorise up to 200MW of installed capacity and up to 100 wind turbines, with a maximum tip height of 145m. TWP is now progressing MWF Stage 2 through a Substantive Application under the Fast-track Approvals Act 2024.

Stage 1 of the wind farm was commissioned in 2011 and involved 12 Vestas V90 turbines with a maximum tip height of 125m with a combined output of 36 MW. Stage 2 will consist of up to 44 additional turbines which will have a maximum tip height of 165m. Stage 2 also includes a new 110kV transmission line, substation and a Battery Energy Storage System ("BESS").

Although the resource consents do not specify what turbines must be constructed, 100 x 2 MW turbine or 67 x 3MW options were considered as options at the time. Those types of turbines are not readily available, and a realistic and non-fanciful turbine has been selected which could be constructed under the land use consent for the purpose of clause 23 of Schedule 5 to the Fast-track Approvals Act and s127 of the Resource Management Act 1991. This is as follows:

– What is realistic under current consent conditions: 47 turbines, 145m high, 9m ground clearance, 136m rotor diameter within a possible 78 locations/Contingency Zones ("CZ")
– What is proposed: 44 turbines, 165m high, 20m min ground clearance, 136m rotor diameter, within 54 possible locations/CZs.

This avifauna assessment seeks to determine the effect of the changes to the consent conditions, and to assess the effect on avifauna of the new activities proposed.

Methods

The study started with a comprehensive review of:

– The prior investigations carried out at this site between 2006 and 2012.
– All sources of avifauna reporting which have been produced since those earlier studies.
– A review of the site itself to determine if there have been any changes to the local environment, vegetation and habitats since consent was granted that would change the assessed risk to avifauna.

Supplementary site investigations were then carried out for a week in January 2025 and a week in February 2025 to confirm the range of habitats present, the use of those habitats by avifauna during summer, and to compare the MWF Stage 2 site with the more diverse habitats of the Lake Mahinerangi and associated wetlands of the Waipori Hydroelectric Power Scheme. These investigations used standard point count, 5-minute bird count, and bio-acoustic surveys, covering mid and late summer, and including the peak period of the departure of domestic migrants from Southland to the North Island, as well as nocturnal activity.

An assessment was then carried out which considered all potentially affected species to confirm if the Eastern New Zealand falcon (falcon) remained the main species of concern. The assessment then focused on the proposed consent condition changes, and the new activities, to determine if this would change the risk profile for falcon.

Results

Review of Prior Investigations

Three studies were conducted as part of the original consenting process, and to meet conditions of consent for construction of Stage 1 of the MWF. They were:

- The original effects assessment (Kingett Mitchell Ltd, 2006).
- Falcon breeding and territory studies carried out over multiple breeding seasons (2006/07 to Golder 2011/12) and summarised in 2012 (Golder Associates Ltd, 2012).
- Post construction bird strike monitoring (Golder Associates, 2013).

Baseline studies carried out as part of the Assessment of Effects concluded "*the MWF Layout is not an important habitat for threatened bird populations, and evidence from overseas studies indicates that in such situations, the incidence of bird mortality is generally low*" (Kingett Mitchell Ltd, 2006).

Subsequent investigations of falcon distribution and breeding were detailed and comprehensive and followed standard practice for falcon studies and turbine collision studies. They concluded that:

- There was no bird strike of falcon during the two years of observation.
- There was no evidence of displacement of falcon by the operational wind farm. Falcon continued to hunt within the Stage 1 site after commissioning.
- There was no evidence that the presence of the turbines affected nesting. Falcon continued to nest locally and successfully fledge chicks during construction and after commissioning of Stage 1 of the wind farm.

Bird strike studies were carried out over two years using accepted methods and included dogs which significantly increased carcass detection over human observers. The key findings were:

- Of the 33 bird species recorded on the MWF Site, eight species recorded one or more bird strikes. Four were native with one mortality each for Australasian harrier, black-backed gull, paradise shelduck and silvereye. Four were introduced species, with the most recorded mortalities being magpie (6 mortalities) and skylark (4 mortalities) and 1 mortality each for rock pigeon and mallard duck.
- It was concluded from both the bird strike monitoring, the tracking of individual falcon, and from international papers, that risk of falcon collision was highly unlikely and was not recorded through all the monitoring.

Review of Avifauna Records and Habitats

In the 12 years since the Stage 1 bird strike studies were completed (Golder Associates Ltd, 2013) the land use has not changed and there have been no obvious changes to the vegetation and habitats within the MWF Site that would attract more falcon to the site or encourage breeding within the site.

At the time of the original Assessment of Effects an early conservation status prepared by Hitchmough (2002) classified falcon as 'gradual decline'. By the time the falcon monitoring was completed the conservation status had changed to Threatened – Nationally Vulnerable (and has remained) so the conclusions in the monitoring reports relating to the threat status of falcon remain appropriate.

There have been changes to the conservation status of three other native species, pied oystercatcher, NZ pipit, and little shag, which were not threatened in 2006, but now have a conservation status of At Risk - declining or At Risk – Relict. This assessment uses the current status.

A number of recent sources of bird data were reviewed to determine if there have been any changes or new observations of birds within and adjacent to the Site. There do not appear to have been marked changes in the presence of bird species locally and which may utilise the MWF Site.

Site investigations

To supplement the earlier monitoring and observations, a further two weeks of field work were carried out in January and February 2025. This enabled confirmation:

– of the range of habitats present and the species utilising them.

– of the range of species that are resident within or regularly utilise the MWF Site.

– that falcon are still present within the MWF Site and appear to still occupy several territories last observed in 2012.

– that there is a clear separation between the populations of birds resident within the pastoral MWF Site and the waterbird populations present within the lakes and wetlands of the wider landscape including Lake Mahinerangi, as concluded by the 2006 assessment, remains valid.

– that the key species of concern remains the falcon.

The supplementary investigations also identified that small numbers of South Island pied oystercatchers (pied oystercatcher) breed within the Project Site, and an assessment of risk was also carried out for this species.

Review of Risk to Falcon

Using the key proposed changes to the type and number of turbines, collision risk was calculated for both the layout possible under the current conditions, versus the Stage 2 proposed layout. This analysis aimed to confirm whether the Stage 2 layout as proposed will have a positive, neutral, or negative effect on falcon.

The modelling concluded that the risk to falcon will be reduced by about 46% under the proposal to raise the blade swept height from 9 to 20m, and to reduce turbine numbers to a maximum of 44 additional turbines.

Review of Risk to Pied Oystercatcher

While 4 domestic migrant species have been observed at Lake Mahinerangi, only the pied oystercatcher has been historically observed within the MWF Site. It was also observed during the supplementary study in 2025.

Small numbers of pied oystercatchers have been seen nesting at the MWF Site by wind farm staff both within the existing turbines of Stage 1, and within the wider Windfarm Development Area. While nesting and foraging within an operational wind farm indicates the species is highly tolerant of the turbine operation and of normal farm practices, protection of ground-based nests, if found within the wind farm site, during construction is required.

Assessment of Effects

This assessment confirms many of the findings of the 2006 assessment with regard to the construction and operation of the wind farm, adding some additional detail and context based on newer information. It also adds to the effects assessment where new risks to falcon have come to light in the past decade:

Falcon

Wind Farm Construction

- **Habitat Disturbance:** Based on the knowledge of this and other sites, it is not considered that falcons will be displaced from habitat during construction;
- **Breeding Disturbance:** If close to a nest site, construction activity is known to disturb nesting adults and potentially cause loss of chicks. There are no known nest sites that sit in close proximity of proposed turbine locations. Monitoring of nest sites within the development area during construction is however required.

Wind Farm Operation

- **Loss of habitat:** Based on post construction monitoring at this and other sites, it is unlikely that the prey species of falcon will be reduced by the construction of Stage 2 of the windfarm.
- **Displacement from habitats:** Based on studies at this and White Hills windfarm sites, falcon are not displaced from habitat by turbines.
- **Collision Mortality:** There is no evidence to date of collision mortality of falcon at New Zealand wind farm sites where post construction monitoring has been conducted, and falcon have been present. To provide further confidence, analysis of the new turbine layout shows that the changes proposed will provide increased separation between turbines and falcon activity by raising the turbine blade and reducing turbine number, further reducing risk. Nonetheless, monitoring which was carried out for Stage 1 under condition 27 will also be carried out for Stage 2.

Transmission Lines

- **Electrocution**: A new transmission line is proposed as part of Stage 2. Electrocution is a known concern for falcon and is considered to pose the greatest risk to falcon at this site. The causes of electrocution are well known and ways to make power lines safe have been developed. The risk of electrocution can be avoided through these design solutions.
- **Collision with transmission lines:** Based on studies at this, and White Hills windfarm, falcon are unlikely to collide with transmission lines and a number of observations of falcon during 2025 were of them perching on the transmission lines installed for Stage 1 of the wind farm. This is not considered to be a risk.

Pied Oystercatcher

Wind Farm Construction

- **Breeding Disturbance:** This species nests in scrapes on the ground within the MWF Site and so is tolerant of disturbance. However, construction activity will need to be managed during breeding to protect nest sites.

Wind Farm Operation

- This species has been breeding in small numbers within the Stage 1 wind farm. There have been no observations of turbine collisions, and the species does not appear to have been displaced by either the turbines or normal farm operations.

Transmission Lines

- This species is not at risk of electrocution as it is not a perching bird. There have been no records of pied oystercatcher collision with the transmission lines installed as part of Stage 1 of the wind farm.

Schedule 7 Approval relating to Wildlife Act

- A Schedule 7 Approval relating to the Wildlife Act is being sought to continue the monitoring of falcon that was undertaken for Stage 1 of the MWF. The proposed activity involves fitting tracking transmitters on a number of falcon in the local population.
- This is a standard method for monitoring this species. The methods use well tested and accepted protocols and only experienced falcon experts can be used to carry this out. It is considered that the risk of injury to falcon of this activity to be very low.

Effects Management

The range of potential risks to falcon from construction and operation are well known and management and monitoring methods are well established.

Falcon

Avoidance

- With timely monitoring and good site management it is possible to avoid effects on nesting falcon and protect juveniles.
- With consideration of the risk of electrocution and good design of the transmission lines electrocution of falcon, risk for this species can be avoided.

Compensation

- Condition 28 requires ongoing mammalian pest control to ensure that the densities of predator and prey species are in low densities. The existing pest control being carried out in Stage 1 will continue and will be expanded to also cover Stage 2.

Monitoring and Management

- Monitoring and site management which are considered necessary are described based on current knowledge.
- Reviews of the current Management Plan highlight that some changes are required to respond both to the results of the falcon monitoring and current knowledge of falcon.

Pied Oystercatcher

Avoidance

- With timely monitoring and good site management avoidance of effects on nesting pied oystercatcher and protection of juveniles can be achieved.
- This species appears to be tolerant of turbine operation and farm operations, which will extend to the maintenance of the operational windfarm. Monitoring is only considered necessary during the construction phase to locate nests and provide appropriate protection.

Conclusions

Based on this assessment, of the 14 native species observed within the MWF Site, the falcon and the pied oystercatcher are the only species of concern. The primary risks are:

- Disturbance of nest sites by construction activities.
- Electrocution from new transmission lines (falcon only).
- Potential rare collisions with turbines.

In each case the risks are known, as are the required management responses. These are detailed in the following sections.

Some changes to the conditions are proposed by the application, as well as modifications to the certified Monitoring and Management Plan to recognise increased knowledge of the risks and new techniques for monitoring and management of those risks.

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1. Introduction and Project Background

1.1. Introduction

This assessment relates to construction of Stage 2 of the Mahinerangi Wind Farm situated on the eastern foothills of Lammerlaw Range, approximately 5 km north of Lake Mahinerangi and approximately 50 km west of Dunedin. Tararua Wind Power Limited (TWP), a fully owned subsidiary of Mercury NZ Limited, is progressing Stage 2 through a Substantive Application under the Fast-track Approvals Act 2024. This wind farm is to be known as "Puke Kapo Hau" ("the Project", "Puke Kapo Hau" or "MWF Site").

Resource consents for the Mahinerangi Wind Farm were granted by the Environment Court in 2009. The Wind Farm Site is approximately 1,723ha, within which the "Windfarm Development Area" is located and is where all physical works are to occur. Also within the Windfarm Development Area are Windfarm Buffer Areas, and areas excluded from development by the Environment Court (see BMPW07190).

Condition 26 required two years of bird carcass monitoring (which has been completed); condition 27 required the consent holder to undertake a monitoring programme to monitor the Eastern New Zealand falcon (falcon) in the vicinity of the Wind Farm Site for two summers prior to the first turbine becoming operational for two years after the wind farm is operational (which has been completed); while condition 28 requires a mammal pest control programme (which remains on-going). Condition 27 is discussed in further detail later in this assessment.

The consent conditions reference the New Zealand falcon (falcon). However, it is recognised that there are three forms of the New Zealand falcon (*Falco novaeseelandiae novaeseelandiae*), each with a different conservation status. At the MWF Site the relevant form is the Eastern variant which has a conservation status of Threatened - Nationally Vulnerable.

Stage 1 of the wind farm is located in the southern western corner of the Wind Farm Site. It was commissioned in 2011 and contains 12 Vestas V90-3MW turbines. Avifauna monitoring was carried out over a period of six years during both pre and post construction, and the results of these studies has informed this assessment.

TWP now wishes to complete the wind farm (Stage 2) using newer, larger, and more efficient turbines than were available when the project was consented. While 2MW turbines were realistic in 2006 (when the original applications were filed), given the advancement in wind technology, it is not realistic to advance a consented 88 x 2MW (the balance of the 100 turbine locations when considering a 2MW turbine and observing the 200MW installed capacity limit in the current consent) turbine layout for assessment purposes. Therefore, TPW have adopted a real word configuration for assessment purposes. This is as follows:

- What is possible under existing consents: 47 turbines, 145m high, 9m ground clearance, 136m rotor diameter within a possible 78 locations/CZs.
- What is proposed: 44 turbines, 165m high, 20m min ground clearance, 136m rotor diameter within 54 possible locations/CZs.

To accommodate these changes, the land use consent will require several variations to the consent conditions.

This assessment seeks to identify the effect of the change in conditions/layout that would be allowed by approval of the proposed consent variations would increase risk on avifauna compared to the consented wind farm design.

Specifically, this assessment looks at whether the change in number, layout, design and size of the Stage 2 turbines will result in a reduction or an increase in potential collision risk for falcon.

Additionally, the assessment also considers the effects of new activities including the Battery Energy Storage System (BESS) and transmission line. Boffa Miskell has been commissioned to complete necessary avifauna investigations with a specific focus on falcon, with reference to the consent variations proposed for Stage 2 and the additional relevant new activities.

This assessment builds on historical studies carried out for the original ecological impact assessment (Kingett Mitchell 2006), four years of pre and postconstruction falcon nest surveys (Golder Associates 2012) and two years of post-construction collision monitoring (Golder Associates 2013).

1.2. Proposed Changes to the Land use Consent

In summary, there are four proposed changes to the land use consent that are relevant to this assessment of risk to avifauna:

- TWP is seeking to increase the height limit for the turbines from the currently consented 145m (as set out in condition 17) to a blade tip height of 165m. TWP has also confirmed that the total number of turbines required within the wind farm can reduce from a consented maximum of 100 (as per condition 12) to 56 (12 existing plus 44 proposed). It is proposed that up to 44 additional turbines be constructed within 54 potential locations. A turbine with a tip height of 165m, minimum of 20m ground clearance, and 136m rotor diameter is used for assessment purposes.
- To accommodate changes to the size of the turbines some changes to the Contingency Zones and Windfarm Buffer Areas will be required. A revised Windfarm Layout Plan is proposed to accommodate changes required for Stage 2.
- TWP also seeks new consents for a 110kV transmission line connection between the wind farm and the National Grid (steel pole structures and access tracks), and associated infrastructure including a substation, and BESS.
- In addition, specific changes to the conditions of consent relating to ongoing monitoring of avifauna are proposed as are some changes to the avifauna monitoring and management plan which was certified under the current consents in 2011.

1.3. Terms used in this report:

Puke Kapo Hau Wind Farm	*"the Project", "Puke Kapo Hau" or "MWF Site"*
Wind Farm Site	*The Site as consented has a total area of 1,723 ha. The Wind Farm Site area has reduced from that consented due to the removal of the Thomas Block. See Map 1.*
Windfarm Development Area	*The Windfarm Development Area contains all physical works associated with the construction and operation of the windfarm such as turbines; access tracks, spoil disposal areas, and lay down areas. See Map 2.*
Study Area	*For mobile species such as birds the study area extends beyond the Wind Farm Site to include nearby nest sites and home ranges which overlap with the Development Area. For falcon Golders focused on an area extending 5km from the Windfarm Development Area.* *For this review and site investigations, the focus has been on the relevant part of Windfarm Development Area for Stage 2 but also extends to the south and west to include the various lakes and associated wetlands that form part of the Waipori Hydroelectric Power Scheme. See Map 3.*
Wind Farm Buffer Area	*Buffer areas relevant to the current consent are referred to as 'Windfarm Buffer Areas' in the conditions of consent.*

Resident birds	*A population of non-migratory birds which reside within and rely upon habitat within the project site for foraging, roosting and nesting (e.g. grey warbler).*
Local birds	*A non-migratory birds whose home range extends to include habitat within the project footprint, but do not roost or nest within it (e.g. falcon).*
Cryptic birds	*Birds, often of freshwater swamps, which are highly secretive.*
Migration	*The regular seasonal movement, often north and south along a defined flyway, between breeding and wintering grounds (e.g. pied oystercatcher, banded dotterel, wrybill, pied stilt). These birds may utilise a site as a stopover or staging area during the migration.*
Vantage Point	*Fixed sampling locations used repeatedly over time to gather consistent baseline data.*
Point count	*Standardised fixed point, fixed period sampling to gather data on movements and behaviour in relation to a topographic feature or development areas.*
5-minute bird counts (5MBC)	*Standardised methodology for bird presence/absence and relative abundance surveys.*
Incidental observations	*Any bird observation not part of standardised sampling.*
NZ Falcon (eastern)	*The site has the eastern variant of the New Zealand falcon. 'Falcon' is used in the text from this point*
South Island pied oystercatcher	*The South Island pied oystercatcher is referred to as 'pied oystercatcher' from this point.*

1.4. Acknowledgements

The weekly avifauna "fixed point – fixed period" study was carried out, in good weather and bad, by Urtica Ecology, Kiri Pullen and Greg Coats.

Our thanks to the landowners for providing access and support, and to the onsite staff.

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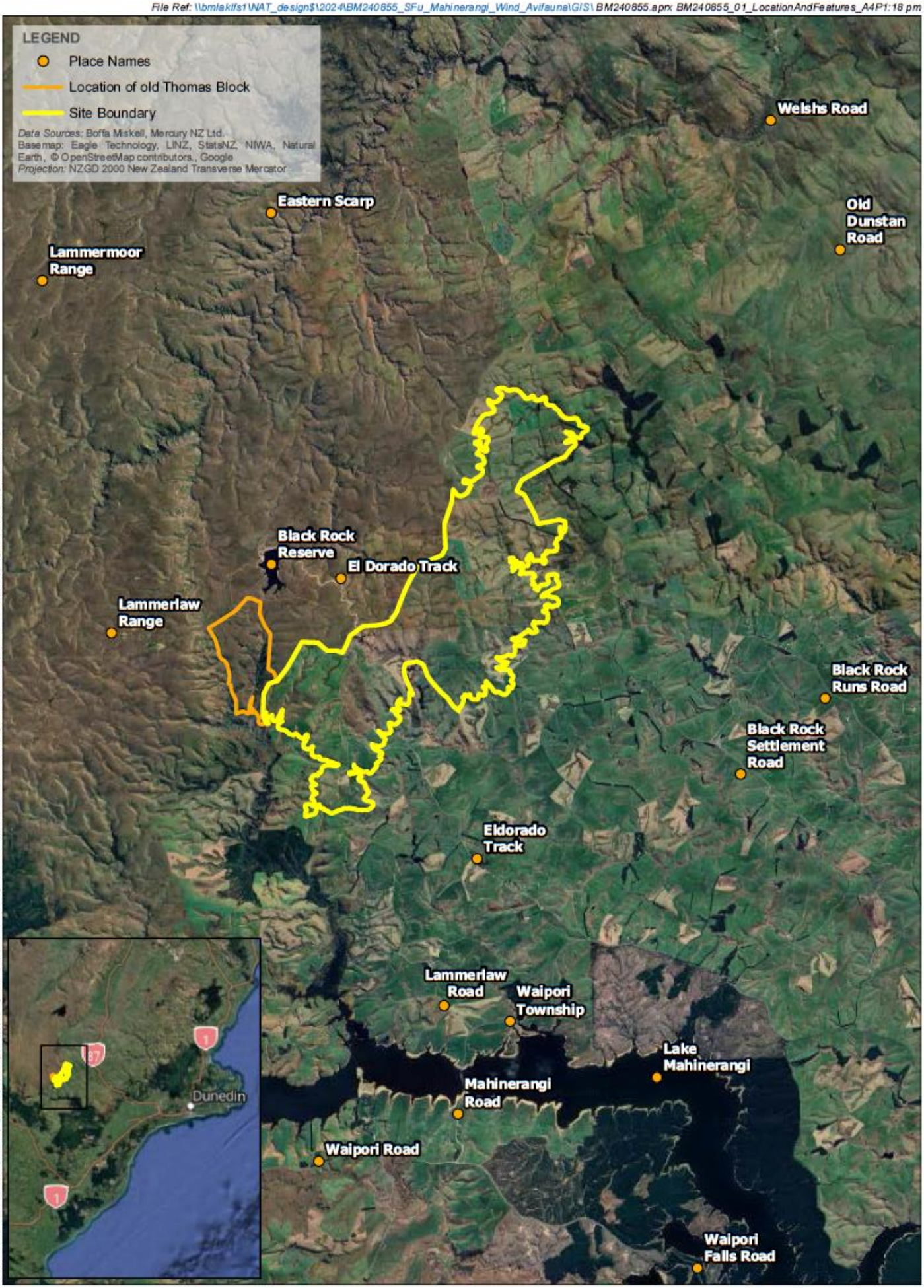

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MAHINERANGI WIND FARM

Location Map and Features referred to in report

Date: 13 June 2025 | Revision: 0

Plan prepared for Mercury NZ Limited by Boffa Miskell Limited

Project Manager: Stephen.Fuller@boffamiskell.co.nz | Drawn: LJa | Checked: SFu

Map 1

2. Project Description

The scope of the Stage II development is detailed in the Application, and the key changes have been discussed earlier. In summary:

Earthworks and Vegetation Clearance

Matters of earthworks, surplus fill disposal, vegetation clearance, and habitat restoration are addressed in the ecological effects assessment of SLR Consulting.

The Windfarm

Stage 2 remains within the consented Windfarm Development Area, with several very minor amendments relating to a limited number of Turbine movements. These exceptions are addressed by Riley and SLR and are of no consequence to this assessment.

A significant change proposed is the removal of Thomas Block located in the western most section of the Wind Farm Development Area. This reduces the overall area to be assessed by some 160 ha and avoids development within an identified high-quality tussock area.

Turbines

Stage 2 reduces the maximum number of turbines from a consented maximum of 100 (as per condition 12) to 56 (12 existing plus 44 proposed).

In addition, some of the turbines have been moved from their consented locations including into consented buffer areas, some Contingency Zones have been enlarged to 100m radius, and spoil disposal areas altered.

Proposed consent conditions specify a maximum tip height of 165m and minimum of 20m ground clearance. For the assessment of collision risk purposes only where a number of turbine metrics are required, the Vesta V136 turbine is used as a representative example (although TWP do not seek the specification of a particular turbine in the consent conditions).

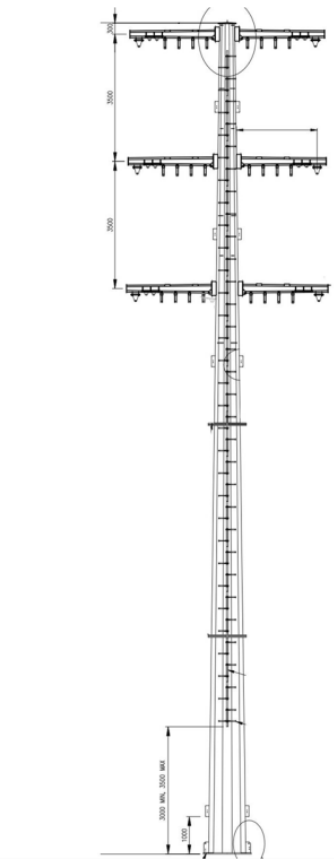
Transmission Lines

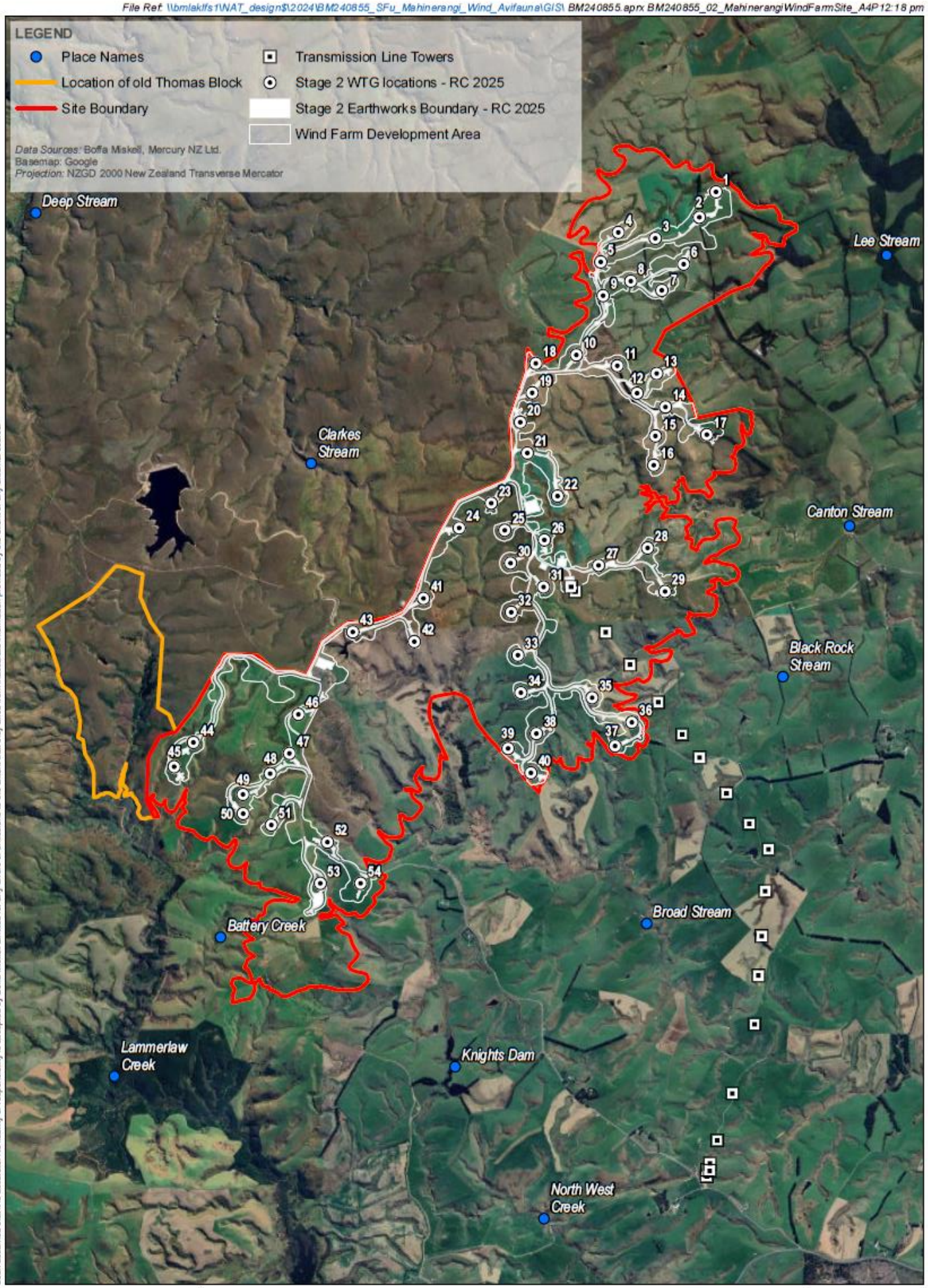
TWP also seeks new consents for a 110kV transmission line connection approximately 6 km in length between the wind farm and the National Grid (steel pole structures and access tracks), and associated infrastructure including a substation, and BESS.

The main elements of the supporting infrastructure are summarised as follows:

– A substation, BESS and 2 pole structures (up to 45m in height as shown in Figure 1) located within a transmission corridor (See Map 2).
– 20 pole structures of up to 45m in height above ground level are required to support the double 110kV circuit transmission line and its connection points. The poles will be established with intervals of 300-600m between them.
– Up to 8 pole structures (up to 45m in height) at the connection point with the National Grid.
– An access road will be approximately 6km in length and will be accessed by an existing farm track and utilise existing farm tracks where possible.

Figure 1: A visual depiction of the pole structures.





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MAHINERANGI WIND FARM

The Mahinerangi Wind Farm Site

Date: 23 September 2025 | Revision: 0

Plan prepared for Mercury NZ Limited by Boffa Miskell Limited

Project Manager: Stephen.Fuller@boffamiskell.co.nz | Drawn: LJa | Checked: SFu

Map 2

3. Methods

3.1. Summary of Methods

Avifauna values at and around the MWF have been assessed over lengthy period of time, and therefore the following were subject to a comprehensive review:

- The prior investigations carried out at this site between 2006 and 2012.
- Any sources of avifauna information which have been produced since those earlier studies.
- The site itself to determine if there have been any changes to the local environment, vegetation and habitats since consent was granted, that would change the assessed risk to avifauna and in particular falcon and which would be relevant to the change in consent conditions (increase in tip height in particular).

Supplementary site investigations were then carried out for a week in January 2025 and a week in February 2025 to confirm the range of habitats present, the use of those habitats by avifauna, and to compare the MWF Site with the more diverse habitats of Lake Mahinerangi and surrounding complexes. These included standard point count and 5-minute bird counts, and bio-acoustic recorders which covered the peak period of the departure of domestic migrants from Southland to the North Island and other nocturnal activity.

An assessment was then carried out which looked first at all potentially affected species to confirm if falcon remained the main species of concern. The assessment then focused on the proposed consent changes and revised the layout to determine if there would be an effect of the changes as they relate to the risk profile for falcon. This included a collision risk model (CRM) which was able to quantify any changes between the two layouts proposed.

The assessment concluded with a review of the Avifauna Management Plan (2009).

3.2. Review of Prior Investigations

As noted above, this study commenced with a review of all historical reports from MWF with regard to avifauna generally, and falcon specifically. The purpose was to confirm that these earlier investigations were complete and to consider the findings in terms of the changes being proposed to turbine layout and design.

The review included the Environmental Monitoring Plan and Report (Golder Associates Ltd, 2011) prepared for Stage 1 to identify any limitations or improvements that could be made as a result of the findings of the earlier studies and new information on falcon.

Similarly, the conditions of consent which detail the avifauna requirements (conditions 26 and 27) were reviewed.

3.3. Desktop Review

Review of Vegetation and Habitats

– A review of the farming activity and habitat availability within the Wind Farm Site and surrounds was carried out to determine if there have been changes to the extent and distribution of vegetation and habitats that could have resulted in changes to the abundance and distribution of avifauna.

- Vegetation mapping for the 2006 assessment was reviewed together with Google Earth imagery from 2013 (the first complete site image) and 2023 (the most recent complete site imagery). See Appendix 2, page 67.

Review of Conservation Status

- The conservation status of the falcon was updated to Nationally Vulnerable by Miskelly et.al. (2008) and applied during the falcon monitoring that was carried out between 2009 and 2013. In the most recent review of conservation status (Robertson et.al. (2021)) the eastern falcon remains listed as Nationally Vulnerable.
- Several other species observed in 2006 have had their conservation status changed and these have been reviewed to determine if there have been any consequential changes to the analysis of risk to species. See Appendix 3, page 68.

Review of Avifauna Records

- Several documents containing relevant information were referenced, and the current knowledge of bird distribution was obtained from two citizen science projects.
  - **Bird Atlas of New Zealand (eBird-Atlas NZ)**[1]. This project aims to record the presence of every bird species encountered in approximately 3,200 10 x 10 km grid squares across New Zealand. For this study we compiled all observations over nine 10 x 10 km grid squares (See Table 1). All birds located within this area are potentially present and are considered.
  - **eBird (eBird-New Zealand)**[2]**, and iNaturalist**[3], are citizen science projects. eBird sometimes contains information additional to the Bird Atlas data, particularly additional observations for rarer species. However, iNaturalist did not provide reliable information not already found in the Bird Atlas or eBird NZ projects.

Table 1: Birds NZ Bird Atlas Grid Squares used for eBird analysis

Grid Square	MWF Overlap	Primary Habitats
DV27	-	Tussock grasslands
DW27	Part Stage 2	Tussock grasslands / Improved pasture
DX27	Part Stage 1	Improved pasture / Plantation pine / Lake Mahinerangi
DV28	-	Improved pasture / 2 x Rivers (Sutton & Deep Streams)
DW28	Part Stage 1	Improved pasture
DX28	Part Stage 2	Improved pasture / Plantation pine / Lake Mahinerangi
DV29	-	Improved pasture
DW29	-	Improved pasture
DX29	-	Improved pasture

- eBird and iNaturalist are typically of incidental observations. There are some limitations to the data these provide which must be considered when using the data.
- Additional information on bird behaviour, abundance and distribution has been obtained from NZ Birds Online[4] and the volumes of the Handbook of Australian and New Zealand Birds provided data on the eastern falcon.

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1 https://ebird.org/atlasnz/effortmap. Note the Bird Atlas data is hosted on the eBird Site.

2 https://ebird.org/newzealand/home. Note the eBird NZ site combines the Bird Atlas data and all other observations.

3 https://www.inaturalist.org/

4 https://www.nzbirdsonline.org.nz/

– Appendix 5 (page 71) lists all species recorded within the study area separated by source.

3.4. Field Investigations

A preliminary visit was conducted in December 2024. This visit confirmed the range of sampling methods that would be used and their locations. This was followed by four weeks of bio-acoustic sampling, and two weeks of field observation by experienced ornithologists.

– 10 December 2024: a preliminary site visit.

– 7 Jan 2025: Site visit to install ARD acoustic monitors.

– 27-Jan to 31 Jan inclusive, and 3 Feb to 7 Feb inclusive: Bird counts.

The sample sites for these investigations are shown on Map 2.

In addition to the MWF Site, surveys of Lake Mahinerangi, the nearest large and diverse lake and wetland habitat was undertaken. Monitoring the MWF Site and the Lake Mahinerangi complex was carried out simultaneously to allow consideration of any movement between the two sites, and identification of those species limited to one or the other habitat.

Point Counts

Point counts are a standard methodology for wind farm avifauna surveys. These counts were carried out at eight Vantage Points within the MWF Site and six at Lake Mahinerangi sites.

Within the MWF the locations were chosen to sample the full range of habitats found within the site as presented in Table 2. Map 3 (page 13) shows the Vantage Point locations, and a photograph of each site is provided in Figure 2 (page 15).

Table 2: Point Count and 5-Min Bird Count sites.

Vantage Point	Location	Vegetation / Habitat
PC-01	MWF- Stage 1	Improved pasture on rolling ridgelines.
PC-02	MWF- Stage 1	Improved pasture on rolling ridgelines. Located at the boundary of the Lammerlaw Range tussock grasslands. Seep wetlands in incised flow paths.
PC-03	MWF- Stage 2	Pasture with regenerating tussock. Traversed by 2 incised gullies with some shrublands and rock outcrops.
PC-04	MWF- Stage 2	A native forest remnant in a ravine with rock outcrops. Surrounded by improved pasture.
PC-05	MWF- Stage 2	Rough pasture with regenerating tussocks on rolling ridgetops.
PC-06	MWF- Stage 2	Rough pasture and tussocks on rolling ridgetop with seep wetlands. Located at the boundary of the Lammerlaw Range tussock grasslands.
PC-07	MWF- Stage 2	Strongly rolling to steep hills with improved pasture on high ground, regenerating tussockgrasslands on slopes, shrublands and seep wetlands in incised flow paths.
PC-08	MWF- Stage 2	Improved pasture, shelterbelts, and croplands with incised gullies.

Point counts were 20-minutes long and observations were conducted by one designated ornithologist with a second person recording. Only indigenous species were recorded for point counts.

These surveys collected a range of data for each observation of a bird or flock. This included weather conditions, species, numbers, flight height, direction of travel, and behaviour such as,

arrival, departure, feeding, resting, and breeding and flight height relative to the rotor swept area (RSA).

5-Minute bird counts (5MBC)

At each vantage point the point counts were followed by a 5-minute bird count (5MBC), during which all birds, native and introduced, were recorded as heard or seen. This count is also a standard method which provides a measure of relative abundance for each species. This sampling includes all species, native and introduced.

Wetland, lake and river birds (Hydro Lakes and Lagoons)

Other than the Dam C Reservoir, located just north of the Stage 1 windfarm area, there are no large ponds or associated vegetated wetland systems, that would provide habitat for divers, dabblers and waders and cryptic wetland species. Several point count sites were located on ridgelines east and west of Dam C to capture any movements to or from this small reservoir.

West and south of the site are large and small hydro dams and associated lagoons and wetlands which are part of the Waipori and Deep Stream Hydroelectric Power Schemes. Six Vantage Points were identified with views of these lakes/reservoirs and surrounding habitats. For these locations a five-minute point count was carried out, as well as more detailed descriptions of any threatened or at-risk species seen.

The locations were chosen to sample as much of the range of habitats found within the site as possible as presented in Table 3. The vantage points are shown on See Map 3 (page 13) and a photograph of four of these is provided in Figure 2 (page 15).

Table 3: Lake and pond 5-Min Bird Count sites (See Map 3, page 13).

Vantage Point	Location	Vegetation / Habitat
Dam-01	Lake Mahinerangi	Lake and margins, Includes Waipori Township and lagoon.
Dam-02	Lake Mahinerangi	Lake and margins, Mahinerangi Road Bridge looking east and west.
Dam-03	Loch Luella (Lagoon 'B')	Embayment of Lake Mahinerangi and Pioneer Stream wetlands
Dam-04	Lake Mahinerangi	Lake margin, south side looking north.
Dam-05	Loch Luella (Lagoon 'A)'	Embayment of Lake Mahinerangi with plantation pine forest margin.
Dam-05	Deep Stream Reservoir near Black Rock Reserve	Small hydro dam, Deep Stream, Lammerlaw Ranges tussock grasslands and shrublands.

Incidental Observations

In addition to standardised surveys, the observers recorded any incidental observations of key species (threatened or at risk) during their daily surveys while travelling between vantage points.

Specifically, if a falcon, or migrant bird species was observed the field team were required to focus on that bird, recording flight paths and behaviours, until it had departed.

Cryptic Bird Surveys

Two cryptic marsh and wetland bird species, the Australasian bittern and the fernbird are known to be present in the vegetated margins and associated wetlands found within the Mahinerangi Lake complex.

However, it was determined that there were no equivalent habitats within the MWF Site that would support populations of either species, therefore no cryptic bird surveys were necessary.

Bioacoustic Recorders

To supplement weekly observations of bird movement bio-acoustic surveys were conducted to capture bird activity including potential traverses of migratory species known to be vocal when in flight (e.g. pied oystercatcher, godwit, banded dotterel, pied stilt).

This survey covered the peak of migrant departure (mid-January to mid-February) of pied oystercatcher, banded dotterel and pied stilt.

Acoustic sampling was undertaken in accordance with proposed protocols from (Abrahams, 2018) with minor adjustments to specifically target migrant species

- Acoustic Recording Devices (ARD) were deployed in summer (3 January until 14 February 2025). Recorders were set to record upon deployment for 24 hours a day, to capture departures and flights that would not be seen by Urtica observers during the two weeks of point count surveys.
- Eight ARDs were used for this study, each placed at a point count site.
- The ARDs were installed with a clear line of site across the study area and were located a minimum of 1.5m above the ground on a tree or fence post. The locations of these ARDs are shown below in Map 3. Photos of the sampling locations are provided in Figure 2.
- Once the ARDs were retrieved, the audio recordings were downloaded and analysed on Kaleidoscope Pro, an avifauna bioacoustics analysis program.

3.5. Wildlife Approvals under Fast-track Approvals Act

- Condition 27 required comprehensive falcon monitoring to identify any nests within 5km of the wind farm site, determine breeding success, record any bird strike and record incidental observations. If the monitoring identified any breeding failure due to the operation of the wind farm, then a mitigation programme and further monitoring was required. To achieve these requirements, the consent holder obtained wildlife authorities to place transmitters on a number of falcon to track their movements.
- An additional round of monitoring of falcon has been recommended, and an approval under Schedule 7 for the placing of transmitters has been sought. The information requirements contained in Schedule 7 are provided in an updated Avifauna Monitoring and Management Plan (Boffa Miskell Ltd, 2025a).

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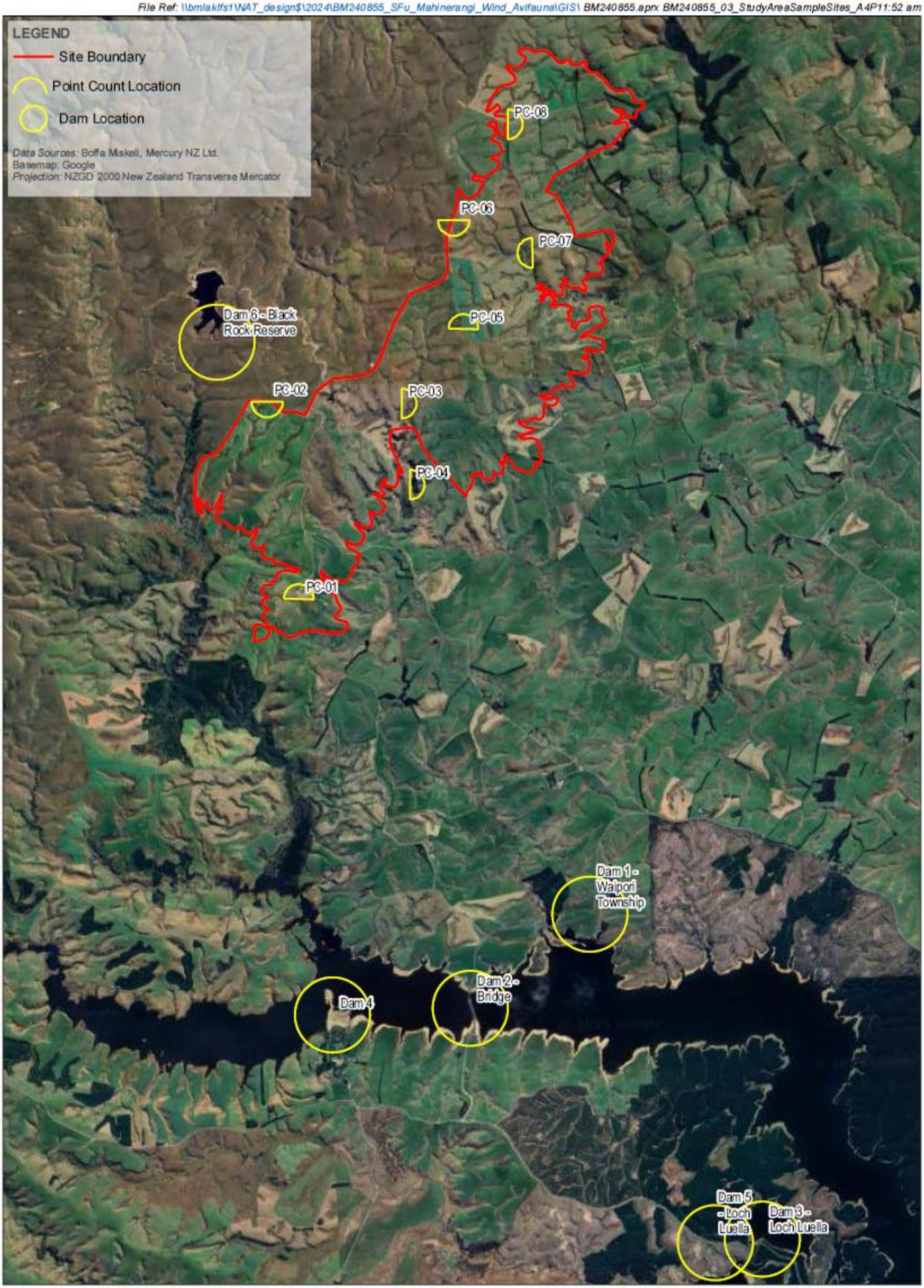

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MAHINERANGI WIND FARM

The Study Area and Sample Sites

Date: 13 June 2025 | Revision: 0

Plan prepared for Mercury NZ Limited by Boffa Miskell Limited

Project Manager: Stephen.Fuller@boffamiskell.co.nz | Drawn: LJa | Checked: SFu

Map 3

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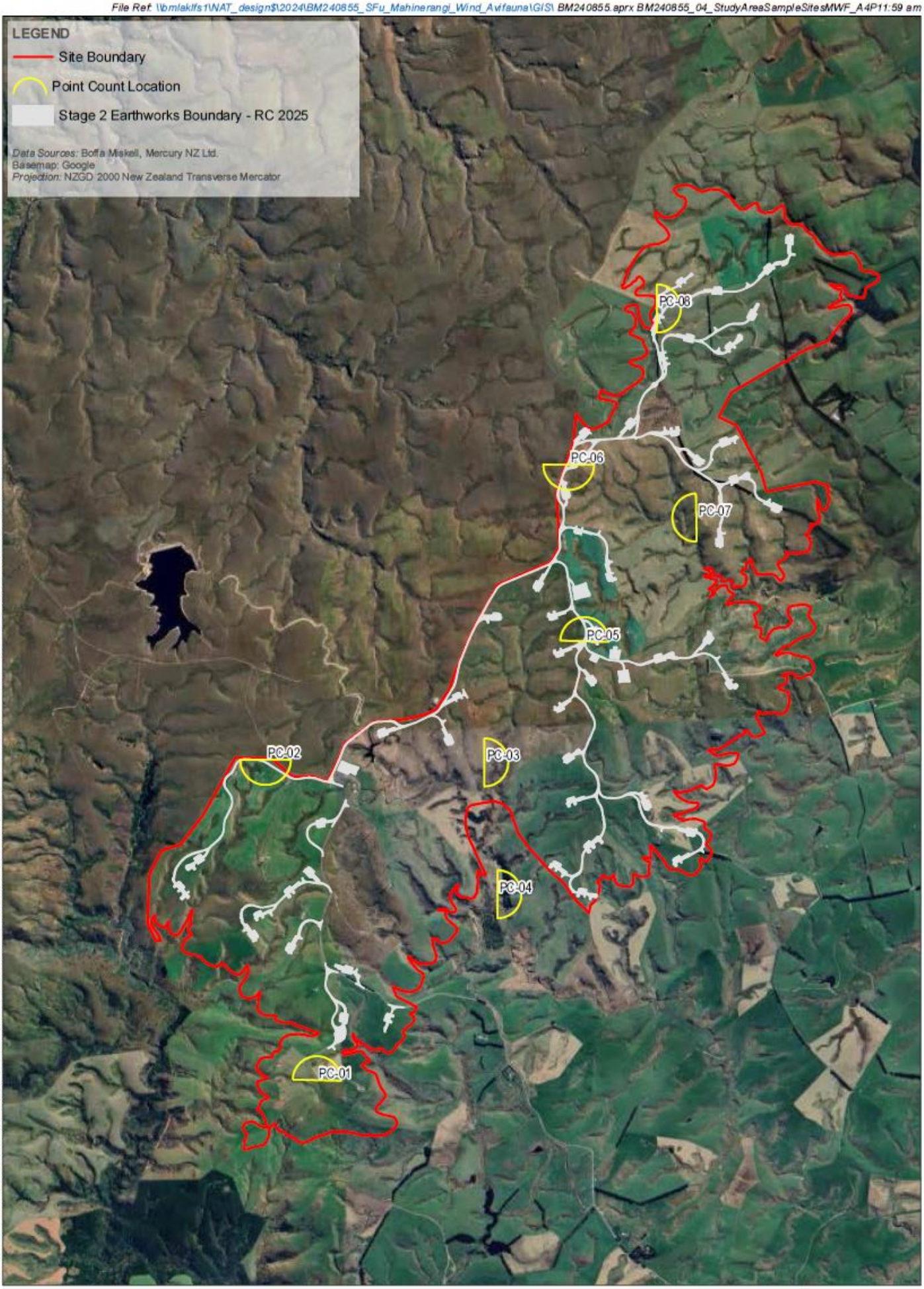

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MAHINERANGI WIND FARM

The Wind Farm Site and Sample Sites

Date: 13 June 2025 | Revision: 0

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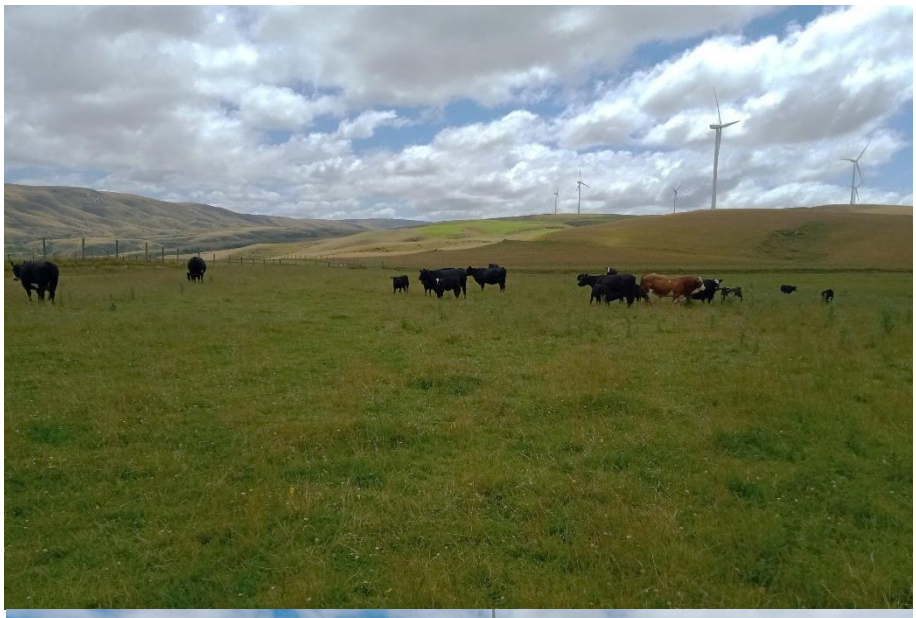
Project Manager: Stephen.Fuller@boffamiskell.co.nz | Drawn: LJa | Checked: SFu

Map 4

Figure 2 Site Photos of Avifauna Sample Sites and associated, representative, habitats.



Sample Site PC01: Within the Stage 1. Improved pasture on rolling hills.

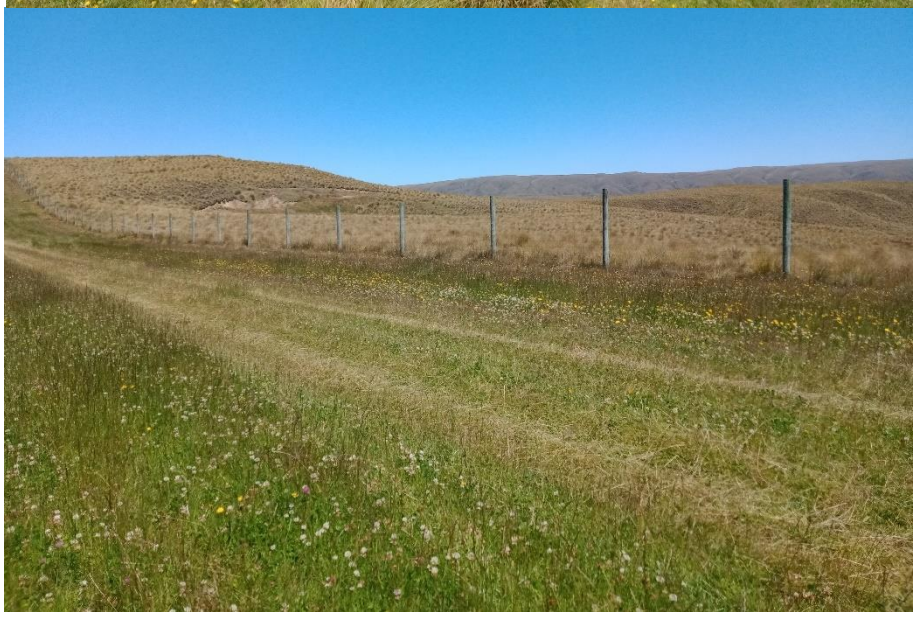
Sample Site PC02: Within the Stage 1. Improved pasture on rolling hills.

Sample Site PC03. Within the Stage 2 looking toward the ridgeline with proposed turbines 34, 38 and 39.

Improved pasture on rolling hills overlooking several incised streams with rough pasture and scattered native tussocks and shrubs. Some exposed rock outcrops above the waterways.

Sample Site PC04.
The larger of two forest remnants adjacent to but outside the Wind Farm Site.
Rolling hills of improved pasture, with shrublands above a remnant of native beech dominated forest in the rocky Broad Stream gully (RAP 9 Black Rock).
Rock outcrops throughout.
The only falcon nest site near the project was in this location (see Map 7).

Sample Site PC05.
Looking south toward proposed Turbines 25 and 30, and 31.
Rolling hills with rough pasture and scattered native tussocks.
Stage 1 of the windfarm in the distance.



Sample Site PC06.
Looking south toward proposed turbines 20, 21, and 23.
Rolling hills in improved pasture to the left, tussock grasslands regenerating in pasture of the Lammermoor Ranges to the right.

Sample Site PC07.
Looking west toward proposed turbines 19, 20 and 22.
A mix of improved pasture and croplands on rolling hills with regenerating tussock grasslands in incised gullies. Rocky outcrops in some areas.

Sample Site PC08.
Looking east toward proposed turbines 3, 4, 5 and 8.
Improved pasture and shelterbelts on rolling hills at the north end of Stage 2.

Near Sample Site Dam 01.
Looking across Lake Mahinerangi, the Waipori Village centre right.
Lammerlaw Road

Sample Site Dam 2
On Mahinerangi Road bridge.
Mahinerangi Road

Sample Site Dam 03.
Loch Luella (Lagoon 'B') with plantation pine providing shelter from the North.
Waipori Falls Road.

Sample Site Dam 04.
Looking across river outfall terrace on the margins of Lake Mahinerangi.
Waipori Station Road

4. Desktop Results - Prior Investigations

4.1. Summary of Studies

Three studies were conducted as part of the original consenting process, and to meet conditions of consent for construction of Stage 1 of the MWF. They were:

- The original effects assessment carried out in Jan and Nov 2006 (Kingett Mitchell Ltd, 2006).
- Pre Construction Falcon breeding and territory studies carried out over 3 breeding seasons:
  - 2007/2008 (Nesting Sep-Feb),
  - 2008/2009 (Nesting Sept-Feb, Radio Tracking 20 Jan – 30 Apr)
  - 2009/2010 (Nesting Sept-Feb)
- Post construction falcon breeding and territory studies carried out over a further 2 breeding seasons with all results from 2006/07 to 2011/12) summarised in 2012 (Golder Associates Ltd, 2012).
  - 2010/11 Nest Survey (Sept-Dec). Radio tracking (10 January and 24 April 2011.)
  - 2011/12 Nest Survey (Sept-Dec). Radio tracking (10 January and 24 April 2012.)
- Post construction bird strike monitoring was carried out for two years (Golder Associates, 2013).
  - 1 May 2011-30 Apr 2012
  - 1 May 2012 to 30 Apr 2013.

  It was concluded from both the bird strike monitoring, the tracking of individual birds, and from international papers, that falcon collision was highly unlikely.

4.2. Assessment of Effects (Kingett Mitchell 2006)

An assessment of avifauna within the MWF environs was compiled from previous surveys undertaken in the vicinity such as the New Zealand Bird Atlas (Ornithological Society of New Zealand, 2002), and from field observations during ecological surveys undertaken in January 2006 and September 2006 (Kingett Mitchell Ltd, 2006). Taxa were identified and general abundance and location/ activity recorded.

In total 34 bird species (26 native and 8 introduced) were recorded by desktop and field surveys within the MWF Site and the surrounding environment. These species can be divided into those seen and previously recorded within the MWF Site, and those seen and previously recorded in and around Lake Mahinerangi. All but one of the native species with a Conservation Status (Hitchmough, 2002) were seen at Lake Mahinerangi or elsewhere in the Waipori Ecological District (ED) but were not seen within the MWF Site. The only native species with a conservation status recorded within the Site was the falcon.

On the basis of these investigations, the ecological effects assessment concluded that effects on the common pastoral species found within the site, or to species which are vagrants to the site or species that occasionally traverse the site, would be less than minor. The only species of concern was the eastern New Zealand falcon due to a lack of information on the local population. A range of recommendations for additional pre and post construction studies were developed accordingly.

A complete list of species observed during this study are provided in Appendix 4 (page 69).

4.3. Falcon Monitoring (Golders 2006 - 2012)

Introduction to the Falcon

Three varieties of New Zealand Falcons are recognised that differ in size, colour and habitats: the 'bush' falcon, the 'southern falcon' and the 'eastern falcon' which is found at this site. The eastern falcon is the largest of the three falcon varieties and has a conservation status of Threatened - Nationally Vulnerable. This classification describes a species with a moderate population size (between 1,000 and 5,000 mature individuals), and a population which is currently considered stable (+/- 10%). However, qualifiers note continued conservation research is required (CR) due to a lack of data on the population and trends (DPS, DPT).

Tussock grassland and pastoral farmland such as that within the vicinity of MWF is suitable foraging habitat for both New Zealand falcons (Heather & Robertson, 2000; Lawrence, 2002). Falcon prey upon small birds and mammals, and open grassland sites are favoured hunting grounds.

Falcon typically nest where small birds are abundant, usually in sites offering unobstructed views, easy access, protection from weather and freedom from disturbance (Marchant et al., 1993). For the falcon such sites are often simple scrapes beneath rocky outcrops or in sheltered sites, generally on the sides of valleys with good views of the surroundings and opportunities for nest defence.

Conditions of Consent

Falcon monitoring requirements were detailed in Consent Condition 25D which required preparation of an Ecological Monitoring and Management Plan, Condition 26 which required Bird Strike Monitoring, Condition 27 which required monitoring of falcon breeding and behaviour, and Condition 28 which required pest control.

Golder developed the 'Mahinerangi Wind Farm Environmental Monitoring Plan and Report' (2011) with a methodology designed to satisfy these conditions. The method was agreed to by Clutha District Council (CDC) and Department of Conservation (DOC).

Falcon Monitoring (Condition 27)

The following is drawn from the final MWF falcon monitoring report (Golder Associates Ltd, 2012).

Surveys for falcon were undertaken within and adjacent to the MWF Site for six consecutive breeding seasons starting with pre-construction surveys in 2006/2007, 2007/2008 and 2008/2009, then construction surveys in 2009/2010 and 2010/2011, and then the 2011/2012 breeding season post commissioning of the windfarm

The monitoring included nest searches within 5 km of the MWF Site, assessing breeding success for all known pairs, and radio tracking of four falcons between 24 January and 24 April 2012. During these surveys, a maximum of five pairs of falcons were confirmed to be simultaneously breeding within 5 km of the wind farm site (See Figure 4). However, a high rate of 'natural' mortality and recruitment of falcons was recorded so that this number fluctuated year on year.

Causes of adult and chick mortality are discussed in the report. They included unseasonal snow storms, there was one confirmed predation of an adult on a nest, and there was also one confirmed collision of a juvenile falcon with a vehicle on Lake Mahinerangi Road (4.5 km south of the MWF Site). There were no recorded mortalities associated with construction or operation of the wind farm.

The nest sites were typically on rocky outcrops with some nest site protection in the form of bush cover, rank pasture grass and/or tussock grasslands. Figure 3 shows four examples of nest sites seen during these studies (Golder Associates, 2009).

Within the wind farm site there are several rocky outcrops, but these were grazed and lacked any significant stands of trees, shrubs or tussock cover. There was one observation of a nesting attempt in a paddock, which was believed to have been abandoned due to cattle grazing. These results confirmed that suitable nests sites are largely confined to the steep, rocky escarpments in the adjacent Deep Stream catchment to the north and west of the site and there were few suitable nesting sites present within the Wind Farm Development Area.

In terms of habitat use, the following table was provided showing the % of time spent in each available habitat by the Thomas block falcon which nests around 1 km south west of the nearest Stage 1 turbine.

Table 4: Percentage habitat use by the Thomas block male falcon (From Golder 2009).

Habitat type	Number of locations	Proportion of locations
Tussock grassland	*113*	*42 %*
Low producing grassland	*72*	*26 %*
High producing exotic grassland	*44*	*16 %*
Indigenous forest	*30*	*11 %*
Manuka/ kanuka	*12*	*4 %*
Exotic forest	*1*	*0.003 %*
TOTAL	*272*	

In terms of territory size, this study showed that the falcon had large territories between 20 and 30 km^2, which were centred around nest sites some distance from the wind farm. They foraged predominantly in the tussock grasslands in the Lammerlaw Ranges, spending relatively small amounts of time within the wind farm site.

With respect to the effects of the construction and operation of Stage 1 of MWF on falcon nesting, there was no indication that the presence of the operational turbines led to a change in nest location or timing. However, given the nearest nest site to a turbine was 600 m and most were 1 km or more distant from operational turbines, this lack of nesting disturbance was not surprising. Nest disturbance is normally only likely if activities come within 200 m of a nest site (Seaton et al., 2009).

Where possible the male of each breeding pair was radio tracked to determine home range size and core use zones ('kernels'). Kernels were used to determine the likelihood that birds would be active within the wind farm site, and to what extent or frequency. All falcons used portions of the consented wind farm site. All monitored falcons survived the monitoring period and birds whose territories overlapped Stage 1, continued to use the operational wind farm area.

From the sum of evidence resulting from both the falcon monitoring and bird strike monitoring programmes at MWF, it was concluded that falcon bird strike is highly unlikely, and that there was no evidence of displacement of birds from the operational wind farm site, or that the presence of the turbines affected nesting given the separation at this site.

The following images (Figure 3) show examples of the terrain where falcon were observed nesting. Figure 4 provides an overview of the falcon territories that were monitored between 2009 and 2012.

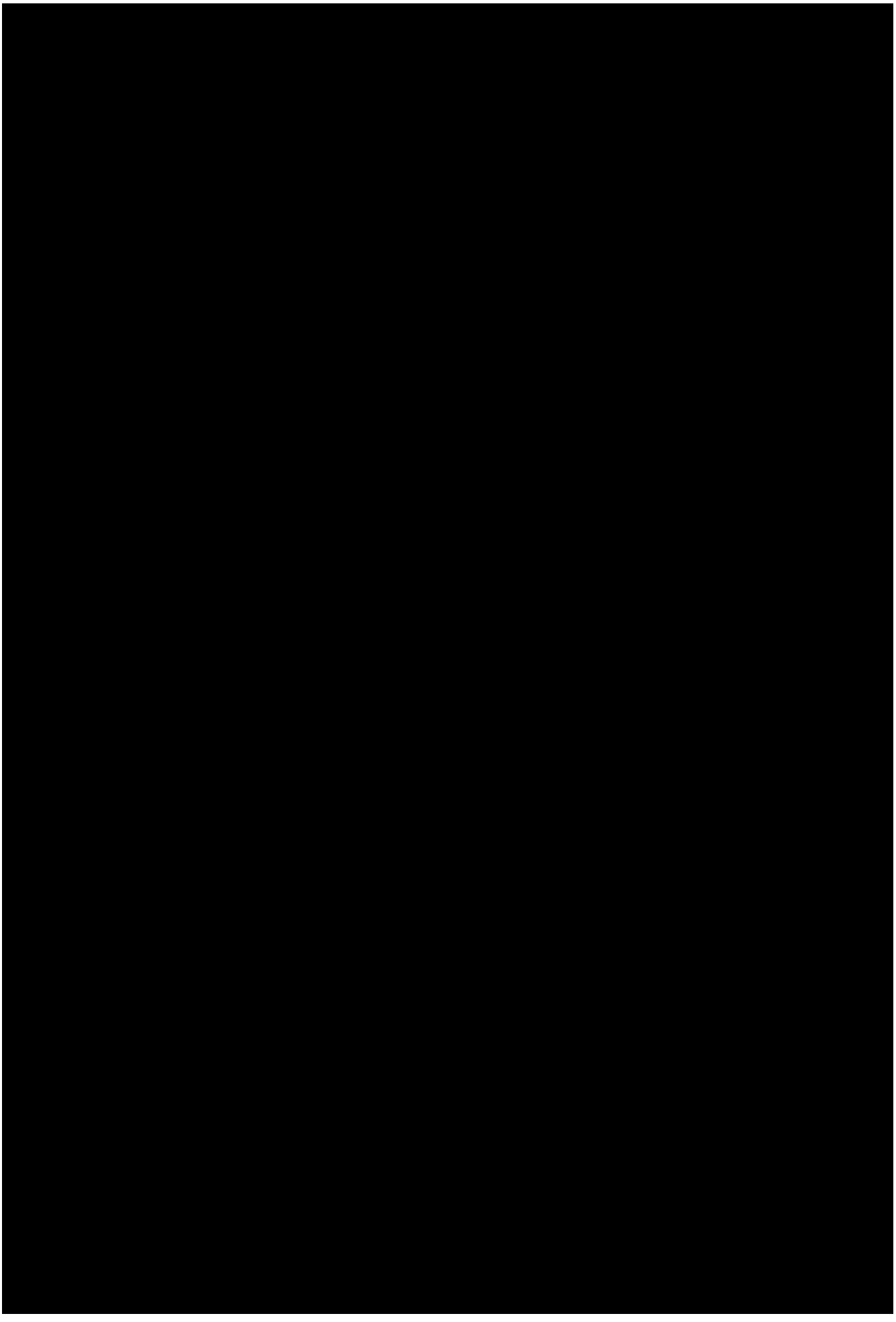
[redacted]

Two 15-day old chicks [redacted]

5-day old chick [redacted]

Two eggs [redacted]

[redacted]



4.4. Bird Strike Monitoring (Condition 26)

The following is drawn from the final monitoring report (Golder Associates, 2013).

Following commissioning of Stage 1, two years of bird strike monitoring was conducted covering 2011 and 2012. This was done in accordance with the "Mahinerangi Wind Farm Ecological Management and Monitoring Plan" (Golder Associates 2010).

During the monitoring, plots beneath all 12 of the Stage 1 turbines were searched approximately weekly during the bird breeding season from 1 September to 31 December and bi-weekly during the non-breeding season from 1 January to 30 August. An appropriate sampling method was used which accounted for sampling biases.

Analysis of the data collected provided an estimated per annum mortality rate (i.e., the observed mortality rate adjusted for searching bias) of 1.5 birds per turbine per year over the first year, which dropped to 0.7 birds per turbine per year for the second year.

The definition of 'significant adverse effect' in consent condition 26 i(d) is "*a strike rate of more than 0.05 individuals per turbine per year on all species*". However, we now know from this and other wind farm sites in New Zealand that a rate of 0.05 birds per turbine per year is improbably low (See Section 8, , page 52 and predictably this threshold was exceeded in both years of monitoring.

In addition, the definition of a significant adverse effect does not distinguish between introduced species and indigenous species. The threat status of a species is one of five criteria for determining the need for a section 128 review of the Consent condition if a significant effect occurs (*Condition 26 iv) a) the species of birds involved and in particular, the level of protection afforded to that species under the Wildlife Act 1953*). However, it relies on the classification of Hitchmough et al (2007) which is considerably out of date.

During the strike monitoring, three species of conservation interest were active within Stage 1 of MWF; New Zealand falcon, pied oystercatcher, and pipit. None of these experienced a mortality. Golder's final monitoring report interpreted this to mean that while the threshold of 0.05 birds mortalities per turbine per annum was exceeded, no mortality to any avifauna species of conservation interest was detected and therefore no actual significant adverse effect of Stage 1 MWF operation was found.

The report concluded that a low perceived risk remained for the fully constructed MWF and recommended that the construction and post construction monitoring of falcon breeding success and mortality be repeated when Stage II commenced.

Table 5: Observed bird strike mortality at Mahinerangi Wind Farm May 2011 to April 2013.

Name	Status	Mahinerangi (2 years)	%
Magpie	Introduced	6	37.5%
Skylark	Introduced	4	25.0%
Australasian Harrier	Native - Not Threatened	1	6.3%
Mallard	Introduced	1	6.3%
Southern black-backed gull	Native - Not Threatened	1	6.3%
Paradise shelduck	Native - Not Threatened	1	6.3%
Silvereye	Native - Not Threatened	1	6.3%
Rock Pigeon	Introduced	1	6.3%
TOTAL		16	100.0%

5. Desktop Results - Avifauna Records

5.1. Summary of Findings

This section looks at any changes to habitat within MWF, reviews changes to the conservation status of bird species, and considers all current sources of information on local avifauna and avifauna habitat.

- Since the Stage 1 studies were completed the land use of MWF has remained largely unchanged. Areas of pasture remain in pasture, shelterbelts occupy the same areas, and there is no obvious increase in the distribution of tussock grasslands regenerating in pasture. Overall, it is concluded that there have been no changes to the vegetation and habitats within the MWF Site that would attract more falcon to the site or encourage breeding within the site.
- The Conservation Status of falcon has not changed since the post construction falcon monitoring was completed, and so the conclusions in those reports relating to the threat status of eastern falcon are appropriate. Similarly the conservation status of pied oystercatcher, NZ pipit, and little shag, has changed from not threatened to at-risk since the original assessment.
- A number of sources of bird data were reviewed to determine if there have been any changes or new observations of birds within and adjacent to the Site. Considering site specific surveys from 2002, 2006 and 2025, current bird atlas surveys, and information compiled by Otago Regional Council (ORC), there does not appear to have been significant changes in the presence of bird species locally and utilising the MWF Site.
- There have been observations of waterbirds traversing the site and occasionally utilising some small stock ponds at the north end of the Site (outside the Windfarm Development Area), but these observations are rare.

5.2. Review of Vegetation & Habitats

A review was carried out of the farming activity and habitat availability within the Wind Farm Development Area to determine if there have been changes to the extent and distribution of vegetation and habitats that could have result in changes to the abundance and distribution of avifauna. This was based on the Vegetation, Wetland, and Terrestrial Invertebrate Assessment (SLR Consulting NZ, 2025). Overall, it was concluded that the landscape within MWF has not changed in any meaningful way since 2006 (other than Stage 1 being constructed). In summary:

- Farm practices overall do not appear to have changed, sheep, beef and winter crops being the primary activities.
- Areas that were pasture and cropland in 2008 are still pasture and cropland today.
- There have been no reductions to the small areas of indigenous forest which lie in a gorge just outside the MWF Site in Broad Stream. This area is a Recommended Area for Protection (RAP 9 Black Rock).
- There are no new shelterbelts. A small area of plantation forestry at the north end of the MWF Site has been felled and replanted.
- No additional stock ponds have been formed, all are very small and grazed to their margins.
- It appears from these aerial images that overall that there has been some degree of intensification of pastural farming over parts of the site, which will further reduce its habitat value for nesting and foraging by falcon.

It is concluded that the vegetation and habitats remain largely unaltered from the earlier baseline studies, and so there will not have been a significant change in the diversity or distribution of birds within the landscape.

5.3. Review of Conservation Status

The original ecological effects assessment from 2006 applied the conservation status of species from Hitchmough (2002). The conservation status of birds was updated by Miskelly et.al. (2008) and again by Robertson et.al. (2021), which is used for this assessment. These changes have been reviewed to determine if there have been any consequential changes (See Appendix 3).

- The Conservation Status of eastern falcon increased from gradual decline to Threatened Nationally Vulnerable in 2008. This was before the pre and post construction studies. Falcon was therefore assessed in those studies using the correct classification.
- Three other species recorded within the MWF Site which in 2006 as not threatened, now have a conservation status as follows:
  - The NZ pipit (At Risk, Declining)
  - The pied oystercatcher (At Risk, Declining), and
  - The little shag (At Risk, Relict).
- This assessment has considered these changes.

5.4. Bird Observations

In this section data from Kingett Mitchell (2006) assessment, surveys by Ryder (2002 and 2020), eBird atlas and eBird New Zealand (2025), and the BML 2025 studies have been pooled to identify if any new species have been identified locally since the completion of earlier studies.

Bird observations have been divided into three tables:

- Table 6 presents all observations of birds found within the MWF Site, primarily pastoral species.
- Table 7 presents all observations of birds which are only found or largely found at Lake Mahinerangi and associated the ponds, and wetlands.
- Table 8 presents species recorded in eBird that were not recorded by either Ryder in 2006 or BML in 2025. The reasons for their absence are noted.

5.4.1. Mahinerangi Wind Farm Site

Table 6 relates to the MWF Site and includes all native species seen at the site. A full list including introduced species can be found in Appendix 5. The observations include both Kingett Mitchell 2006 and BML 2025 studies. Five species with a threat status have been recorded within the site, falcon, black-billed gull, pied oystercatcher and little shag. All other native species are common and widespread. The falcon is the focus of this study, and its presence has been confirmed.

Table 6: Birds observed by KM 2006 and BML 2025 predominantly within the MWF Site, or equally between the MWF Site and the Lake Sites (Native species only).

Common Name	Conservation Status (Robertson et al. 2021)	KM (2006)	BML (2025)	Observations
New Zealand falcon (Eastern)	Nationally Vulnerable	Y	Y	Seen at Lake Mahinerangi, MWF, and more widely in the local landscape.
Black-billed gull	At Risk, Declining		Y	Mainly seen at lakes. In 2025 114 seen at lakes, 1 seen in flight over MWF.
New Zealand pipit	At Risk, Declining	Y	Y	Small population widespread within the Site. 17 observations in 2025.
Pied oystercatcher	At Risk, Declining	Y	Y	Seen in large numbers in farmland surrounding Lake Mahinerangi. 1 group seen at MWF in Dec 2024, several small groups in January 2025 prior to departure north.
Little shag	At Risk, Relict	Y		Predominantly seen at Lake Mahinerangi complex. 1 seen in flight over MWF in 2006. None seen in 2025.
Grey warbler	Not Threatened		Y	Almost all seen at forest remnant PC4
New Zealand fantail	Not Threatened		Y	Only 1 seen at forest remnant PC4.
Paradise shelduck	Not Threatened	Y	Y	Abundant at Lake Mahinerangi. Occasionally seen around small farm ponds in MWH site. In 2025 143 observations at lakes, 14 at MWF.
Silvereye	Not Threatened		Y	Common in forests surrounding Lake Mahinerangi. At MWF almost all seen at forest remnant PC4.
Southern black-backed gull	Not Threatened	Y	Y	Abundant across the site and wider landscape. 213 observations in MWF, 653 at lakes.
Spur-winged plover	Not Threatened	Y	Y	Mainly seen Lake Mahinerangi. In 2025 16 at MWF, 120 observations at Lake Mahinerangi.
Australasian harrier	Not Threatened	Y	Y	Seen at both Lake Mahinerangi and MWF equally.
Welcome swallow	Not Threatened		Y	Predominantly seen MWF
White-faced heron	Not Threatened	Y	Y	Predominantly seen on farmland surrounding Lake Mahinerangi and lake margins. In 2025 3 seen in MWF, 43 observations at Lake Mahinerangi.

It is noted that the black-billed gull and little shag were only seen once traversing the MWF Site. The pied oystercatcher appears to congregate at Lake Mahinerangi seasonally as part of their migration and over this period some disperse to surrounding farmland to forage.

5.4.2. Lake Mahinerangi and Wetlands

Table 7 presents the bird species which were seen or recorded at Lake Mahinerangi including the embayment's of Loch Luella, and associated fen wetlands in Pioneer Stream that form part of the Mahinerangi Lake complex. Surveys include BML Sample Sites, Lakes 1 to 6, as well as earlier surveys of the lake by Ryder 2002 and Kingett Mitchell 2006.

Table 7: Birds Observed only on Lake Sites or mostly seen on lake sites by KM and BML, as well as species. (Native species only).

Common Name	Conservation Status	Ryder (2002)	KM (2006)	BML (2025)	Preferred Habitat
Australasian bittern	Nationally critical	Y			Densely vegetated wetlands and swamps, feeding along edges of pools and streams.
Black stilt	Nationally critical		Y		Breeding pairs are now confined to the area between the Lake Tekapo and Lake Pukaki basins. Outside the breeding season most move locally within the Mackenzie Basin, small numbers visit the Canterbury coast and north to Kawhia and Kaipara Harbours in the North Island.
White heron	Nationally critical	Y			Coastal and inland waterways, wetlands and streams. Nest in southern Westland. Feeds in shallow waters of wadeable depth.
New Zealand falcon (Eastern)	Nationally Vulnerable	Y		Y	Distributed throughout NZ in native bush and isolated high back-country valleys. Typically nest is a scrape of grass or sticks under overhanging rocks on steep slopes.
Grey duck	Nationally Vulnerable	Y			Inland ponds and waterways with submerged vegetation. Feeds in shallow water. Nests away from water amongst vegetation.
Banded dotterel	At Risk, Declining	Y			Coastal areas and margins of rivers. Breeds on inland riverbeds and lake shores.
Black-billed gull	At Risk, Declining	Y	Y	Y	Breed mainly in the South Island on larger shingle riverbeds. Following breeding birds move to the coast. Feed on aquatic insect and land insects, often seen on freshly ploughed fields.
New Zealand fernbird (South Island)	At Risk, Declining	Y			Swamp land and adjacent rough country.
Pied oystercatcher	At Risk, Declining	Y	Y	Y	Estuaries, margins of waterways, boggy ground. Feeds in soft sediments in water of wadeable depth.
New Zealand pipit	At Risk, Declining	Y	Y	Y	Grasslands. A pastoral species.
Royal spoonbill	At Risk, Naturally Uncommon	Y			Estuaries and river mouths. Feeds in shallow, wadeable waters. Nests on coastal islands.
Black shag	At Risk, Relict	Y		Y	Coastal and inland waters, ponds and creeks. Nest on cliff faces, trees and in swamp land.
Little shag	At Risk, Relict	Y	Y	Y	Coastal and inland waters, streams and rivers. Nest in trees near lakes, ponds, swamps and inlets. Feeds in deep waters by diving.
Cattle egret	Non-resident native, Migrant	Y	Y		Wide variety of habitats but mainly along lake shores and in wet pasture.
Black swan	Not Threatened	Y	Y		Lakes and estuaries. Feeds in shallow areas on submerged macrophytes. Nests on lake shores.
Grey teal	Not Threatened	Y		Y	Lakes, ponds, lagoons. Feeds by dabbling, on water insects, snails and plants.
Grey warbler	Not Threatened			Y	A species of forest and scrub
New Zealand scaup	Not Threatened			Y	Diver. Large deep lakes.
Paradise shelduck	Not Threatened	Y	Y	Y	Pastures, swamps, bogs and wetlands. Nest on dry ground amongst vegetation. Feeds on soft grasses and herbs, some insects.

Common Name	Conservation Status	Ryder (2002)	KM (2006)	BML (2025)	Preferred Habitat
Pied stilt	*Not Threatened*	*Y*		*Y*	*Open wetlands, swamps, flooded paddocks and boggy ground. Feeds in soft soils or sediment in shallow water. Nest on dry around, particularly delta areas of lakes.*
Silvereye	*Not Threatened*			*Y*	*A species of forest and scrub*
Southern black-backed gull	*Not Threatened*	*Y*	*Y*	*Y*	*Wide variety of habitats. Nests in dry areas without vegetation.*
Spur-winged plover	*Not Threatened*	*Y*	*Y*	*Y*	*Pasture grassland, marshy ground, river margins. Nests on delta areas of lakes.*
Australasian harrier	*Not Threatened*	*Y*	*Y*	*Y*	*Common throughout country, especially pastoral land. Feeds mainly on small mammals, insects, lizards, carrion.*
Welcome swallow	*Not Threatened*	*Y*		*Y*	*Found in open country close to water. Feeds on small flying insects, often above open water.*
White-faced heron	*Not Threatened*	*Y*	*Y*	*Y*	*Margins of waterways, tidal flats, boggy ground and wetlands. Nest in tall trees. Feeds in shallow water of wadeable depth.*

The birds seen in 2025 cover the same groups as those seen in 2006. Because of the presence of extensive wetlands and areas of forest, more threatened and at-risk species are present at Lake Mahinerangi than within the MWF Site which is largely pastoral.

The only one new species was recorded in 2025, was NZ scaup seen in a small group on Loch Luella. This is a diving duck which is common on large, deep, freshwater lakes, including hydro-electric lakes. There is no habitat for this species within the MWF Site.

5.4.3. eBird

Table 8 presents the eleven bird species which were recorded by eBird within 10km of the site, but which were not seen by either the KM study, or the BML study.

One species, the Eurasian coot, has a conservation status of Naturally Uncommon. However, Coots are entirely aquatic, preferring freshwater lakes and ponds with submerged vegetation and reedy, grassy islands or edges. There is no habitat for this species within the MWF Site.

Six other species are native, but are widespread, common, and not Threatened. Their absence from the site is also likely to be due to the lack of preferred habitat within the MWF Site. The remaining four species are introduced.

Table 8: Birds recorded within the wider landscape (eBird 2025) but not seen at either the Lake sites or within the MWF by KM 2006, or BML 2025 (Native species only).

Common Name	Conservation Status (Robertson et al. 2021)	Comments
Australian coot	*At Risk, Naturally Uncommon*	*eBird 2025, Not seen KM or BML*
Australasian shoveler	*Not Threatened*	*eBird 2025, Not seen KM or BML*
Bellbird	*Not Threatened*	*eBird 2025, Not seen KM or BML*
Brown creeper	*Not Threatened*	*eBird 2025, Not seen KM or BML*
New Zealand pigeon	*Not Threatened*	*eBird 2025, Not seen KM or BML*
Pukeko	*Not Threatened*	*eBird 2025, Not seen KM or BML*
Tui	*Not Threatened*	*eBird 2025, Not seen KM or BML*

Migrants

The various historical studies identify 6 species of migrant present at Lake Mahinerangi. They are black stilt (Nationally critical), white heron (Nationally critical), banded dotterel (At Risk - declining), pied oystercatcher (At Risk - declining), pied stilt (Not threatened), and cattle egret (non-native migrant). No international migrants have been seen at Lake Mahinerangi or within the landscape surrounding the MWF Site. Looking at each species:

- There have been no recent observations of black stilt.
- White heron are seen occasionally on the coastline north and east of Dunedin, typically limited to coastal estuaries and lowland lakes and wetlands. There have not been any recent observations of this species inland of Berwick near Lake Waipori.
- Banded dotterel are similarly seen along the coastline in estuaries lakes and are also seen less frequently within inland farmland. They haven't recently been recorded at Lake Mahinerangi but have been recorded on two occasions (2020, 2021) in pasture to the east of the MWF Site (eBird).
- Pied stilt are seen more broadly within the landscape and have recently (2022) been recorded at Lake Mahinerangi in low numbers (2 – 4 birds).
- Cattle egret have not been recorded at Lake Mahinerangi or near the MWF Site.
- Of the migrant species only the pied oystercatcher has been regularly recorded at Lake Mahinerangi and within the MWF. Eight observations of this species have been made on the Eldorado Track where this road passes through Stage 1 of the MWF. Of these observations five were in pasture and gravels within a few metres of the side of the road, the other 3 were within tussock basins. Also five of these observations were within 25m to 100m of an operational turbine. Finally, three observations were of pairs of birds at the start of the breeding season. No mention was made of nesting behaviour in the eBird records, however, it is likely that some breeding is occurring within the site.

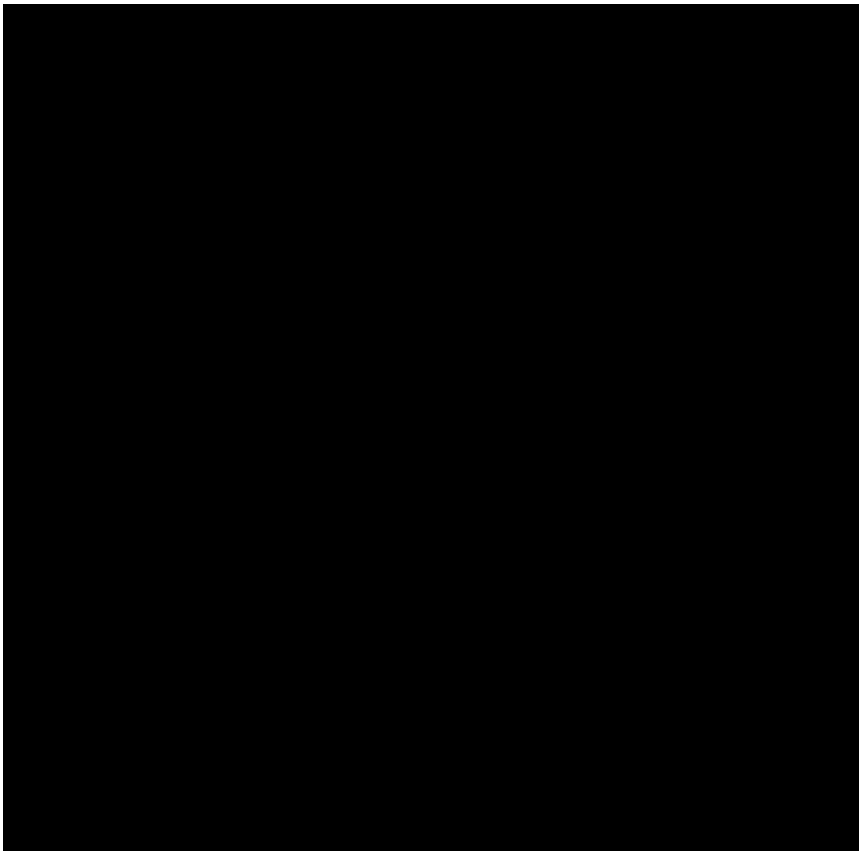


Figure 6: Looking north across Lake Mahinerangi toward Stage 1 of the MWF.

5.4.4. Otago Regional Council - GIS Portal

The Otago Regional Council (ORC) maintains a GIS Viewer[5] which includes "Ecosystems and Habitats in the Otago region". The spatial data was compiled from a number of sources including the Department of Conservation, LINZ; Otago Regional Council; Maanaki Whenua Landcare Research; and the knowledge of local consultants. The distribution of preferred habitat for seven native bird species which are considered significant within the region, are presented in this data set, as well as habitats of forest birds generally:

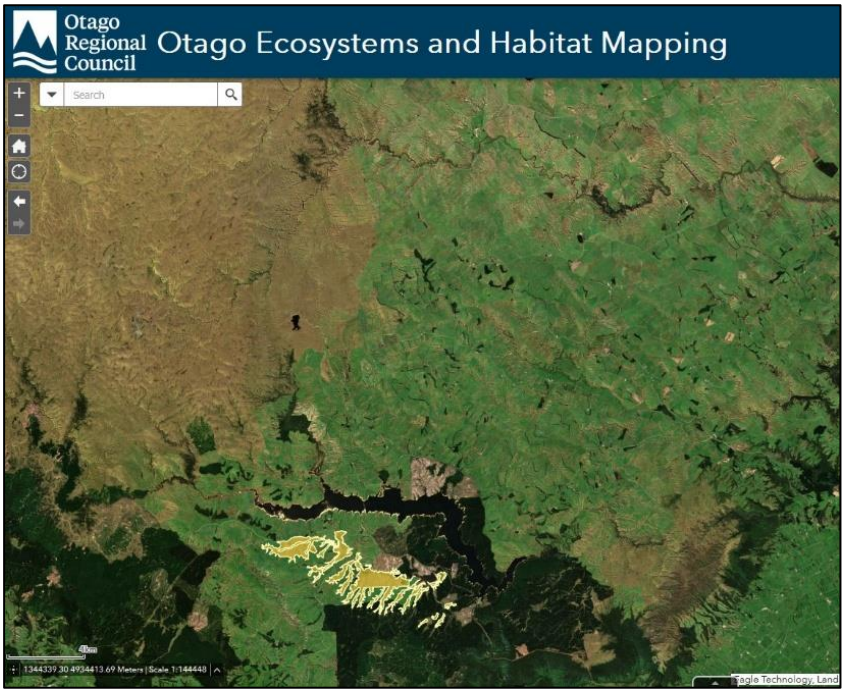
- Of the 7 key species, rock wren, kaka, blue duck, and crested grebe habitat are limited to the Southern Alps and associated hydro lakes; Wakatipu, Wanaka and Hawea.
- Two species, the kaka and yellowhead are limited to large areas of native forest in the southern alps, as well as the forests of the Blue Mountains and Catlins Ranges.
- Fernbird habitat is identified in large wetlands and shrublands along the Otago coastland (Lake Tuakitoto wetlands, Lake Waihola wetlands, Taieri River Mouth, and scrub and wetlands of Swampy Ridge above Dunedin. It has been recorded south of Lake Mahinerangi, although there is no habitat mapped near the MWF Site.
- Habitat for native forest birds is more widespread as shown in
- Figure 7. The closest identified forest habitat to the MWF Site is the Waipori River and some nearby exotic forestry. No native forest habitat is mapped within the MWF Site: Otago Regional Council GIS Portal.

[5] https://maps.orc.govt.nz/OtagoViewer232/?map=7d0ef0d7ba724378a0ba22ecd88f3180

Figure 7: Forest bird habitat from Bittern Habitat from "Ecosystems and Habitats in the Otago region".

Finally, Figure 8 shows the nearest bittern habitat recorded on this site, which lies south of Lake Mahinerangi in the large Pioneer Stream wetlands, and associated Loch Luella embayment. These lie 7.5km to 10 km south of the MWF Site.

Figure 8: Bittern Habitat from "Ecosystems and Habitats in the Otago region"



6. Results – Field Investigations

6.1. Summary of Results

To supplement the prior monitoring, a further two weeks of field work were carried out in January and February 2025. The additional field observations reconfirmed that:

- Falcon are still present within the MWF Site.
- The range of habitats present and the species utilising them.
- The separation between the pastoral MWF Site and Lake Mahinerangi waterbird populations.

In summary:

- The diversity of birds at the MWF Site is relatively low with 25 species in total of which 13 are native. The species are predominantly pastoral, abundant locally and most are not threatened. Five species with a conservation status of threatened or at risk were observed and assessed.
- Falcon were observed at the MWF on 8 of the 10 days. In total there were 17 observations, although they were likely of the same two or three birds, seen repeatedly at a subset of sites. The distribution of observations suggests that two and perhaps three of the original territories are still occupied (Map 6).
- There is a greater diversity of habitat at Lake Mahinerangi including native forest, plantation pine, deep lakes, lake edges and wetlands leading to greater diversity and rarity of birds at this site.
- The surveys observed minimal movement of birds between the lake and the MWF Site. Nine species of waterfowl were seen at the lakes but not seen at the MWF Site and two species were only seen at the MWF Site once when traversing the site.
- All threatened or at-risk species were assessed, and it was confirmed that the falcon remains the key species of concern at this site. In addition, pied oystercatcher breeds within the MWF Site and also requires consideration in this assessment.

6.2. All bird observations

The site investigation carried out over two weeks in January and February 2025 recorded a total of 33 bird species across the MWF Site and Lake Mahinerangi and complexes, and Black Rock Reservoir. Of those, eighteen were native and fifteen were introduced. Of the native species, falcon has a conservation status of Threatened Nationally Vulnerable and five have a conservation status of At-Risk.

A total of 6,415 birds were observed, 1,473 at the eight point-count sites within the MWF Site, and 4,942 birds at the six point-count sites at Lake Mahinerangi and Black Rock Reserve reservoir.

In this section the Regional Conservation Status of Birds (Jarvie et al., 2025) supplementary to the National Conservation Status (Robertson et al., 2021) is referenced with the highest threat status being used.

Full lists of all birds seen, native and introduced are provided in Appendix 5 and Appendix 6.

Table 9. All native species recorded during the 2025 study, all methods and all locations. Sorted by relative abundance.

Common Name	Latin Name	`National Conservation status	Regional Conservation Status	Sum of counts
Southern black-backed gull	Larus dominicanus	Not Threatened	Not Threatened	866
Paradise shelduck	Tadorna variegata	Not Threatened	Not Threatened	157
Welcome swallow	Hirundo n. neoxena	Not Threatened	Not Threatened	153
Spur-winged plover	Vanellus miles novaehollandiae	Not Threatened	Not Threatened	136
Black-billed gull	Larus bulleri	At Risk, Declining	Regionally Vulnerable	115
Pied oystercatcher	Haematopus finschi	At Risk, Declining	Regionally Vulnerable	101
Black shag	Phalacrocorax carbo novaehollandiae	At Risk, Relict	Regionally Endangered	99
New Zealand pipit	Anthus n. novaeseelandiae	At Risk, Declining	Not Threatened	94
Silvereye	Zosterops lateralis	Not Threatened	Regionally declining	90
Grey teal	Anas gracilis	Not Threatened	Not Threatened	84
Australasian harrier	Circus approximans	Not Threatened	Not Threatened	47
White-faced heron	Egretta novaehollandiae	Not Threatened	Not Threatened	46
Grey warbler	Gerygone igata	Not Threatened	Not Threatened	28
New Zealand scaup	Aythya novaeseelandiae	Not Threatened	Not Threatened	25
Eastern falcon	Falco novaeseelandiae 'eastern'	Nationally Vulnerable	Regionally Vulnerable	18
Pied stilt	Himantopus h. leucocephalus	Not Threatened	Not Threatened	16
Little shag	Phalacrocorax melanoleucos	At Risk, Relict	Regionally Vulnerable	4
South Island fantail	Rhipidura f. fuliginosa	Not Threatened	Not Threatened	1
Total				2,080

(Note the counts in this and following tables will represent multiple counts of the same bird/s over multiple visits. They provide a measure of relative abundance only. They are not an estimate of population size).

6.2.1. Habitat Preferences

Table 10 compares the species present and their relative abundance between the open water Lake and wetlands of the Lake Mahinerangi complex (380m a.s.l.), and the pasture and grasslands of the MWF (660m to 780m a.s.l). Only native birds are shown.

Sixteen native species were observed at the Lakes sites in 2025. Those with the largest number of observations (>50) being the southern black-backed gull, paradise shelduck, spur-winged plover, black-billed gull, black shag and grey teal.

Thirteen native species were seen at the MWF Site in 2025. Those with the largest number of observations (>50) were the southern black-backed gull, welcome swallow, NZ pipit, silvereye, and pied oystercatcher.

There were two native species seen at the MWF Site but not at the Lakes sites; the falcon and fantail. There were five native birds seen at the Lakes sites but not the MWF Site; the black shag, grey teal, NZ scaup, pied stilt and little shag.

Table 10 has been sorted by relative abundance between the lake and MWF Sites. This shows a predictable difference in bird presence and observation frequency between the open water lake habitats and the pastoral habitats of MWF.

Table 10. A comparison of native bird presence and relative abundance between the MWF Site, and the Lakes Sites. Using Point Count and 5-Minute bird counts only. Sorted by % presence at each habitat.

Common Name	National and Regional Conservation status as appropriate	Dams All	% Total	MWF All	% Total
Eastern falcon	Nationally Vulnerable	0	0%	10	100%
South Island fantail	Not Threatened	0	0%	1	100%
Grey warbler	Not Threatened	2	7%	26	93%
NZ pipit	Nationally At Risk - Declining	2	11%	17	89%
Silvereye	Regionally declining	17	19%	73	81%
Welcome swallow	Not Threatened	33	22%	120	78%
Australasian harrier	Not Threatened	16	34%	31	66%
Pied oystercatcher	Regionally Vulnerable	3	50%	3	50%
Black-backed gull	Not Threatened	653	75%	213	25%
Spur-winged plover	Not Threatened	120	88%	16	12%
Paradise shelduck	Not Threatened	143	91%	14	9%
White-faced heron	Not Threatened	43	98%	1	2%
Black-billed gull	Regionally Vulnerable	114	99%	1	1%
Little shag	Regionally Vulnerable	4	100%	0	0%
Black shag	Regionally Endangered	99	100%	0	0%
Pied stilt	Not Threatened	16	100%	0	0%
NZ scaup	Not Threatened	25	100%	0	0%
Grey teal	Not Threatened	84	100%	0	0%
Total		1,374		526	

(Note the counts in this and following tables will represent multiple counts of the same bird/s over multiple visits. They provide a measure of relative abundance only. They are not an estimate of population size).

6.2.2. Cryptic bird surveys

The Lake Mahinerangi complex of lagoons, embayment's and wetlands is a known site for two cryptic bird species, bittern and fernbird (Ryder 2002, Kingett Mitchell 2006, eBird 2025).

Within the MWF Site however, there are no large wetland areas suitable for bittern, no densely vegetated ponds, or dense rush and reedlands in wetlands, that would provide habitat for bittern or fernbird. There are only a few small stock ponds within the site, all lie in pasture or croplands and are grazed to their margins.

In the absence of large waterbodies with densely vegetated wetland margins, breeding surveys for bittern using Acoustic Recording Devices (ARDs) were not required.

The Mahinerangi Wind Farm Site lies within several thousand square km of equivalent rolling pastoral land including the Lammerlaw and Lammermoor ranges. There is nothing in the MWF Site that makes it standout or would specifically attract these species to it in preference to another site. So any traverse of the site would be a rare event.

It is concluded that this windfarm does not pose a risk to cryptic species.

6.2.3. Migratory bird surveys

The potential presence of domestic and international migrants was studied through both Point Count and incidental observations, and bio-acoustic devices within the Site.

Observers (Point Counts & Incidental observations)

Only two migrant species were observed during supplementary studies. They were the pied oystercatcher which was seen most frequently within the MWF Site, and the pied stilt which was only seen at the Lake Mahinerangi.

The Dams

- A total of 16 pied stilt were seen at point count locations at Dam 1 through Dam 4, albeit in low numbers (1 to 3 birds). This is consistent with observations made during the 2006 assessment. No pied stilt were seen within the MWF Site.
- Only three pied oystercatcher were observed, at Dam 3 on January 30.

THE MWF Site

- Pied oystercatcher were first seen during the preliminary site visit on 10 December 2024. The observation was of a single group of three birds, one of which was a juvenile. December is near the end of the breeding season, but it is still usual to see adults with recently fledged young and occasionally occupied nests with young. Birds are also seen more often in larger groups as they prepare for the migratory flight to the northern estuaries. This continues until mid to late January.
- The site was visited again on 7 January 2025 for the set out of the bio-acoustic recorders. On this visit no pied oystercatcher were seen.
- During the two weeks of the avifauna study, there were a total 62 pied oystercatcher observations. This total includes repeat counts of two groups of birds. One group of 19 birds was recorded three times repeatedly between 27 and 31 January. Another group of 3 was observed twice on the same day. These birds were primarily foraging in pasture. Juveniles were seen with two groups. The location of these pied oystercatcher observations can be found in Map 5.
- Importantly a number of observations were within the Stage 1 windfarm, on the margins of access tracks and close to or under operational turbines. Table 11 presents the observations for this period.

Table 11. Pied oystercatcher observations and associated notes from the survey team within the MWF Site on 10 December 2024, 7 January 2025, and during site observations between Monday 7 January and 7 February 2025.

Survey type	Start Date	Number of Birds	Behaviour	Notes
Incidental	10/12/2024	3	Foraging	Feeding in group on short grass
Incidental	07/01/2025	-	-	No pied oystercatcher observed
Incidental	27/01/2025	19	Foraging	Feeding in group on short grass
Incidental	28/01/2025	2	Resting	Resting on the gravel road directly below turbine. One chick (grey legs) begging for food.
Point Count	29/01/2025	19	Foraging	Feeding in usual place with 4 plovers on short grass
Incidental	30/01/2025	-	-	No pied oystercatcher observed
Incidental	31/01/2025	12	Foraging	Feeding in usual place in short pasture
Incidental	3/02/2025	3	Foraging	Feeding in paddock

Survey type	Start Date	Number of Birds	Behaviour	Notes
Incidental	3/02/2025	3	Foraging	Same group as above. Feeding on ground at side of track.
Incidental	04/02/2025	-	-	No pied oystercatcher observed
Incidental	05/02/2025	-	-	No pied oystercatcher observed
Incidental	06/02/2025	1	Traversing	Flying steady height, moving rapidly W.
Incidental	07/02/2025	-	-	No pied oystercatcher observed

Bioacoustic Recorders

To supplement the point counts and incidental observations from the survey team, eight ARDs were deployed within the MWF Site for 32 nights from 7 January to 7 February 2025 with the last two weeks coinciding with the field survey. They were run from dusk until dawn each night. The only migratory bird species recorded over this time was the pied oystercatcher.

Out of 256 nights of observation (8 ARDs x 32 nights) pied oystercatcher were recorded as single or repeat calls 13 times at 4 of the 8 ARD locations. Two were within the existing Stage 1 Wind Farm in close proximity to existing turbines (ARD-02 and ARD-03), and two were at the northern end of the consented Stage 2 site (ARD-07 and ARD-08).

The recorders were located on fenceposts and so it is not possible to determine if the birds were in flight or on the ground. Repeat calls over several hours at night suggest they were roosting nearby.

A summary table of where the species were detected is provided below, and the full list of observations can be found in Appendix 7.

Table 12 Summary table of recorded calls of migratory birds detected by bioacoustic devices between 7 January 2025 and 7 February 2025.

Dates	ARD-01	ARD-02	ARD-03	ARD-04	ARD-05	ARD-06	ARD-07	ARD-08	Sum
16/01/2025			3				1	3	7
17/01/2025		4	1					4	9
18/01/2025									0
19/01/2025		3	3				5	2	13
20/01/2025		1							1
21/01/2025			5						5
22/01/2025									0
23/01/2025									0
24/01/2025			1						1
Total	0	2	5	0	0	0	5	4	16

6.2.4. Falcon

In the two weeks on site in 2025, there were 17 falcon observations, on 7 out of 10 days. Some of these were repeat observation of the same birds (See Table 13). Based on the distribution of these observations, up to three territories appear to still be occupied from as defined by the 2009 to 2013 studies. One of the observations was of a pair of adult falcon seen once within the MWF Site, suggesting a local breeding pair.

Falcons were observed traversing and occasionally hunting within the Wind Farm Development Area, including the area occupied by the Stage 1 turbines. They were also seen moving to and from the tussock grasslands to the west of the site (See Map 6). This is consistent with earlier studies.

Table 13. Summary table of the migratory birds detected by bioacoustic devices between 7 January 2025 and 7 February 2025.

Survey Type	Monitoring Site	Date	Number Counts	Notes
Roving	Incidentals	27-Jan-25	1	Flew at constant height over little gully, heading to pine hedge and disappeared. Looked quite dark in colour. Didn't see it for long.
Roving	Incidentals	27-Jan-25	1	Seen flying over grass and under powerline. Hugged ground, flying low over tussock. Disappeared into gully to south then popped up high briefly to 15m, then disappeared into gully again.
Point Count	PC7	28-Jan-25	1	Habitat = tussock, scrub. Flew low through gully and landed at base of rock stack. Stayed for 20 seconds
Point Count	PC7	28-Jan-25	1	Same falcon. Habitat = tussock, scrub. Flew 100m and landed in Coprosma. Stayed 5 seconds then departs.
Point Count	PC7	28-Jan-25	1	Same falcon. Habitat = tussock + scrub. Flew east through saddle and disappeared. At all times below us.
5 minute	PC5	28-Jan-25	1	-
Point Count	PC4	30-Jan-25	1	Direction of movement W+N. Female bird seen flying out of beech forest over pasture and circled us a couple of times. Then continued circling over pasture through to turbines flying very high at max of 200m W. Then flew N and dropped out of view behind.
Point Count	PC6	31-Jan-25	1	Initially seen flying through saddle. Flew across face of small tussocky hill and landed on fence post. Possibly a male.
Point Count	PC6	31-Jan-25	1	Same falcon. Flew off to the W over tussock and out of sight. Was outside the 200m radius.
Roving	PC7	31-Jan-25	1	Was initially seen perched on a log. Flew to hedgerow and circled it. Then began chasing some small birds. Disappeared into gully near PC7. Looked like a male.
Roving	Incidentals	03-Feb-25	2	Birds perched on adjacent power poles. Departed shortly after truck with observers arrived.
Roving	Incidentals	03-Feb-25	1	Female falcon on power pylon, very near previous falcon record.
Roving	Incidentals	03-Feb-25	1	Falcon dropped off pylon as we drove past. Heading low going north. Same bird as previous record.
Point Count	PC4	04-Feb-25	1	Habitat: native bush, pasture. Come out of bush same spot as a record last week. Flew 100m west and landed on a power pylon. Stayed for 4 min, didn't see him leave.
Roving	Incidentals	05-Feb-25	1	Was on the ground near a gate, flushed as we arrived. Flew low to the east into windfarm.
Roving	Incidentals	06-Feb-25	1	Behaviour: 4a,1b. Heard calling, very heavy misty, no chance to see.
Point Count	PC4	06-Feb-25	1	Habitat: pasture, native bush. Flew up valley just above canopy, landed in canopy. Was calling as it came in.

6.2.5. Relative flight height

Table 14 presents the relative flight heights of the native species that were observed within the MWF Site. It summarises the number of flights which were either below the observer (typically when viewed flying below a ridgeline), above the observer but below the lower blade tip (20 m), within the turbine rotor swept area or RSA (20 to 165 m) or above the upper blade tip height (165 m).

Of the 525 observations of native birds only 155 were seen in flight and had flight data collected. For most species there were insufficient observations to be helpful, sometime none, or as few as 1 or 2.

Six species have 10 or more flight observations giving an estimate of the proportion of flight height within the Rotor Swept Area (RSA). Falcon (15 observations in flight, 7% at RSA), NZ pipit (39 observations, 0% at RSA), black-backed gull (44 observations, 32%), grey warbler (16 observations, 0%), silvereye (15 observations, 0% at RSA), and welcome swallow (18 observations, 0% at RSA).

Table 14. Relative flight height of all native birds observed during this study. Derived from all methods where birds were observed in flight.

Species	Threat status	Below Observer	Below blade tip	Within RSA	Above blade height	Sum	% in RSA
Eastern falcon	Nationally Vulnerable	3	11	1	0	15	7%
Black-billed gull	Regionally Vulnerable	0	1	0	0	1	0%
NZ pipit	Nationally At Risk - Declining	2	37	0	0	39	0%
Pied oystercatcher	Regionally Vulnerable	0	1	0	0	1	0%
Black shag	Regionally Endangered	0	0	0	0	0	-
Little shag	Regionally Vulnerable	0	0	0	0	0	-
Silvereye	Regionally declining	12	3	0	0	15	0%
Black-backed gull	Not Threatened	0	29	14	1	44	32%
Grey teal	Not Threatened	0	0	0	0	0	-
Grey warbler	Not Threatened	11	5	0	0	16	0%
South Island fantail	Not Threatened	0	0	0	0	0	-
NZ scaup	Not Threatened	0	0	0	0	0	-
Paradise shelduck	Not Threatened	0	1	0	0	1	0%
Pied stilt	Not Threatened	0	0	0	0	0	-
Spur-winged plover	Not Threatened	0	0	0	0	0	-
Australasian harrier	Not Threatened	1	1	1	0	3	33%
Welcome swallow	Not Threatened	6	11	1	0	18	6%
White-faced heron	Not Threatened	0	1	1	0	2	50%

6.3. Identification of Key Species

This section provides an analysis of each species potentially at risk of the construction or operation of the wind farm. It draws on the combined species list derived from all methods and all sources as described in the preceding sections and provided in full in Appendix 5.

6.3.1. Exotic Birds

Exotic bird species seen within the MWF Site are all widespread and common pastoral species. They are not assessed further.

6.3.2. Not-Threatened Native Birds

Similarly the not-threatened native species seen within the MWF Site are all widespread and common pastoral species. They are not assessed further.

6.3.3. Threatened and At-Risk Species

This assessment therefore is focused on species which are vulnerable or at-risk. To be at risk a species must be present in sufficient numbers or active in the wind farm site with sufficient frequency that collision is possible. Similarly behaviour can play a large part in collision risk. For this assessment population level effects is the relevant scale.

Of the six threatened or at-risk species observed during 2025, three are commonly found at the MWH site.

Table 15. The presence and relative abundance of threatened and at-risk native species, comparing those seen at the MWF Site, and the Lakes Sites. Point count and 5 MBC only. These are considered the key species.

Common Name	Conservation status	Dams All	MWF All
Eastern falcon	Nationally Vulnerable	0	10
NZ pipit	Nationally At Risk - Declining	2	17
Silvereye	Regionally Declining	17	73
Pied oystercatcher	Regionally Vulnerable	3	3
Black-billed gull	Regionally Vulnerable	114	1
Black shag	Regionally Vulnerable	99	0
Little shag	Regionally Declining	4	0
Total		1,374	526

6.4. Assessment of Key Species

The following list presents an assessment of risk for each of the six species in Table 14, which draws on all information obtained during this and previous studies including relative abundance, primary habitat, flight height, breeding and behaviour. Sorted by Threat Status.

Black Shag *(Phalacrocorax carbo novaehollandiae)*

- This New Zealand native is a cosmopolitan species found around the world. It can occupy a variety of habitats, coastal waters, estuaries and harbours, rivers, lakes and ponds up to the subalpine zone. In New Zealand it is widespread, although sparsely so.
- The national conservation status of this species is At Risk – Naturally Uncommon. Its regional conservation status is Regionally Endangered. The national and regional qualifiers to its conservation status is DPS (Data Poor Size); DPT (Data Poor Trend); Sp (Biologically Sparse) meaning it naturally consists of small and widely scattered sub-populations.; CR (Conservation Research Needed); and SO (Secure Overseas).
- This is a species of coastal and inland waters, small ponds and creeks. It nests on cliff faces, trees and in swamp land. It is a common species at Lake Mahinerangi, however, there is no habitat within the MWF Site to support this species.
- During the 2025 survey black shag (97 observations) were seen at every dam site, often individually but also in groups of up to 32 birds. None were observed at the MWF Site.
- Similarly, the survey in 2006 only observed this species at Lake Mahinerangi.

- There are no observations of black shag collisions with turbines at any of the Wind Farms where bird strike monitoring has been carried out.
- This is not a species of concern.

Eastern Falcon *(Falco novaeseelandiae novaeseelandiae)*

- The 'eastern' falcon is one of three ecological forms of the endemic New Zealand falcon. Eastern falcons range from Marlborough down into the southern end of the South Island. The eastern form lives in open dryer habitats east of the Southern Alps, extending from coast to coast in the central South Island.
- The conservation status of this species is Nationally and Regionally Vulnerable. The national and regional qualifiers are DPR (Data Poor Recognition), DPS (Data Poor [population] Size); DPT (Data Poor [population] Trend); and NStr (National Stronghold) which is where more than 20% of the national population breeds or is resident for more than half their life cycle in the region. The national population is considered to be between 1,000 and 5,000 individuals and the Otago population is considered to be relatively stable.
- In the two weeks on site in 2025, falcon were seen on 7 out of 10 days, and based on the distribution of these observations, at least three territories appear to still be occupied.
- Of the 6 historic nest sites only two are closer than 1km to Stage 2 turbines. The Thomas Block nest is 620m from the nearest Windfarm Development Area, and 870m from turbine 45. The Broad Stream nest site lies within RAP 9 Black Rock, which is avoided by the Wind Farm Site. The nest lies approximately 385m from the nearest Windfarm Development Area, and 450m from the nearest proposed turbine 39). During 2025 a pair was seen near the Broad Stream nest site suggesting the habitat is still occupied (See Map 7).
- This remains a species of concern.

South Island Pied Oystercatcher *(Haematopus finschi)*

- This large and conspicuous endemic bird breeds in inland South Island riverbeds and farmland from August to January. It migrates to northern harbours following breeding and is found on most large northern estuaries from January to July.
- The *nationally conservation status of this species is At-Risk – Declining, however, the regional status is R*egionally Vulnerable. The national and regional qualifiers are CD (Conservation Dependent), a taxon that is likely to move to a worse conservation status over the longer of the next 10 years or three generations (maximum 100 years) if current management ceases: CL (Climate Impact) when a taxon is adversely affected by long-term climate trends and/or extreme climatic events; and NStr (National Stronghold) which is where more than 20% of the national population breeds or is resident for more than half their life cycle in the region.
- This is a bird of estuaries, margins of waterways, and boggy ground. It typically feeds in soft sediments in water of wadeable depth. It is also a domestic migrant.
- Pied oystercatcher usually breed inland in the South Island, mainly east of the Southern Alps on riverbeds and in farmland but are also known to breed on high country grasslands, and in coastal areas adjacent to estuaries and lagoons.
- Pied oystercatcher were observed within the Site when it was originally assessed in 2009, and there were no mortalities of this species during the 2011 and 2012 bird strike monitoring.
- During this study pied oystercatcher were seen most frequently within the existing stage 1 windfarm with smaller numbers near PC-05, and bio-acoustic records at PC-07 and PC-08 (See Map 5).

- Only one bird was seen in flight (below the Rotor Swept Area). However, based on observations at other sites, the flight heights of pied oystercatcher when breeding are significantly lower than when migrating. At Jericho Windfarm (Boffa Miskell Ltd, 2025c) there were 41 observations of flight height while foraging in the Waiau River Valley, with only one flight at RSA (2%).
- From the observations made during both the earlier studies and the supplementary studies of this assessment in 2024 and 2025 it is concluded that this species is highly tolerant of normal farm activity, the nearby movement of vehicles, and in the presence of turbines.
- While collision risk may be low, the MWF staff have noted this species nests in small numbers within the MWF Site including within the Stage 1 windfarm area. It nests in shallow scrapes on the ground often in gravels and dirt, and in short pasture. Because of potential breeding within the construction zone, it is a species of concern and management of construction activities around nest sites will need to be considered.

Black-billed gull (*Larus bulleri*), At Risk: Declining

- This small endemic gull has a national conservation status of At Risk, Declining, and a regional conservation status of Regionally Vulnerable. CL (Climate Impact), RF (Recruitment Failure), and CR (Conservation Research needed).
- The species breeds on sparsely vegetated gravels on inland riverbeds, moving to the coasts after breeding. The majority of the national population nests in Southland with only c.5% nesting in the North Island.
- None were seen within the site during the 2006 survey, but they were common at and around Lake Mahinerangi.
- This pattern was also seen during the 2025 survey. There were 114 observations of this species at the Lakes sites either as individuals or in flocks of up to 60. However, only one bird was seen over this period at the MWF Site. It was traversing across the site.
- There are no observations of black-billed gull collisions with turbines at this site, or any other wind farm site where black-billed gull are present.
- This is not considered to be a species of concern

Little Shag (*Phalacrocorax melanoleucos brevirostris*)

- This small native shag is the most widely distributed shag species in New Zealand, seen in coastal estuaries and harbours, as well as on inland lakes, farm ponds, rivers and streams.
- The national conservation status of this species is At Risk - Relict, however its regional conservation status is Regionally Vulnerable. The national and regional qualifiers are DPS (Data Poor [population] Size); DPT (Data Poor [population] Trend); and CR (Conservation Research needed).
- This is a species of Coastal and inland waters, streams and rivers. They nest in trees near lakes, ponds, swamps and inlets. They feed in deep waters by diving. It is a common species at Lake Mahinerangi, however, there is no habitat within the MWF Site to support this species.
- During the 2025 survey little shag (4 observations) were only seen at two of the lake sites. None were observed at the MWF Site.
- During the survey in 2006 one recorded 1 little shag at the site described as *"One vagrant observed over-flying"*.
- There are no observations of pipit collisions with turbines at any of the sites that have been studied
- This is not a species of concern.

New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*)

– This is a bird of open country, which has adapted well to the spread of pastoral farming and is widespread across the country.
– The national conservation status of this species is At Risk Declining, however its regional conservation status is not threatened. The national and regional qualifiers are CI (Climate Impact) used when a taxon is adversely affected by long-term climate trends and/or extreme climatic events; DPR (Data Poor Recognition), DPS (Data Poor [population] Size); DPT (Data Poor [population] Trend). The Regional Report notes that there is "no evidence of a decline in Otago. Well-distributed in suitable habitat in the region, with these types of habitats not as impacted as elsewhere in the country."
– This is a bird of open country; historically found on sandy beaches and dunes, open riverbeds and subalpine tussocklands. It has adapted well to the spread of pastural land and is widespread across New Zealand.
– NZ pipit have been present at every wind farm site which the author has assessed. They are inquisitive and often attracted to construction activity feeding on invertebrates in the disturbed soils.
– In 2025 there were a total of 31 point-count observations within the MWF Site, and a further 59 incidental observations of between 1 and 6 birds. All observed flights were below blade height which is consistent with observations of this species at other New Zealand windfarms. There are no records of pipit collisions with turbines at any of the sites that have been studied.
– This is not a species of concern.

Silvereye *(Zosterops lateralis lateralis)*

– This is a species able to occupy a wide range of habitats, from urban gardens and parks, farmlands, orchards and all indigenous and exotic forests and scrublands.
– Nationally this species is not threatened, however, within the Otago Region this species is considered to be declining and therefore its regional classification is At Risk. The national and regional qualifiers are CR (Conservation Research needed); DPS (Data Poor [population] Size); and SO (Secure Overseas). The Regional Report noted that this species:

> *"… shows a shallow decline regionally for the 10-year period from 2013–2023 and a moderate decline regionally for the 5-year period from 2018–2023, respectively, steeper than other parts of the country showing a decline."*

– This decline was based on the 2023 New Zealand Garden Bird Survey (Hayman et al., 2024). The latest 2024 survey (Hayman et al., 2025) reports the following:

> *"Silvereye (tauhou) counts show little or no change nationally over 10 years (0%) and 5 years (2%), compared to the shallow and moderate declines, respectively, seen last year. Their regional long- or short-term trends now show increases in 10 regions."*

– This suggests a natural perturbation in the population size rather than ongoing decline. Nevertheless, we have considered this species based on its current status.
– There were 73 observations of this species within the Project Site of which 90% were seen in or near the native forest in Broad Stream (PC04). The remainder were seen in a deep scrubby gully to the north of the site (PC07). There were 10 observations in flight, with none at turbine blade height.
– There are 3 records of collisions of this species with turbines, 1 mortality at Te Apiti (2010), 1 at Te Uku (2014) and 1 at Mahinerangi during the bird strike monitoring stage 1 ((Golder

Associates Ltd, 2013). All were associated with the much smaller V90 turbines used at those sites. These mortalities are shown in Section 8.

– Overall, the natural flight behaviours will rarely put this species at risk of turbine collisions, although they may occur in low numbers, but not the extent of affecting the local population. It is concluded that this is not a species of concern. This species is discussed further in the following section.

6.5. Conclusion

Falcon remains a key species of concern as identified in the 2006 investigations.

The nesting of pied oystercatcher within the site requires consideration as part of construction monitoring and management. At the time of the original application SIPO were only rarely seen and there were no observed effects upon this species. However, given their continued decline as a species and confirmation of their presence in several locations within the windfarm site, methods for the protection of nesting are proposed.

The other species with a conservation status, and which are listed and described above are unlikely to be affected by the changes to Stage 2 of the windfarm as they are habitat limited and only appear on site rarely or are known to occur locally but are unlikely to utilise habitat within the Stage 2 Wind Farm Development Area.

7. Collision Risk

7.1. Falcon

The proposed windfarm and turbine changes that are considered in this analysis are:

- The design possible under existing consents: 47 turbines, 145m high, 9m ground clearance, 136m rotor diameter within a possible 78 locations/CZs
- The design possible with proposed variations: 44 turbines, 165m high, 20m min ground clearance, 136m rotor diameter within 54 possible locations/CZs.

To test whether these changes will have a positive or negative effect, the changes between the two turbine layouts were calculated using provided turbine metrics, and a hypothetical number of falcon traverses. This was done using a simplified version of collision risk modelling, that has been used for this type of study before.

Turbine Metrics

For this analysis the turbines have different rated output (3.45MW and 4.3MW) however, the turbine metrics are largely the same. The critical variables for collision risk modelling are shown in Table 16.

Table 16: Turbine Metrics required for modelling and analysis.

Metric	V136 –Pitch regulated with variable speed		Notes:
K: [1D or [3D] (0 or 1)	1		Fixed.
No Blades	3		Fixed.
Max blade chord	4.1	m	Fixed. From Spec Sheet.
Blade Pitch (estimate)	2.18	Degrees.	Variable. Calculated based on response to sites wind speed distribution.
Rotor Diameter	136	m.	Fixed. From Spec Sheet.
Rotation Period (estimate)	5.69	Sec.	Variable. Calculated based on response to sites wind speed distribution.
Turbine Downtime	21.0	%	Variable. Provided by TWP.
Cut-in wind speed	3	m/s	Fixed. From Spec Sheet.
Nominal power at wind speed	8.5	m/s	Fixed. From Spec Sheet.
Cut-out wind speed	25	m/s	Fixed. From Spec Sheet.

The only difference between the consented and proposed turbine design relate to the upper and lower blade tip clearance.

Table 17 Changes to the blade tip upper and lower heights.

Metric	Consented	Proposed
Maximum blade tip height	145m	165 m
Minimum blade tip clearance	9m	20 m

Avifauna Metrics

Flights within the Rotor Swept Area (RSA)

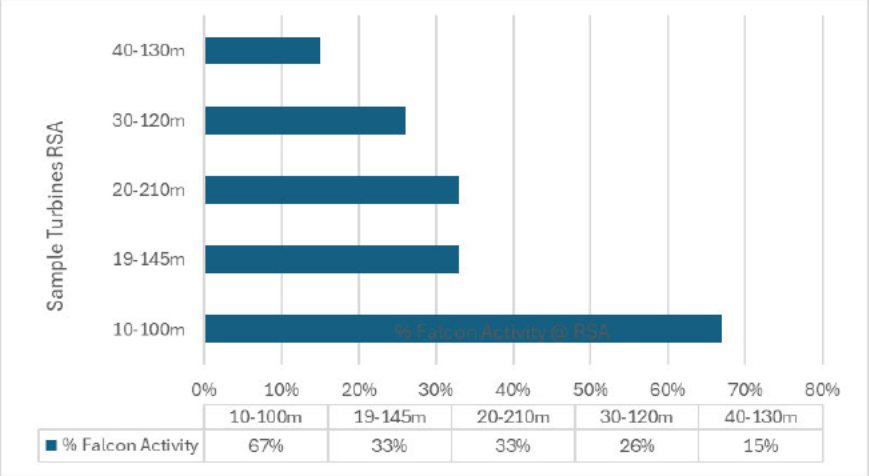
The key metric for this simple comparison is the proportion of flights falcon carry out within the rotor swept area (RSA). For this site we are specifically looking at the difference between a blade RSA from 9m to 145m, and a proposed blade RSA from 20m to 165m.

There is insufficient data from the MWF Site to determine flight height, and only one study, carried out for the Harapaki Windfarm, provides falcon flight activity within 10m increments for lower blade clearance.

For Harapaki flight activity was compared for four turbine options that would meet the consented maximum blade tip height (120m), and a larger more modern turbine which exceeded the consented maximum by 25m.

For each turbine option it presented the proportion of flight activity within the RSA or Rotor Swept Area, which equates to the rotor diameter and its height above ground as shown. The results are shown in Figure 9.

Figure 9: % Falcon activity within RSA for 5 turbine options.



In the Harapaki, to determine the effect of an increase in the maximum blade tip height, the key result from Figure 8 was the proportion of flights within RSA for the consented turbine (RSA 19m – 145m), and the proposed turbine height increase (RSA 20-210m). Both options had similar lower blade tip clearance, but the upper tip height differed by 35m. Despite this difference, the proportion of flights within RSA were identical for both options. This suggested that the flights above 110m were rare, and the upper blade height was not a key factor in collision risk for falcon. The larger turbine design was subsequently consented.

For Mahinerangi, the relevant comparison of blade sweep is set out in Table 18 below.

Table 18: Falcon Flight activity at RSA 9m to 145m (67% ± 20%)

Option	RSA	% Flight activity at RSA
Consented	RSA = 9m – 145m	67%
Proposed	RSA = 20m – 165m	33%

Calculated Risk

Table 19 presents a simple analysis of the change in terms of relative effect on falcon. This analysis concluded that the risk to falcon will be in the order of 46% lower under the Stage 2 design.

Table 19: Falcon Flight activity at RSA 9m to 145m (67% ± 20%)

	Consented	*Proposed*
Turbines	*47*	*44*
% in Rotor Zone	*67%*	*33%*
Combined	*31.5*	*14.5*
Relative effect		*46%*

– Having fewer turbines alone will provide a proportionate reduction in risk to falcon.

– However, the reduction in the percentage of birds at risk (46%) is most strongly influenced by raising the lower blade tip clearance from 9m to 20m.

– Increasing the maximum upper blade tip height from 145 to 165m will have a negligible effect on falcon as the majority of falcon flights recorded at this site were below 50m (Golder 2012).

– The minor changes to the Windfarm Development Area or the layout within it will not directly affect the mortality rate to any noticeable extent. Each turbine poses its own threat to falcons flying in the area. However, removing the Thomas Block from the Windfarm Development Area removes turbines which would have been close to the Thomas Block and Gully nest sites, providing greater separation from those breeding pairs.

– The turbine risk depends on the geometry of the turbines. It is understood that the specifications of the consented and proposed turbines are sufficiently similar that there will be no appreciable difference in the mortality arising from the different turbines.

A reduction in risk with increasing blade tip clearance, and reduced turbine numbers is consistent with international literature.

Given this result the proposed increase in tip height, combined with a reduction in turbine number will not increase risks to resident falcon and is likely to materially reduce risk.

7.2. Pied oystercatcher

- There were insufficient observations of pied oystercatcher in flight at MWF to produce the same analysis for this species.
- However, it is reasonable to conclude that any residual collision risk for pied oystercatcher will be reduced by both increasing the ground clearance of the blade from 9m to 20m, and from the reduction in turbine numbers.

8. Bird Strike Monitoring - New Zealand Examples

To provide some context to the known risk of bird strike, Table 20 presents the results of the bird strike monitoring at Mahinerangi in 2011 and 2012 (See Section 4.4) in relation to the results of bird strike monitoring at four other sites in New Zealand.

Rates of bird strike vary between wind farms depending on a range of factors such as their location and the diversity and extent of indigenous habitats. West Wind Wind Farm, a semi coastal site with a complex mix of habitats had an annual mortality rate calculated over three years was in the order of 6.8 birds / turbine / year (Boffa Miskell Ltd, 2013). Te Uku Wind Farm has a similar the mortality rate averaged over three years of 7 birds/turbine/year (Boffa Miskell Ltd, 2014). At Waipipi Wind Farm, a coastal site with diverse habitats, annual mortalities lay within a range of 7 to 13 birds/turbine/year (Boffa Miskell Ltd, 2024). Mahinerangi Wind Farm has a very simple set of bird habitats and a low bird diversity compared to other sites. The mortality rate over two years was 1.2 and 0.7 birds per turbine per year respectively (Golder Associates Ltd, 2013).

In all cases introduced bird species such as magpie, skylark, mallard duck, and the many finch and small passerine species which dominate pastoral landscapes, made up the majority of mortalities. The Australasian harrier is the only native species with a high rate of collisions across several sites with occasional paradise shelduck and black-backed gull, and one or a few of several other native species.

Mortalities of only two native birds with a conservation status, a fairy prion and a broad billed prion (At Risk – Relict) have been recorded and both mortalities occurred in coastal sites. Occasional mortalities of oceanic species such as these, driven inland during storms, was predicted for coastal sites (Boffa Miskell Ltd, 2005).

Falcon were present at two of these sites, Mahinerangi and Te Apiti and were present in low numbers or rarely, at several of the others. Falcon are also present at White Hills Wind Farm and at Kaiwera Downs Wind Farm and their survival and breeding success has been studied at those sites for a number of years, however, bird strike monitoring was not carried out at these two sites and so they are not listed in this table. No mortalities of falcon have been recorded to date during post construction studies at these sites.

Pied oystercatcher are present at both the Waipipi Wind Farm and the Mahinerangi Wind Farm. No mortalities have been observed at either site.

Table 20: Avian mortalities recorded during post-construction collision monitoring at 5 wind farms in New Zealand. (Sorted by combined count).

Common Name	National Conservation status (Robertson et al., 2021)	West Wind	Mahinerangi	Te Apiti	Te Uku	Waipipi
Australasian Harrier	Native - Not Threatened	12	1	1	6	13
Magpie	Introduced		6	2	11	1
Skylark	Introduced	2	4		9	2
Mallard	Introduced	4	1	2	1	3
Finch sp.	Introduced	3				5
Passerine sp.	Unknown					8
Chaffinch	Introduced	6		1		
Paradise shelduck	Native - Not Threatened	5	1			
Southern black-backed gull	Native - Not Threatened	4	1		1	

Common Name	National Conservation status (Robertson et al., 2021)	West Wind	Mahinerangi	Te Apiti	Te Uku	Waipipi
Redpoll	Introduced	4				
Silvereye	Native - Not Threatened		1	2	1	
Yellowhammer	Introduced	3				1
Goldfinch	Introduced	1		1		
Tui	Native - Not Threatened	2				
Blackbird	Introduced	1			1	
Sparrow	Introduced					1
Broad billed prion	Native - At Risk (Relict)					1
Dunnock	Introduced	1				
Eastern rosella	Introduced	1				
Fairy prion	Native - At Risk (Relict)	1				
Greenfinch	Introduced	1				
Rock pigeon	Introduced		1			
Song thrush	Introduced	1				
Spur-wing plover	Native - Not Threatened	1				
Greylag turkey	Introduced				1	
Possible seabird	Unknown					1

Note: Search effort varies between sites as follows:

West Wind = 3 years of fortnightly monitoring.
Mahinerangi = 2 years of weekly (spring breeding) and bi-weekly monitoring.
Te Apiti = 2 months of daily monitoring (autumn and spring).
Te Uku = 3 years of fortnightly monitoring.
Waipipi =Ongoing. Data represents 3 years of fortnightly monitoring.

9. Assessment and Management of Effects

This study has confirmed that falcon remain a species of concern at this site. Falcon have been studied over a number of years at this site, where up to five pairs have territories that overlap the Wind Farm Site, and three pairs have been observed successfully breeding nearby; the other two pairs breeding within the wider study area. The findings of this assessment are considered in relation to the existing consents for this wind farm.

This study has also identified breeding of pied oystercatcher within the MWF Site. Based on the areas of activity of this species, at least some nests may be located within or in close proximity to the Windfarm Development Area. Nest disturbance therefore needs to be considered.

9.1. Falcon

In this section the potential effects on falcon from both construction and operation are considered.

9.1.1. Construction Disturbance

Disturbance of Breeding

There is a known risk that construction activity in close proximity to nests can disturb nesting and the rearing of chicks. An accepted approach is to avoid effects on nesting by identifying each seasons' nest sites and ensuring they are adequately buffered from construction activity until the chicks have fledged. The size of buffer should be no less than 200m (Seaton et al., 2009) and potentially up to 500m (Hiromi pers.com) from the nest site to the area of activity. This distance will vary based on visibility, terrain, the type of activity, and the degree to which the birds are habituated to existing farm operations.

For this reason, ongoing surveys of breeding activity and the location of active nests will be carried out each spring during construction. If a nest is located within 500m of the Windfarm Development Area, the falcon expert will assess the risk, determine the appropriate nest buffer extent which will be no less than 200m from the nest, or may be more if advised by the raptor expert. The raptor expert will also advise on the duration that the buffer will need to be in place to ensure protection of the nest and chicks from disturbance.

Currently there are no nest sites within the Windfarm Development Area which is intensively farmed. However, there is at least one nesting area that may be close enough to the Wind Farm Development Area to require the establishment of a nest buffer. Currently the closest nest site to the at MWF is in Broad Stream approximately 385m from the Windfarm Development Area and 400m from Turbine 39 in the Stage 2 layout. A pair of falcon were seen at this location on three occasions in 2025. All other nest sites located during earlier studies are currently 0.5 km or more from the edge of the Windfarm Development Area, now that the Thomas Block has been removed from the MWF Site.

Monitoring for nest sites and the establishment of nest buffers was not included in the certified Ecological Monitoring and Management Plan (2010). A variation to Condition 26 now requires the establishment of necessary construction buffers for active nests in the Avifauna Management Plan. This plan has been prepared and forms part of this application (Boffa Miskell Ltd, 2025a).

Overall, with the implementation of appropriate monitoring and site management it is considered that breeding disturbance can be avoided on nesting birds and juveniles.

9.1.2. Operational Disturbance

Displacement through Turbine Avoidance

Internationally some raptor species have been found to avoid a wind farm once it becomes operational, essentially displacing them from that habitat. However, international studies suggest that most raptors have a low sensitivity to displacement by wind farms. This includes species similar to the New Zealand falcon (Madders & Whitfield, 2006).

Early studies at the White Hill Wind Farm found no evidence of displacement of adult birds which foraged, bred and successfully fledged chicks in and around the windfarm (Boffa Miskell Ltd, 2017).

The earlier Mahinerangi studies (Section 4) reinforced these results, finding no evidence of displacement from habitat within the wind farm site and no effects of the presence of turbines and wind farm activity on nesting success (Golder Associates Ltd, 2012).

Similarly the 2025 survey observed one falcon traversing through part of the Stage 1 Windfarm and passing close to as many as 6 turbines while in flight.

Based on the above, it is concluded that falcon won't be displaced from their foraging or breeding areas once the wind farm is operational.

Collision Risk

International research suggests that the large soaring raptors have behaviours that make them susceptible to collisions with turbines, and this has been found to be the case in New Zealand with the Australasian harrier.

However, international research indicates that smaller raptors that hunt on the wing have very high avoidance rates approaching 100%. Their avoidance behaviour includes changes in flight direction when entering a wind farm to fly between rows, increasing their altitude to fly above turbine blades, and direct avoidance of individual blades and tower, and for a few species avoidance of the wind farm entirely (Garvin et al., 2011; Watson, R.T. & et.al, 2018).

Following extensive monitoring at MWF, the final monitoring report concluded:

> *"The study found no evidence of adverse effects on the falcons from any of the identified potential impacts: collision, disturbance, displacement, or electrocution."*

To provide further confidence that the risk to falcon is very low, analysis of the new turbine layout for Stage 2, shows that the changes proposed will provide increased separation between turbines and falcon activity by raising the turbine blade and reducing turbine number, which will result in a further reduction in risk to falcon.

However, the rarity of this species and the qualifiers associated with its conservation status warrant the continued generation of data to refine and support this analysis and collision risk. For these reasons, post construction studies required by the Condition 27 will be repeated as detailed in the Avifauna Management Plan (Boffa Miskell Ltd, 2025a).

A Wildlife Approval under the Fast-Track Approvals Act is required for the capture of falcon, banding and the attachment of a GPS transmitter. An application for this Wildlife Approval has been provided as part of this application.

In addition, Consent 28 requires implementation of a mammalian pest control programme to provide for any residual effect on falcon. This control programme was established as part of MWF

Stage 1 and will be expanded to include MWF Stage 2. An updated Mammalian Pest Control Plan has been prepared and forms part of this application (Boffa Miskell Ltd, 2025b).

9.1.3. Overhead Transmission Lines

The new 100kV line requires consideration of the electrocution risk to falcon.

Electrocution

Electrocution is a known risk for falcon (Fox & Wynn, 2010; Wingspan Birds of Prey Trust, 2010). Electrocution does not appear to be an issue with the larger transmission lines where the distances between the live wires and other tower components are too large for a falcon to bridge. However, it is a known risk with smaller transmission and distribution lines (33kV, 66kV and 110kV) where birds can perch on transformers or span wires with their wings.

The most comprehensive study of falcon mortality was carried out by Fox and Wynn (2010) in Marlborough. In this study 53 falcon were radio-tagged meaning that the deaths of 21 of these birds were able to be tracked to the source. Only one of these deaths was natural, a bird killed by an Australasian Harrier. The other 20 included electrocution on power poles, predation by cats, road deaths, shooting, poison, and one where the cause is unknown.

In a later paper by Waite (2017) 14 falcon mortalities were recorded over a 10-year period in the Wakatipu District. Causes were electrocution, building window strike, collision with a deer fence, as well as several where the cause was unknown. Collisions with transmission lines were not recorded in these papers, and there are no other records in the published literature.

Ways to insulate transmission poles have been identified and guides have been developed detailed in the Wingspan brochure (2010), and in Douglas et al. (2017). These modifications have been used successfully by several lines companies within the South Island in recent years and so are proven effective.

These line modifications have been viewed by TWP, and it has been confirmed that the aspects of transmission line design that create risk for falcon, will not be present, or will be modified to avoid electrocution.

Based on this information, it is concluded that the risk of electrocution will be avoided.

Risk of Collision with Transmission Lines

Internationally, collision with transmission lines has been identified as a potential risk factors for some birds, but not universally as flight behaviour plays a material role in the risk profile.

Both White Hill and Mahinerangi Wind Farms have transmission lines within the site. At White Hill no interactions or collisions were recorded between falcon and the transmission line despite there being multiple sightings of falcon flying over or in close proximity to the transmission line over multiple years (Boffa Miskell Ltd, 2017). At Mahinerangi the pre and post construction falcon studies concluded that “given the small area occupied by masts and transmission lines relative to the spatial scale at which falcons use the landscape, the risk is expected to be low” (Golder Associates, 2013).

Based on this information, it is concluded that collision with transmission lines is a very low risk for falcon, and no mitigation is considered necessary.

9.2. Pied Oystercatcher

9.2.1. Construction Disturbance

Disturbance of Breeding

Disturbance of breeding is considered to be the main risk to this species from development of Stage 2. Relevant to this is that pied oystercatcher are more likely to nest on excavated ground, and areas of bare earth and gravels, than on pasture. Also nesting success is higher on these open sites than in pasture (Sagar et al., 2002). This explains the observations of pied oystercatcher on the stony margins of roads and tracks, and on the compacted dirt and gravel pads around turbines.

The bulk of pied oystercatcher nesting activity occurs in September, October and November. By December most juveniles have fledged, and by the end of January, breeding is complete, and the birds have migrated north. Nest protection and protection of the nesting female during this period is the focus. Young fledglings are also at risk from vehicle collision (Sagar et al., 2000, 2002).

Table 21 shows the time periods where different breeding activities occur in Southland (derived from eBird). The data indicates the key periods of breeding activity that could be affected by construction are between 1 September to the end of December, although it will differ from nest to nest and from season to season.

Table 21: Breeding Observations as recorded by eBird over three years (2020-2024).

Activity	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
C -Courtship				1	1	6	12	6	3	3	3	
ON - Occupied nest							3	19	29	12	3	2
NE - Nest with eggs								24	10	6	1	
NY - Nest with young								6	12	5	2	1
FL - Recent fledge young								6	54	14	12	3
FY - Feeding young							1	3	10	3	6	
DD - Distraction display								1	5	2	2	1
T - territorial defence							4	4	5			
A - Agitated behaviour							3	6	11	6	6	1

Protection Measures

Monitoring and protection of pied oystercatcher nest sites was not considered in the certified Ecological Monitoring and Management Plan (2010). A variation to Condition 26 now requires consideration of pied oystercatcher in the Avifauna Management Plan which has been prepared and forms part of this application (Boffa Miskell Ltd, 2025a).

Overall, with the implementation of appropriate monitoring and site management it is considered that effects on nesting pied oystercatcher can be largely avoided or minimised to the extent that any effect will be less than minor. Any residual effects that do occur will be compensated through site wide pest control as detailed in the Mammalian Pest Control Plan (Boffa Miskell Ltd, 2025b). Control of mammalian predators has been shown to improve nest success and chick survival for this species.

9.2.2. Operational Disturbance

Displacement from Habitat

Pied oystercatcher are currently occupying pastoral habitat within the operational extent of the MWF, both alongside active farm roads, within and beneath turbines, and also more widely in open pasture and within tussockgrasslands. Most of this activity appears to occur within the Stage 1 windfarm site which is in line of sight of Lake Mahinerangi (See Figure 6).

These birds appear habituated to the operation of the windfarm, to normal farm activity and to the operation and maintenance of turbines. This suggests that any birds that nest within the Stage 2 development will also be tolerant of these same activities.

Collision Risk

Collision risk has been discussed in this assessment in Sections 4.4, and Section 8. No collisions were observed at this site during Bird Strike Monitoring for Stage 1, and no mortalities of pied oystercatcher have been observed within the Stage 1 wind farm since then by staff.

One other windfarm, Waipipi has seasonal movements of pied oystercatcher through the site. The fourth year of post-construction collision monitoring has been completed, and there have been no mortalities of this species to date (Boffa Miskell 2024).

It is concluded that the risk of turbine collision for this species is very low. If collisions do occur, they are likely to be rare. Considering the size of the national population which is estimated to lie somewhere between 100,000 and 110,000 rare losses of one or several birds over the life of the wind farm will not have a population level effect on the species.

Overhead Transmission Lines

Electrocution

Pied oystercatcher are not a perching bird and so there is no risk of electrocution on powerlines

Risk of Collision with Transmission Lines

Pied oystercatcher currently occupy parts of the operational windfarm during breeding season, including the areas around the existing 33kv line. Windfarm staff have not observed collisions of this species with these lines, and the risk of collision is considered to be very low.

9.3. Bird Strike - Other Species

Consent Condition 26 required bird strike monitoring for the first two years of operation of the MWF. This was carried out between May 2011 and April 2013 and the range of species affected were consistent with other wind farm sites in New Zealand (Section 4.4, page 25.).

None of the recorded mortalities were of species classified as threatened or at risk. The majority were introduced species, and the few mortalities of native birds were of common and widespread species which were not threatened (Section 8, page 52). Small numbers of mortalities of these species will not have a significant adverse effect on local ecology or local populations.

In the analysis of this bird strike study it was identified that the definition of 'significant risk' (condition 26 i(d)) included non-threatened and native species. While the analysis of bird strike at windfarms always includes a total collision risk, indigenous species are always highlighted. Further, the consideration of significance of the effect has always related to the effect on indigenous species, and

often to species with a conservation status that have been specifically identified. It has also been noted that the threshold for a significant effect of 0.05 birds/turbine/year is too low to be useful.

The analysis of the bird strike monitoring has confirmed this is a low diversity site, mortalities that have been recorded did not include threatened species, all were of common and widespread pastoral species and the two species of concern discussed in this assessment, the falcon and pied oystercatcher were not affected. The reasons why we consider these two species to be a low risk of collision have been discussed above.

We conclude that if further collision monitoring is carried out, the range of mortalities will be very similar to those recorded during Bird Strike Monitoring undertaken for Stage 1 and is highly unlikely to include species with a threat classification (See section 4.4 and Section 8).

It is not considered that further bird strike monitoring is warranted, but that the focus of any post construction monitoring should be targeted on falcon.

10. Conclusion

This study began with a review of all historical investigations at the MWF Site that led to consenting of this project.

The original ecological assessment for this site identified one species, the falcon, as being of concern. That assessment concluded that the risk to this species was low, but any small effects could be offset by appropriate mammalian pest control. Pest control was included in conditions of consent and is being carried out.

Conditions of consent also required pre and post construction monitoring. The pre and post construction monitoring was carried out over five years which included 2 years of bird strike. It concluded that falcon were not displaced by the wind farm, that they continued to hunt around and within the Stage 1 wind farm site, and they continued to breed and fledge chicks in the surrounding territories.

Bird strike monitoring was also carried out as part of the post-construction monitoring. Collisions did occur but all were of common and widespread species found within pastoral landscapes. Specifically there were no collisions of falcon or pied oystercatcher, both of which are judged to have high avoidance of turbines and a low risk of collision.

This study then looked at whether there have been any changes at the site or to the local avifauna since consent was granted that may change the results of the earlier assessment. This study concluded that there have been no changes of note to the farming operation or the presence and distribution of vegetation and habitats within and around the site. There have also been no obvious changes to the species occupying the site or the nearby lakes and wetlands. The conservation status of several species had changed since consent was granted, and this was considered.

Additional site investigations were then carried out in January and February 2025. These confirmed the falcon are still present and utilising habitat within and around the Stage 1 and Stage 2 areas, including potentially using at least two of the same territories. It also found that there have been no changes to the presence of other native species within the site, and little mixing of species on this pastoral landscape with those that occupy the lakes and wetlands to the south and west.

This study did identify the presence of breeding pied oystercatcher, a species which has a conservation status of At Risk, Declining. Breeding of this species was not observed during the earlier ecological assessment. The protection of nests, chicks and adults within the Windfarm Development Area has been considered and included in the assessment.

The development of Stage 2 has been considered in light of proposed consent variations to change the size and design of turbines. These changes were found to be positive for falcon and will further reduce risk to this species. This change is also likely to provide the similar benefits for pied oystercatcher while breeding on the site.

The ongoing protection of falcon was considered against the current conditions and the scope of the certified Monitoring and Management Plan:

- Protection of nests during breeding is not detailed in the current Monitoring and Management plan. Condition 26 has been varied to require the Avifauna Management Plan to address this issue.
- It was considered that the post construction falcon monitoring detailed in Condition 27 is still of value and this monitoring will be repeated for Stage 2. This is detailed in the Avifauna Management Plan.
- There may still be some residual risk to falcon, and the current pest control will continue to be carried out as required by condition 28 to provide a sufficient compensation . This pest control is

being expanded from Stage 1 to cover the full extent of the wind farm as detailed in the Mammalian Pest Control Plan.

- It is considered the risk to falcon of electrocution with the proposed transmission line will be avoided.

The ongoing protection of pied oystercatcher was assessed. None of the current conditions addressed monitoring of this species, however, variations to Condition 26 requires consideration of this species in the Avifauna Management Plan.

- The protection of nest sites from construction is required and a method for this has been added to the Monitoring and Management Plan.
- The ongoing use of the Stage 1 wind farm site by this species speaks to the very low risk of collision with turbines or displacement. No additional post construction monitoring is proposed.
- Similarly it is concluded that this species is not at risk of electrocution or collision with the new transmission line, as it has been seen in close proximity to the Stage 1 transmission lines.
- The ongoing pest control will be providing some benefit to nesting pied oystercatcher.

Overall, with suitable protection of nesting of falcon and pied oystercatcher, and ongoing pest control to account for any residual effects, it is concluded that the development of Stage 2 will have a lesser effect on these species than the consented layout.

11. Literature Cited

Abrahams, C. (2018). Bird bioacoustic surveys - developing a standard protocol. *In Practice*, *102*, 20-23.

Boffa Miskell Ltd. (2005). *Project West Wind Wellington: Ecological values and effects report* (Report W02020-3). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Boffa Miskell Ltd. (2013). *West Wind post-construction avifauna monitoring: Year 3 bird activity and mortality results* (Report W05158_100). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Boffa Miskell Ltd. (2014). *Project Te Uku post-construction avifauna & bat monitoring: Year 3 annual report* (Report A10203_900). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Boffa Miskell Ltd. (2017). *White Hill Wind Farm falcon monitoring: 2005 - 2017* (Report C05085). Prepared by Boffa Miskell Ltd for Meridian Energy Ltd.

Boffa Miskell Ltd. (2024). *Boffa Miskell Limited 2024. Waipipi Wind Farm, South Taranaki: Year 3 Post-Construction Bird Mortality Monitoring Results* (Report W18053A; p. 69). Prepared by Boffa Miskell Ltd for Tararua Wind Power Ltd.

Boffa Miskell Ltd. (2025a). *Mahinerangi Wind Farm Stage 2 - Puke Kapo Hau: Avifauna Management Plan.* (BM240855; p. 25). Report prepared by Boffa Miskell Limited for Tararua Wind Power Ltd.

Boffa Miskell Ltd. (2025b). *Mahinerangi Wind Farm Stage 2 - Puke Kapo Hau. Mammalian Pest Control Plan.* (Management Plan BM240855). Prepared for Tararua Wind Power Limited.

Boffa Miskell Ltd. (2025c). *Proposed Jericho Wind Farm Blackmount, Southland. Ecological Impact Assessment for Avifauna.* (BM230390; p. 71 pp.). Prepared for Pioneer Energy Group Limited Partnership.

Department of Conservation. (2022a). *New Zealand Threat Classification System manual 2022*. Department of Conservation.

Department of Conservation. (2022b). *NZCTS: New Zealand Threat Classification System*. New Zealand Threat Classification System. https://nztcs.org.nz/home

Douglas, R., Barea, L., Waite, E., & Hankin, C. (2017). *How Good Design Can Protect the kārearea (New Zealand Falcon) and Improve Network Safety* (p. 14) [EEA Conference & Exhibition 2017, 21 - 23 June, Wellington].

Fox, N., & Wynn, C. (2010). *Wild bird electrocutions in New Zealand*. The Marlborough Falcon Conservation Project.

Garvin, J. C., Jennelle, C. S., Drake, D., & Grodsky, S. M. (2011). Response of raptors to a windfarm. *Journal of Applied Ecology*, *48*(1), 199–209.

Golder Associates. (2009). *New Zealand Falcon Monitoring at Mahinerangi Wind Farm 2008-2009* (TRUPO-DUD-011; p. 23). Prepared by Golder Associates for TrustPower Ltd.

Golder Associates. (2013). *Mahinerangi Wind Farm Stage 1, 2 years post-construction Bird Strike Monitoring, 2011 - 2013*. Prepared by Golder Associates for TrustPower Ltd.

Golder Associates Ltd. (2011). *Mahinerangi Wind Farm Environmental Monitoring Plan and Report* (1078405206-D; p. 12). Submitted to TrustPoser Ltd.

Golder Associates Ltd. (2012). *Monitoring Report. New Zealand Falcon Monitoring at Mahinerangi Wind Farm 2011-2012.* (11784_05_234; p. 45). Prepared by Golder Associates Ltd. for TrustPower Ltd.

Golder Associates Ltd. (2013). *Mahinerangi Wind Farm Stage 1, 2 years post-construction Bird Strike Monitoring, 2011- 2013* (1 27840571 7-002-R-RevO; p. 38). Prepared by Golder Associates (NZ) Ltd for TrustPower Ltd.

Hayman, E., Brandt, A. J., MacLeod, C. J., Howard, S., Diprose, G., Gormley, A. M., & Spurr, E. B. (2024). *State of NZ Garden Birds 2023 | Te Ahua o nga Manu o te Kari i Aotearoa* (ISSN 2744-5267; p. 21). Manaaki Whenua - Landcare Research, Lincoln.

Hayman, E., Brandt, A. J., MacLeod, C. J., Howard, S., Diprose, G., Gormley, A. M., & Spurr, E. B. (2025). *State of NZ Garden Birds 2024 | Te Ahua o nga Manu o te Kari i Aotearoa* (ISSN 2744-5267; p. 21). Manaaki Whenua - Landcare Research, Lincoln.

Heather, B. D., & Robertson, H. A. (2000). *The field guide to the birds of New Zealand*. Penguin Books.

Hitchmough, R. A. (2002). *New Zealand threat classification system lists 2002* [Threatened Species Occasional Publication]. Department of Conservation.

Jarvie, S., McKinlay, B., Palmer, D., Rawlence, N. J., & Thomas, O. (2025). *Regional conservation status of birds in Otago* (Otago Threat Classification Series 12). Otago Regional Council. https://www.orc.govt.nz/media/zz5lxiki/regional-conservation-status-of-birds-in-otago-may-2025.pdf

Kingett Mitchell Ltd. (2006). *Mahinerangi Wind Farm, Ecological Assessment* (TRUPODUD005/MWF; p. 80). Prepared by Kingett Mitchell Ltd for TrustPower Ltd.

Lawrence, S. (2002). *RANZ/DOC New Zealand falcon breeding survey 1994-1998* (DOC Science Internal Series 84). Department of Conservation.

Madders, M., & Whitfield, D. P. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis*, *148*(s1), 43–56.

Marchant, S., Higgins, P. J., Davies, J. N., & Considine, M. (1993). *Handbook of Australian, New Zealand and Antarctic birds: Volume 2, Raptors to Lapwings*. Oxford University Press.

Michel, P. (2021). *Amendment to the New Zealand Threat Classification System manual 2008: Revised categories 2021*. Department of Conservation.

Miskelly, C. M., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Powlesland, R. G., Robertson, H. A., Sagar, P. M., Scofield, R. P., & Taylor, G. A. (2008). Conservation status of New Zealand birds, 2008. *Notornis*, *55*(3), 117–135.

New Zealand Wind Energy Association. (2013). *Wind farm development in New Zealand: A framework for best practice*. New Zealand Wind Energy Association.

Ornithological Society of New Zealand. (2002). *Bird distribution atlas scheme: 1999-2005: Instructions to contributors* (Revised). Ornithological Society of New Zealand.

Robertson, H. A., Baird, K. A., Elliott, G. P., Hitchmough, R. A., McArthur, N., Makan, T. D., Miskelly, C. M., Sagar, P. M., Scofield, R. P., Taylor, G. A., & Michel, P. (2021). *Conservation status of birds in Aotearoa New Zealand, 2021* (New Zealand Threat Classification Series 36). Department of Conservation.

Sagar, P. M., Barker, R. J., & Geddes, D. (2002). Survival of breeding Finsch's oystercatchers (Haematopus finsch~) on farmland in Canterbury, New Zealand. *Notornis*, *49*, 233–240.

Sagar, P. M., Geddes, D., Banks, J. C., & Howden, P. (2000). Breeding of South Island pied oystercatchers (*Haematopus ostralegus finschi*) on farm land in mid-Canterbury, New Zealand. *Notornis*, *47*(2), 71–81.

Seaton, R., Holland, J. D., Minot, E. O., & Springett, B. P. (2009). Breeding success of New Zealand falcons (*Falco novaeseelandiae*) in a pine plantation. *New Zealand Journal of Ecology*, *33*(1), 32–39.

SLR Consulting NZ. (2025). *Vegetation, Wetland, and Terrestrial Invertebrate Assessment Mahinerangi Wind Farm Stage 2* (No: 810.031205.00001; p. 106). Prepared for Tararua Wind Power Limited.

Waite, E. (2017). Reports on a review of 13 mortality events in the New Zealand falcon (Falco novaeseelandiae; kārearea) in Glenorchy and the Whakatipu district over a 10-year period from Apr 2006-Jun 2016. *Notornis, Mar 2017; 1:P.21-23; Issn:*, *64*, 21–23.

Watson, R.T., & et.al. (2018). Raptor interactions with wind energy: case studies from around the world. *The Journal of Raptor Research*, *Vol. 52*(No. 1), 1–18.

Wingspan Birds of Prey Trust. (2010). *Wingspan 2010: Avoiding electrocution of falcon. Information series.*

12. Appendices

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Appendix 1: Report Authors Qualifications and Experience

Stephen Fuller

Qualifications

- Stephen Fuller is a Senior Principal Ecologist with Boffa Miskell Limited (BML). He has worked as an applied ecologist for over 40 years, including employment with the Department of Lands and Survey and the Botany Division of DSIR. From 1997 to 2002 he was the project manager responsible for the design and development of the Karori Wildlife Sanctuary (Zealandia). In November 2002 he joined Boffa Miskell Ltd.
- Mr Fuller holds a Bachelor of Science in Zoology and Botany, and a Diploma of Applied Science in Ecology from Victoria University of Wellington. He is a Certified Environmental Practitioner, and a Fellow of the Environment Institute of Australia and New Zealand.
- He works primarily in the area of ecological impact assessments.

Wind farm experience

- Since 2003 Mr Fuller has coordinated wind farm investigations throughout New Zealand. In each case the risk to avifauna of collision or displacement was a key consideration.
- To date, 12 windfarms he has prepared assessments for have been consented, five of those have been completed, and a further four are likely to commence construction in the next 12 months.
- He has also assisted with design of avifauna surveys and bird strike monitoring at a further three sites.
- In 2013 he coauthored a paper in the NZ Journal of Zoology on the results of post construction mortality monitoring at West Wind Wind Farm.[6] He also co-authored guidance for ecological assessments for the New Zealand Wind Energy Association, which was incorporated in part into their current guidance (New Zealand Wind Energy Association, 2013).

Lee Shapiro

Qualifications

- Dr Shapiro is a Senior Principal Ecologist with Boffa Miskell Limited (BML) where he has worked for the previous 9 years.
- Dr Shapiro holds a Bachelor of Science in Zoology and Master of Science in Ecology from Massey University of Palmerston North, and a Doctor of Philosophy in Ecology from Lincoln University, Canterbury. He is a Certified Environmental Practitioner – Ecology Specialist and works primarily in the area of ecological impact assessments and research into new tools for pest mammal control.

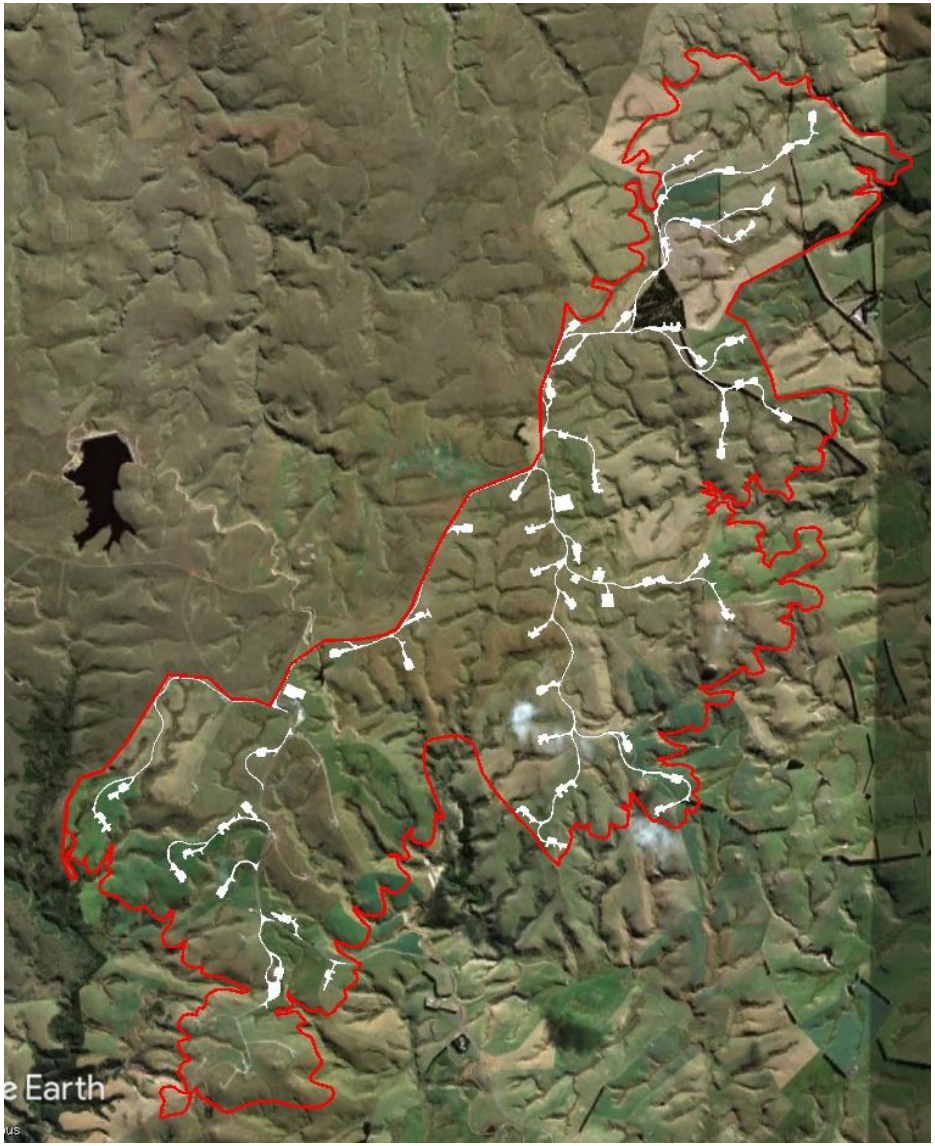
Wind farm Experience

- Dr Shapiro has been involved in surveying and assessing potential risks to avifauna at wind farm sites in New Zealand since 2007 and for each project the risk to avifauna of collision or displacement was a key consideration.
- To date, Dr Shapiro has been involved in one or more components of the surveying, assessment of effects and development of associated management plans, and the construction and post construction monitoring of avifauna at 10 windfarm sites in New Zealand. These sites include those that are in the process of lodging consent applications, are currently being constructed or have been constructed, as well as one which did not proceed to consenting.

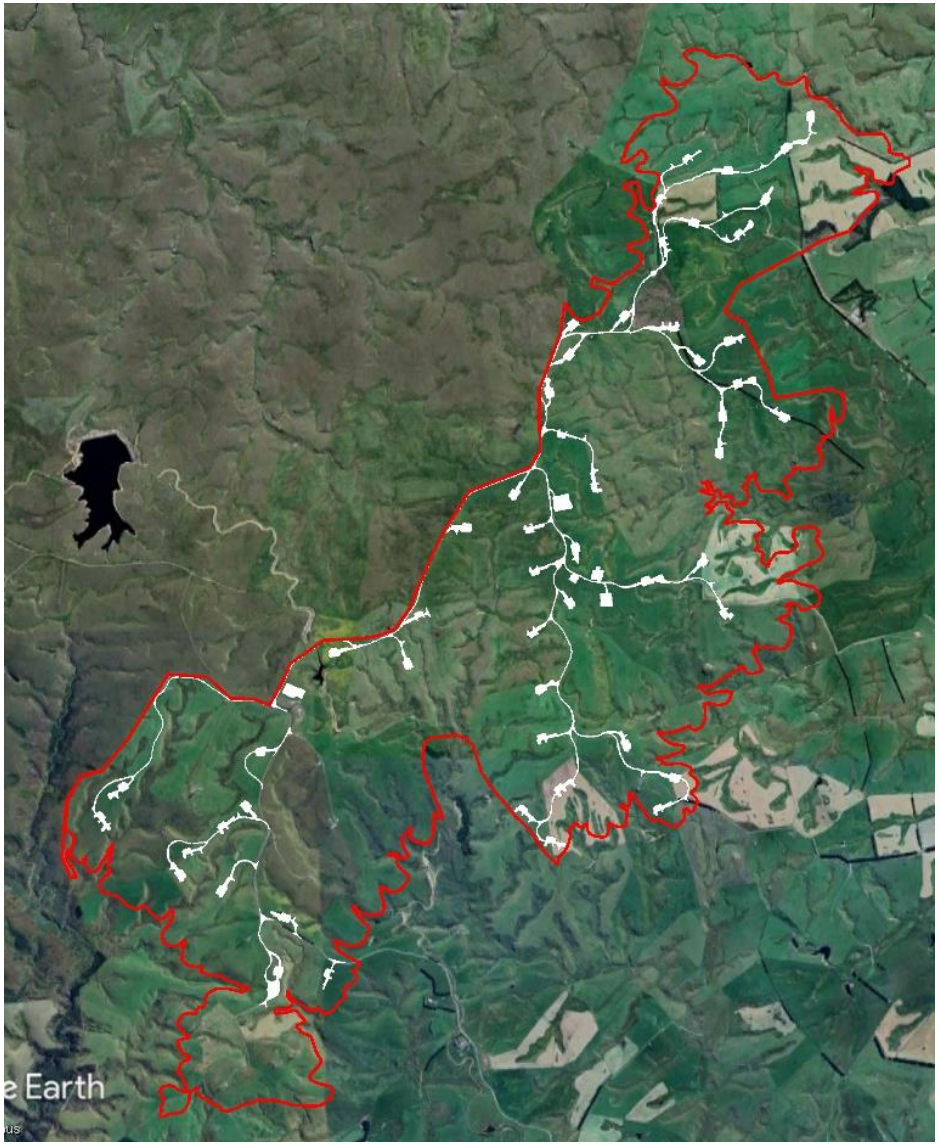
[6] Bull, L. S., Fuller, S., & Sim, D. (2013). *Post-construction avian mortality monitoring at Project West Wind.* New Zealand Journal of Zoology, 40(1), 28-46.

Appendix 2: Vegetation & Land Use (2013 - 2022)

5 April 2013 (Image © 2025 Maxar Technologies



13 Feb 2022 (Image © 2025 Airbus)



Appendix 3: Changes in Conservation Status (2006 - 2025) (updated 15-3-2025)

Comparison of conservation status between this assessment (Robertson et al., 2021) combined with and the Regional Threat Classification, Otago Region (Jarvie et al., 2025), compared to the Baseline Surveys (Miskelly et al., 2008), and Assessment of Effects (Hitchmough, 2002). Native species only. Sorted by current conservation status, highest to lowest.

Common names used in this study (2024)	National & Regional Threat Status (Robertson et al. 2021 & Jarvie et al. 2025)	Conservation Status (Miskelly 2008)	Threat Classification (Hitchmough 2002, OSNZ 2006)
Australasian Bittern	Threatened - Nationally Critical	Threatened - Nationally Endangered	Threatened - Nationally Endangered
Black Stilt	Threatened - Nationally Critical	Threatened - Nationally Critical	Threatened - Nationally Critical
White Heron	Threatened - Nationally Critical	Threatened - Nationally Critical	Threatened - Nationally Critical
Grey Duck	Threatened - Nationally Vulnerable	Threatened - Nationally Critical	Serious Decline
Eastern Falcon MWF	Threatened - Nationally Vulnerable	Threatened - Nationally Vulnerable	Gradual Decline
Black Shag	Regionally Endangered	At Risk - Naturally Uncommon	Sparse
Little Shag MWF	Regionally Vulnerable	At Risk - Naturally Uncommon	Not Threatened
Banded Dotterel	Regionally Vulnerable	Threatened - Nationally Vulnerable	Gradual Decline
Black-Billed Gull MWF	Regionally Vulnerable	Threatened - Nationally Endangered	Serious Decline
Pied Oystercatcher MWF	Regionally Vulnerable	At-Risk - Declining	Not Threatened
Silvereye	Regionally Declining	Not Threatened	Not Threatened
South Island Fernbird	At-Risk - Declining	At-Risk - Declining	Sparse
New Zealand Pipit MWF	At-Risk - Declining	At-Risk - Declining	Not Threatened
Royal Spoonbill	At Risk - Naturally Uncommon	At Risk - Naturally Uncommon	Coloniser
Cattle Egret	Migrant	Migrant	Migrant
Black Swan	Not Threatened	Not Threatened	(Not Native)
Grey Teal	Not Threatened	Not Threatened	Not Threatened
Grey Warbler MWF	Not Threatened	Not Threatened	Not Threatened
New Zealand fantail	Not Threatened	Not Threatened	Not Threatened
Paradise Shelduck MWF	Not Threatened	Not Threatened	Not Threatened
Pied Stilt	Not Threatened	At-Risk - Declining	Not Threatened
South Island Tomtit	Not Threatened	Not Threatened	Not Threatened
Black-Backed Gull MWF	Not Threatened	Not Threatened	Not Threatened
Spur-winged Plover MWF	Not Threatened	Not Threatened	Coloniser
Australasian Harrier MWF	Not Threatened	Not Threatened	Not Threatened
Welcome Swallow MWF	Not Threatened	Not Threatened	Coloniser
White-faced Heron MWF	Not Threatened	Not Threatened	Not Threatened

MWF *Observed at the MWF Site*

Appendix 4: All birds recorded by Kingett Mitchell (2006)

Avifauna within the Waipori Ecological District, and those observed within the proposed Mahinerangi Wind Farm Site (modified from Kingett Mitchell 2006) National Conservation Status as at time of Study.

Common Name	Conservation Status (Hitchmough, 2002)	Waipori ED	MWF Site	Comments
Black stilt	Nationally critical	y		No comment provided
White heron	Nationally critical	y		Recorded from Lake Mahinerangi.
Australasian bittern	Nationally endangered	y		Recorded from Lake Mahinerangi.
Black-billed gull	Serious decline	y		Common in vicinity of Lake Mahinerangi.
Grey duck	Serious decline	y		Common in vicinity of Lake Mahinerangi.
Banded dotterel	Gradual decline	y		Recorded from Lake Mahinerangi.
Eastern falcon	Gradual decline	y		Recorded in vicinity of Lake Mahinerangi; and the Lammermoor's, also reported by local residents.
Black shag	Sparse	y		Recorded from Lake Mahinerangi.
SI fernbird,	Sparse	y		Recorded from Lake Mahinerangi.
Cattle egret	Migrant	y		Recorded from Lake Mahinerangi.
Royal spoonbill	Coloniser	y		No comment provided
Spur-winged plover	Coloniser	y	y	1-4 seen infrequently in southern MWF areas.
Welcome swallow	Coloniser	y		Recorded from Lake Mahinerangi.
Australasian harrier	Not threatened	y	y	1-4 seen over-flying daily.
Grey teal	Not threatened	y		Recorded from Lake Mahinerangi.
Grey warbler	Not threatened	y		No comment provided
Little shag	Not threatened	y	y	One vagrant observed over-flying.
NZ pipit	Not threatened	y	y	1-6 seen daily in grassland.
Paradise shelduck	Not threatened	y	y	2 at small dam in the northern part of MWF area (E2272125, N5496325)
Pied stilt	Not threatened	y	y	Recorded from Lake Mahinerangi. One record from bioacoustic recorder in Feb 2025.
Pied oystercatcher	Not threatened	y	y	One vagrant observed.
SI tomtit	Not threatened	y		No comment provided
Southern black-backed gull	Not threatened	y	y	1-6 seen over-flying daily.
White-faced heron	Not threatened	y	y	One vagrant observed. Also recorded from Lake Mahinerangi.
Mallard	Introduced	y	y	Up to six seen on dam in the northern part. of MWF area (E2272125, N5496325) and occasionally on farm ponds throughout.
Black swan	Introduced	y		Common in vicinity of Lake Mahinerangi.
Canada goose	Introduced	y		Common in vicinity of Lake Mahinerangi.
Chaffinch	Introduced	y	y	Local residents. Occasional
Feral goose	Introduced	y		Common in vicinity of Lake Mahinerangi.
Redpoll	Introduced		y	Occasional
Skylark	Introduced	y	y	Abundant in grassland.

Common Name	Conservation Status (Hitchmough, 2002)	Waipori ED	MWF Site	Comments
Starling	Introduced		y	Several flocks of >50 regularly seen in pasture grassland areas.
White-backed magpie	Introduced		y	A flock of >34 regularly seen on ridge 1 km NE of Bottle Rock.
Yellowhammer	Introduced	y	y	Occasional

1. Names, status and distribution, and threat classification after Ornithological Society of New Zealand (2006) and Hitchmough (2002).
2. Waipori Ecological District data after McEwen (1987), Carter (1994) and Ryder Consulting (2002a).
3. Mahinerangi Wind Farm data from field survey (MWF).
4. Lake Mahinerangi data from Ryder Consulting (2002a).

#. Found within land areas of North, South and Stewart Islands.
C. Inshore islands and waters.
O. Oceanic, outer islands, Antarctica.
E. Endemic – breeds only in New Zealand territories.
I. Introduced by human agency.

Appendix 5: All birds recorded by this study

All species (native and introduced), all sources, sorted by conservation status.

Common Name	National Conservation Status (Robertson et al. 2021)	Ebird (2024)	Ryder (2002)	Kingett Mitchell (2006)	BML (2005)
Australasian bittern	Nationally Critical		Y	Y	
Black stilt	Nationally Critical			Y	
Grey duck	Nationally Critical		Y	Y	
White heron	Nationally Critical		Y	Y	
Black shag	Regionally Endangered	Y	Y	Y	Y
Eastern falcon MWF	Nationally Vulnerable	Y	Y	Y	Y
Banded dotterel	Regionally Vulnerable	Y	Y	Y	
Black-billed gull MWF	Regionally Vulnerable	Y	Y	Y	Y
Little shag MWF	Regionally Vulnerable	Y	Y	Y	Y
Pied oystercatcher MWF	Regionally Vulnerable	Y	Y	Y	Y
Brown creeper	Regionally Declining	Y			
Silvereye MWF	Regionally Declining	Y			Y
New Zealand fernbird	At Risk, Declining	Y	Y	Y	
New Zealand pipit MWF	At Risk, Declining	Y	Y	Y	Y
Australian coot	At Risk, Naturally Uncommon	Y			
Royal spoonbill	At Risk, Naturally Uncommon		Y	Y	
Cattle egret	Regional vagrant		Y	Y	
Australasian harrier MWF	Not Threatened	Y	Y	Y	Y
Australasian shoveler	Not Threatened	Y			
Bellbird	Not Threatened	Y			
Black swan	Not Threatened	Y	Y	Y	
Grey teal	Not Threatened	Y	Y	Y	Y
Grey warbler MWF	Not Threatened	Y		Y	Y
New Zealand fantail MWF	Not Threatened	Y			Y
New Zealand pigeon	Not Threatened	Y			
New Zealand scaup	Not Threatened	Y			Y
Paradise shelduck MWF	Not Threatened	Y	Y	Y	Y
Pied stilt	Not Threatened	Y	Y	Y	Y
Pukeko	Not Threatened	Y			
South Island tomtit	Not Threatened			Y	
Southern black-backed gull MWF	Not Threatened	Y	Y	Y	Y
Spur-winged plover MWF	Not Threatened	Y	Y	Y	Y
Tui	Not Threatened	Y			
Welcome swallow MWF	Not Threatened	Y	Y	Y	Y
White-faced heron MWF	Not Threatened	Y	Y	Y	Y
Australian magpie MWF	Introduced & Naturalised	Y		Y	Y
Canada goose	Introduced & Naturalised	Y	Y	Y	Y
Chaffinch MWF	Introduced & Naturalised	Y		Y	Y
Common redpoll MWF	Introduced & Naturalised	Y		Y	Y
Dunnock MWF	Introduced & Naturalised	Y			Y
Eastern rosella	Introduced & Naturalised	Y			

Common Name	National Conservation Status (Robertson et al. 2021)	Ebird (2024)	Ryder (2002)	Kingett Mitchell (2006)	BML (2005)
Eurasian blackbird [MWF]	Introduced & Naturalised	Y			Y
Eurasian skylark [MWF]	Introduced & Naturalised	Y		Y	Y
European goldfinch [MWF]	Introduced & Naturalised	Y			Y
European greenfinch [MWF]	Introduced & Naturalised	Y			Y
European starling [MWF]	Introduced & Naturalised	Y		Y	Y
Greylag goose	Introduced & Naturalised	Y	Y	Y	Y
House sparrow [MWF]	Introduced & Naturalised	Y			Y
Little owl	Introduced & Naturalised	Y			
Mallard [MWF]	Introduced & Naturalised	Y	Y	Y	Y
Rock pigeon	Introduced & Naturalised	Y			
Song thrush [MWF]	Introduced & Naturalised	Y			Y
Wild turkey	Introduced & Naturalised	Y			
Yellowhammer [MWF]	Introduced & Naturalised	Y		Y	Y

[MWF] Recorded in the Mahinerangi Wind Farm

Appendix 6: All birds - Habitat preferences

All sources combined including Bird Atlas and eBird. All species (native and introduced). Sorted by primary and secondary habitat.

SPECIES	National & Regional Conservation Status. (Robertson et al. 2021 & Jarvie et al. 2025)	Oceanic	Coastal / Estuary	Freshwater / wetlands	Farmland / open country	Scrub / shrubland	Native forest	Exotic Forest	Urban/Residential
Banded dotterel	Regionally Vulnerable								
Royal spoonbill	At Risk, Naturally Uncommon								
Southern black-backed gull	Not Threatened								
White-faced heron	Not Threatened								
Fernbird (South Island)	At Risk, Declining								
Little shag	Regionally Vulnerable								
New Zealand scaup	Not Threatened								
White heron	Threatened, Nationally critical								
Australasian bittern	Threatened, Nationally critical								
Australasian shoveler	Not Threatened								
Black shag	Regionally Endangered								
Black stilt	Threatened, Nationally critical								
Pied stilt	Not Threatened								
Black-billed gull	Regionally Vulnerable								
Grey duck	Threatened, Nationally critical								
Grey teal	Not Threatened								
Greylag goose	Introduced								
Pied oystercatcher	Regionally Vulnerable								
Black swan	Not Threatened								
Eurasian coot	At Risk, Naturally Uncommon								
Mallard	Introduced & Naturalised								
Paradise shelduck	Not Threatened								
Pukeko	Not Threatened								
Canada goose	Introduced & Naturalised								
Cattle egret	Regional vagrant								
New Zealand pipit	At Risk, Declining								
Spur-winged plover	Not Threatened								
Wild turkey	Introduced & Naturalised								
Welcome swallow	Not Threatened								
Australasian harrier	Not Threatened								
Eurasian skylark	Introduced & Naturalised								
European starling	Introduced & Naturalised								
Little owl	Introduced & Naturalised								
House sparrow	Introduced & Naturalised								
Australian magpie	Introduced & Naturalised								
Yellowhammer	Introduced & Naturalised								
European goldfinch	Introduced & Naturalised								

SPECIES	National & Regional Conservation Status. (Robertson et al. 2021 & Jarvie et al. 2025)	Oceanic	Coastal / Estuary	Freshwater / wetlands	Farmland / open country	Scrub / shrubland	Native forest	Exotic Forest	Urban/Residential
European greenfinch	Introduced & Naturalised								
Common redpoll	Introduced & Naturalised								
Chaffinch	Introduced & Naturalised								
Dunnock	Introduced & Naturalised								
Song thrush	Introduced & Naturalised								
Eurasian blackbird	Introduced & Naturalised								
Silvereye	Regionally Declining								
Grey warbler	Not Threatened								
Eastern rosella	Introduced & Naturalised								
New Zealand falcon (Eastern)	Threatened Nationally Vulnerable								
New Zealand pigeon	Not Threatened								
Tui	Not Threatened								
Brown creeper	Regionally Declining								
South Island tomtit	Not Threatened								
Bellbird	Not Threatened								
New Zealand fantail	Not Threatened								
Rock pigeon	Introduced & Naturalised								

Appendix 7: Bio-Acoustic Monitoring

Count of pied oystercatcher calls per night, per ARD, between 7 January 2025 and 7 February 2025.

	Bio-Acoustic Recorders								
Dates	ARD-01	ARD-02	ARD-03	ARD-04	ARD-05	ARD-06	ARD-07	ARD-08	Sum
January									
7/01/2025									0
8/01/2025									0
9/01/2025									0
10/01/2025									0
11/01/2025									0
12/01/2025									0
13/01/2025									0
14/01/2025									0
15/01/2025									0
16/01/2025			3				1	3	7
17/01/2025		4	1					4	9
18/01/2025									0
19/01/2025		3	3				5	2	13
20/01/2025		1							1
21/01/2025			5						5
22/01/2025									0
23/01/2025									0
24/01/2025			1						1
25/01/2025									0
26/01/2025									0
27/01/2025									0
28/01/2025									0
29/01/2025									0
30/01/2025									0
31/01/2025									0
February									
1/02/2025									0
2/02/2025									0
3/02/2025									0
4/02/2025									0
5/02/2025									0
6/02/2025									0
7/02/2025									0
Totals	0	8	13	0	0	0	6	9	36

Appendix 8: 2025 Bird Observations – By sample site

All species observed (native and introduced), by PC station. Sorted between lakes and grasslands.

Row Labels	Dam 1	Dam 2	Dam 3	Dam 4	Dam 5	Dam 6	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	Sum of Counts
Canada goose	365		250	1,749	310	199									2,873
Black-backed gull	91	27	7	458	1	69	21	13	4	10	6	12	7	140	866
Mallard	15	2	140	110	211	14									492
European starling		1		44			186							41	272
Australian magpie	2	2			1		27	5	82	4		2	4	35	164
Common redpoll		2	15	2			3		24	77	2	2	20	11	158
Welcome swallow	16	2	8	7			6		7	16	1	1	6	83	153
Spur-winged plover	12	39	21	44	3	1	5							11	136
Black-billed gull	65	33	4	12									1		115
Paradise shelduck	31	2	6	24	2	30	3	7	3					1	109
Black shag	14	4	12	61	4	4									99
Silvereye			8	7	2				2	65			6		90
Grey teal			17	67											84
Eurasian skylark	2	6	2				11	12	12		18	12	2	4	81
European goldfinch	2	18	5	12			9		1	31				3	81
Australasian harrier	5	3	3	4		1	4		1	13	2	3	2	6	47
Greylag goose		23		21											44
White-faced heron	13	6	7	3	14									1	44
Yellowhammer	1	7	1					1	6	2		1	14	9	42
Eurasian blackbird			3				2			5		1	3	26	40
House sparrow		12	5	9								1	1	7	35
Grey warbler				2			1			22				3	28
NZ scaup	20		5												25
Song thrush														23	23

Row Labels	Dam 1	Dam 2	Dam 3	Dam 4	Dam 5	Dam 6	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	Sum of Counts
Chaffinch	1	2								15			1	3	22
NZ pipit		2					3		1		5	7	1		19
Pied stilt	2	4	4	6											16
NZ falcon (southern)										3	1	2	4		10
European greenfinch			2										1	3	6
Little shag	3		1												4
Pied oystercatcher			3												3
Dunnock										1				1	2
NZ fantail										1					1
Sum Counts per Site	660	197	529	2,642	548	318	281	38	143	265	35	44	73	411	6,184

Appendix 9: National and Regional Threat Classification Systems

This report uses both the New Zealand Threat Classification (NZTCS) (Robertson et al., 2021) and the Regional Threat Classification, Otago Region (Jarvie et al., 2025).

National Conservation Status

The NZTCS is a national system used to assess the conservation status of species found in the wild in New Zealand (Department of Conservation, 2022b). The system is administered by the Department of Conservation (DOC) on behalf of all New Zealanders and complements the International Union for Conservation of Nature (IUCN) Red List system.

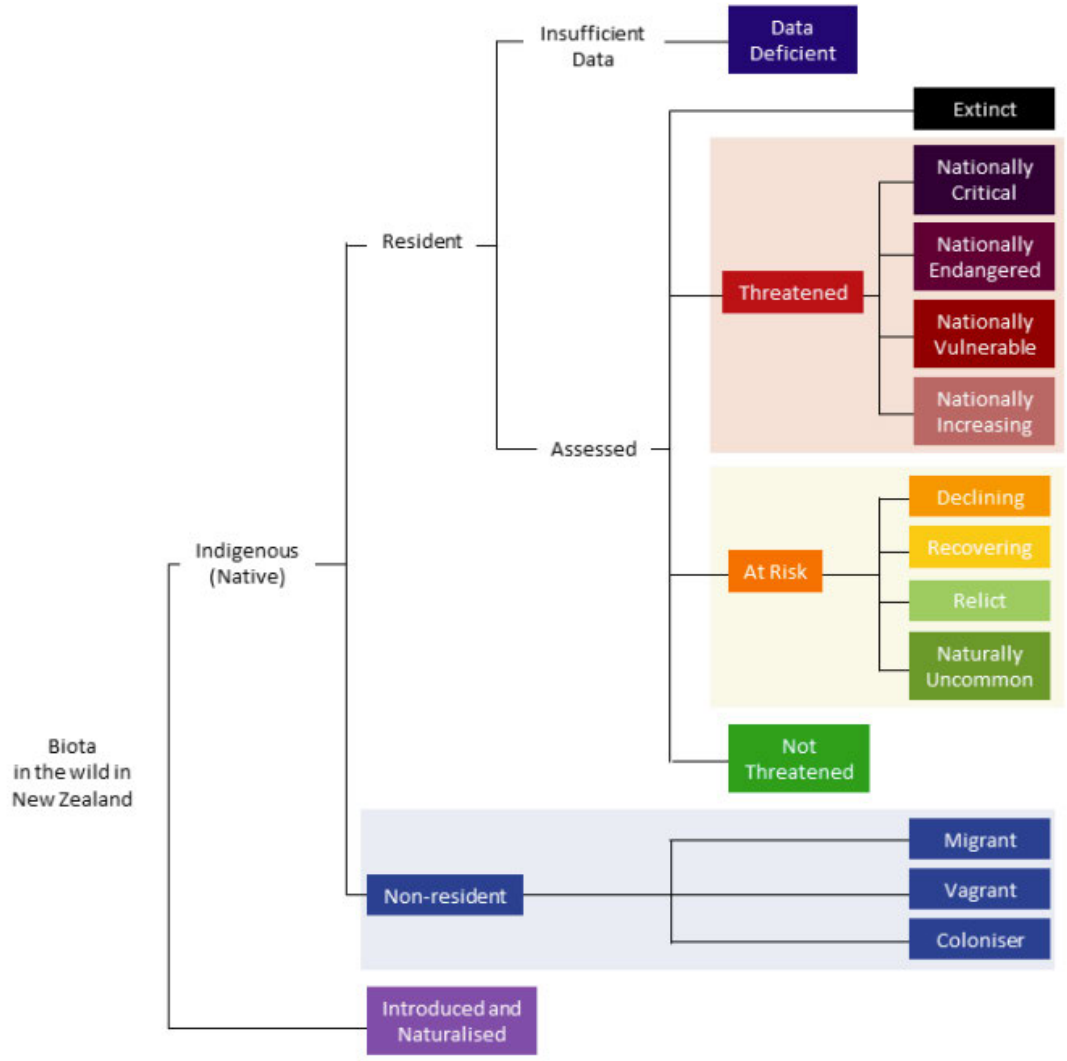


Figure 10 Structure and categories of the New Zealand Threat Classification System as updated by Michel (2021) and used by Robertson et al. (2021) in Conservation status of birds in Aotearoa New Zealand, 2021.

The NZTCS uses a rules-based approach to assess the risk of extinction based on estimates of population size and trend projected over the longer of 10 years or three generations. Qualifiers are an integral part of the NZTCS, as they provide critical additional information about a taxon's assessment, status and management (Table 22:). The national qualifiers are listed in Table C1.

Table 22: Qualifiers used in the NZTCS. The list is arranged in thematic groups covering the NZTCS assessment process, biological attributes of taxa, management of pressures on taxa, population trend and population state (Department of Conservation, 2022a).

Qualifier	Description	Code
Assessment qualifiers		
Data Poor Recognition	A taxon is given the Data Poor: Recognition qualifier when confidence in the assessment is low because of difficulties in determining the identity of the taxon in the field and/or laboratory. Taxa with this qualifier will also often be given the qualifiers Data Poor Size and Data Poor Trend, in which case they are most likely to be Data Deficient.	DPR
Data Poor Size	The Data Poor: Size qualifier indicates that confidence in the assessment is low because of a lack of data on population size.	DPS
Data Poor Trend	The Data Poor: Trend qualifier indicates that confidence in the assessment is low because of a lack of data on population trend.	DPT
Designated	A taxon is given the Designated qualifier when the expert panel has assigned it to what they consider to be the most appropriate status without full application of the criteria.	De
Biological attribute qualifiers		
Biologically Sparse	The Biologically Sparse qualifier is used when a taxon naturally consists of small and widely scattered sub-populations. It can apply to any Threatened or At Risk taxon.	Sp
Island Endemic	The Island Endemic qualifier is given to a taxon whose natural distribution is restricted to one island archipelago (e.g. the Auckland Islands) and is not found on the North or South Islands of New Zealand or Stewart Island/Rakiura. A taxon cannot be given this qualifier if it is Secure Overseas (SO, SO? or S?O) or Threatened Overseas (TO, TO? or T?O).	IE
Natural State	A taxon is given the Natural State qualifier if it has a stable or increasing population that is presumed to be in a natural condition (i.e. it has not experienced a historical human-induced decline). This qualifier is equivalent to the 'natural' population state value in the NZTCS database.	NS
Range Restricted	A taxon that is naturally confined to a specific substrate or habitat or a geographic area of less than 100 000 ha (1000 km2) is given the Range Restricted qualifier. This is assessed by taking into account the area of habitat that is occupied by each sub-population and summing these areas where there is more than one sub-population.	RR
Pressure management qualifiers		
Conservation Dependent	A taxon that is likely to move to a worse conservation status over the longer of the next 10 years or three generations (maximum 100 years) if current management ceases is given the Conservation Dependent qualifier. The term 'management' can include indirect actions that benefit taxa, such as island biosecurity. A taxon is only considered conservation dependent if cessation of the management would result in a worse conservation status, and the influence of the benefits of management on the total population must be considered before using this qualifier. The benefit of managing a single sub-population may not be adequate to trigger this qualifier but may trigger Partial Decline. Furthermore, taxa that are qualified as Conservation Dependent may also be given the Partial Decline qualifier if only one or a few sub-populations have benefitted from management.	CD
Climate Impact	The Climate Impact qualifier is used when a taxon is adversely affected by long-term climate trends and/or extreme climatic events. Variations from 'normal climatic conditions' may include extended periods (e.g. a month, season or year) of higher-than-normal rainfall or below-normal sunshine hours, a short-duration extreme (i.e. rare) event such as an intense tropical storm or 10-day cold spell,	CI

Qualifier	Description	Code
	or gradual long-term changes to sea level or average temperature due to climate change. The adverse effects of climate change may be direct (e.g. the impact of extreme weather on populations) or indirect (e.g. increased impacts from predators that have benefitted from environmental changes caused by climate change)7.	
Conservation Research Needed	*A taxon is given the Conservation Research Needed qualifier if the causes of its decline and/or solutions for its recovery are poorly understood and research is required.*	*CR*
Population Fragmentation	*The Population Fragmentation qualifier is used where gene flow between sub-populations is hampered as a direct or indirect result of human activity. It should be noted that naturally disjunct populations are not considered to be fragmented.*	*PF*
Recruitment Failure	*The Recruitment Failure qualifier is used where the age structure of the current population of a taxon is such that a catastrophic decline is likely in the future. It should be noted that a failure to produce new progeny or the failure of progeny to reach maturity can be masked by apparently healthy populations of mature specimens.*	*RF*
Population trend qualifiers		
Extinct in the Wild	*A taxon that is known only in captivity or cultivation or has been reintroduced to the wild but is not self-sustaining is given the Extinct in the Wild qualifier. Assessment of a reintroduced population should be considered only when it is self-sustaining, which requires both of the following criteria to have been fulfilled: It is expanding or has reached a stable state through natural replenishment and at least half the breeding adults are products of the natural replenishment. It has been at least 10 years since reintroduction.*	*EW*
Extreme Fluctuations	*A taxon that has an increased threat of extinction due to extreme unnatural population fluctuations or natural fluctuations overlaying human-induced declines is given the Extreme Fluctuations qualifier. When ranking taxa with extreme fluctuations, the lowest estimated number of mature individuals should be used for determining population size, as a precautionary measure. However, annual population fluctuations that are a natural function of a taxon's life cycle should not be considered.*	*EF*
Increasing	*The Increasing qualifier is used when a taxon has an ongoing or forecast increase of > 10% in the total population, taken over the longer of the next 10 years or three generations (maximum 100 years). Note that this qualifier is redundant for taxa ranked as Recovering.*	*Inc*
Partial Decline	*A taxon that is declining over most of its range but has one or more secure populations (such as on offshore islands) is given the Partial Decline qualifier. An example of a Partial Decline taxon is North Island kākā (Nestor meridionalis septentrionalis), which is declining towards a small, stable population. The Relict qualifier may be appropriate when the population has stabilised.*	*PD*
Possibly Extinct	*A taxon that has not been observed for more than 50 years but for which there is insufficient evidence to support declaring it extinct is given the Possibly Extinct qualifier. This qualifier may apply to several Data Deficient and Nationally Critical taxa.*	*PE*
Population state qualifiers		
Naturalised Overseas	*A taxon that is endemic to New Zealand but has been introduced (deliberately or accidentally) by human agency to another country and has naturalised there is given the Naturalised Overseas qualifier. An example of such a taxon is Olearia traversiorum in the Republic of Ireland.*	*NO*

7 More details around when the Climate Impact qualifier applies to a species can be found at https://nztcs.org.nz/content/QUALIFIERS

Qualifier	Description	Code
One Location	The One Location qualifier is used where a taxon is found at one location (geographically or ecologically distinct area) in New Zealand that is less than 100 000 ha (1000 km2), so a single event (e.g. a predator irruption or fire) could easily affect all individuals of the taxon. Examples of such taxa include L'Esperance Rock groundsel (Senecio esperensis) and Open Bay Island leech (Hirudobdella antipodum). This qualifier can apply to all Threatened, At Risk, Non-resident Native – Coloniser and Non-resident Native – Migrant taxa, regardless of whether their restricted distributions in New Zealand are natural or human induced. Resident native taxa that have restricted distributions but for which it is unlikely that all sub-populations would be threatened by a single event (e.g. because water channels within an archipelago are larger than known terrestrial predator swimming distances) should be qualified as Range Restricted.	OL
Relict	The Relict qualifier is given to a taxon whose population has declined since human arrival to less than 10% of its former range but has stabilised. The range of a relictual taxon considers the area currently occupied as a ratio of the taxon's former extent. Reintroduced and self-sustaining populations within or outside the former known range of a taxon should be considered when determining whether a taxon is relictual. This qualifier may replace the Partial Decline qualifier once a taxon's population has stabilised within a reduced area.	Rel
Secure Overseas	The Secure Overseas qualifier is used when a taxon is secure in the parts of its natural range outside New Zealand.	SO
Secure Overseas?	Use of the Secure Overseas? qualifier indicates that it is uncertain whether a taxon of the same name that is secure in the parts of its natural range outside New Zealand is conspecific with the New Zealand taxon.	SO?
Secure? Overseas	Use of the Secure? Overseas qualifier indicates that it is uncertain whether the taxon is secure in the parts of its natural range outside New Zealand.	S?O
Threatened Overseas	The Threatened Overseas qualifier is used when the taxon is threatened in the parts of its natural range outside New Zealand.	TO
Threatened Overseas?	Use of the Threatened Overseas? qualifier indicates that it is uncertain whether a taxon of the same name that is threatened in the parts of its natural range outside New Zealand is conspecific with the New Zealand taxon.	TO?
Threatened? Overseas	Use of the Threatened? Overseas qualifier indicates that it is uncertain whether the taxon is threatened in the parts of its natural range outside New Zealand.	T?O

Regional Conservation Status

A Regional Conservation Status was produced for birds in the Otago Region. The methodology for the regional threat assessments leverages off national threat assessments as determined using the NZTCS (Townsend et al. 2008, Rolfe et al. 2021, Michel 2021), with thresholds for area of occupancy or population size adjusted for the land area in the region (Appendix 1).

National strongholds and additional regional qualifiers were also considered (Appendix 2) In that classification the following qualifiers were added.

Table C1: Qualifiers used in the Regional Conservation Status of Birds in Otago (Jarvie et al., 2025).

Code	Qualifier	Description
FR	Former Resident	Breeding population (existed for more than 50 years) extirpated from region but continues to arrive as a regional vagrant or migrant. FR and RN are mutually exclusive.

Code	Qualifier	Description
HR	Historical Range	The inferred range (extending in any direction) of the taxon in pre-human times meets its natural limit in the region.
IN	Introduced Native	Introduced to the region, though not known to have previously occurred in it.
NStr	National Stronghold	More than 20% of the national population breeding or resident for more than half their life cycle in the region.
NR	Natural Range	The known range (extending in any direction) of the taxon meets it natural limit in the region.
RE	Regional Endemic	Known to breed only in the region.
RN	Restored Native	Reintroduced to the region after having previously gone extinct there.
TL	Type Locality	The type locality of the taxon is within the region. Ignore if the taxon is or has ever been regionally extinct