IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Meridian Energy Limited for the resource consents related to the construction of a new channel to enable a permanent diversion of part of the flow of the Waiau Arm and the associated removal of bed material and gravels, together with any maintenance and ancillary activities.

STATEMENT OF EVIDENCE IN CHIEF OF DR LEIGH BULL

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INTRODUCTION

1. My full name is Dr Leigh Sandra Bull, and I am a Director at BlueGreen Ecology Limited (**BlueGreen**).

2. I hold the qualifications of Bachelor of Science (Zoology), Master of Science with Honours (Ecology) and PhD (Ecology) from Victoria University of Wellington. My area of specialisation is ornithology, the study of birds.

3. After completing my PhD in 2003, I worked for the Department of Conservation (**DOC**) in the Biodiversity Recovery Unit as a Species Protection Officer and later as a Senior Technical Support Officer in the Marine Conservation Unit.

4. In 2005, I was awarded a French Ministry of Research post-doctorate fellowship at the Université Paris Sud XI. After completing my post-doctorate, I contracted to the National Institute of Water and Atmospheric Research Limited (**NIWA**) to undertake seabird field investigations on Antipodes Island.

5. I joined Boffa Miskell Ltd (**BML**) in 2007 where I worked on a variety of projects investigating the potential impact of developments on avifauna. In 2023 I established BlueGreen where I have continued to undertake ecological impact assessments.

6. My professional memberships include:

   (a) The Environment Institute of Australia and New Zealand; and

   (b) The New Zealand Ornithological Society.

7. I served in a voluntary role as the Editor of Notornis, the Ornithological Society of New Zealand's peer-reviewed scientific journal, from 2016 to 2018.

8. I currently serve in a voluntary role as a subject matter expert to the Shorebirds Trust[1], a registered charitable trust that invests in scientific research, and funds and co-ordinates conservation efforts aimed to improve coastal biodiversity.

[1] https://www.shorebirdstrust.org.nz/about-us

9. I have been engaged by Meridian Energy Limited (**Meridian**) to provide advice in relation to potential effects on avifauna from the proposed Manapōuri Lake Control Structure Improvement Project (**MLC:IP** or **the Project**). This has included:

   (a) Review of the sections in the Assessment of Environmental Effects: Freshwater Ecology Report (which I will refer to as the **Freshwater Ecology Report**) and the reports and surveys which these sections have been based on; and

   (b) Responding[2] to the bird-related sections of the s92 request for further information from Environment Southland dated 13 May 2024; and

   (c) Providing additional avifauna information[3] to assist with the second pre-hearing meeting (held on 24 July 2024) with Environment Southland and submitters.

10. The Freshwater Ecology Report[4] is attached as Appendix D[5] to the resource consent applications for the MLC:IP. This report has been prepared based on work[6] done by scientists who were formerly employed at NIWA. I have reviewed this report and confirm that I agree with the conclusions reached in this report in relation to effects that were identified on freshwater birds. Thus, the opinions I express in my evidence are based on my own extensive professional experience in this area, and with these species, and has been confirmed through a visit to the Project Site on 21 June 2024. Furthermore, there were several potential effects that were not considered by NIWA and which I have subsequently assessed[3].

11. I confirm that I have read the following draft statements in preparing my evidence:

   (a) Mr Andrew Feierabend (Meridian);

   (b) Mr Daniel Murray (Tonkin + Taylor);

[2] Bull, L. (2024). Manapōuri Lake Control Improvement Project – Response to avifauna S92 requests (Memo Prepared by BlueGreen Ecology Ltd for Meridian Energy Ltd, Dated 31 May 2024).

[3] Bull, L. (2024). Manapōuri Lake Control Improvement Project – Pre-hearing avifauna information (Memo Prepared by BlueGreen Ecology Ltd for Meridian Energy Ltd, Dated 16 July 2024).

[4] Hoyle et al. (2023). Manapōuri Lake Control Flow Improvement Project, Assessment of Environmental Effects: Freshwater Ecology [Report No. 2023293CH prepared by NIWA for Meridian Energy Ltd].

[5] Available here

[6] Whitehead (2021)

(c) Mr Dougal Clunie (Damwatch);

(d) Dr Jo Hoyle (NIWA);

(e) Dr Mike Hickford (NIWA); and

(f) Dr Kristy Hogsden (NIWA).

12. My evidence summarises the potential effects on freshwater birds, and responds to issues raised in submissions and by the Council reviewers in relation to this subject matter.

13. The existing configuration of the Waiau Arm, the MLC and the Lower Waiau River, as well as the proposed Project are described in Sections 2, 4 and 5 of the Assessment of Effects on the Environment (**AEE**) and in Mr Feierabend's evidence and are not repeated in detail here.

CODE OF CONDUCT

14. Although this is not an Environment Court hearing, I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2023. I agree to comply with this Code of Conduct. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

15. I note in particular that I am relying on the work done by NIWA scientists, but that I have formed my own opinion in relation to the potential effects on avifauna.

SCOPE OF EVIDENCE

16. My statement of evidence relates to the ecological values of avifauna species that could potentially be affected by the proposed MLC:IP.

17. In my evidence I will:

(a) Describe the existing environment for avifauna in and around the Project Site;

(b) Explain the methodology used by NIWA to assess effects on freshwater birds, and how that relates to the Environmental Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment framework;

(c) Summarise the results of the NIWA assessment, as well as my own assessment, and the recommended measures to avoid, remedy or mitigate effects;

(d) Give my recommendations as to conditions of consent to manage effects on avifauna;

(e) Comment on issues raised by submitters;

(f) Respond to issues in the Officers' Report in relation to avifauna; and

(g) Provide my conclusions.

SUMMARY OF EVIDENCE

18. The EIANZ Ecological Impact Assessment framework was used to assess the following potential impacts of the Project on avifauna:

(a) Disturbance;

(b) Impacts on foraging ability through changes in suspended and deposited sediments;

(c) Loss of habitat; and

(d) Lighting.

19. While the avifauna assemblage includes several At Risk or Threatened species, any direct effects of the Project on these species are mitigated by their mobility, and/or by their preference for locations (e.g., tributaries) not affected by the Project, and by timing the Project to avoid critical times (e.g., bird breeding season).

20. Thus, the overall effects of the Project on avifauna will be Low to Very Low.

21. While this level of effect does not require any mitigation or offsetting, consent conditions have been recommended to ensure the overall levels of effect remain Low to Very Low for avifauna.

22. The section 42A Officer's Report and supporting technical report (Attachment 2 to the Officer's Report) confirm that there are no points of disagreement with respect to potential effects of the MLC:IP on avifauna, and how these can be managed through the proposed consent conditions.

EXISTING ENVIRONMENT

Avifauna species

23. Lists of the freshwater and terrestrial avifauna species that have been recorded in the wider area and associated with the Manapōuri Lake Control site (MLC) are provided in Table 1 and Table 2 respectively. These species were identified through desktop and formal survey data collected in and around the Project area (Whitehead, 2021[7]), as well as additional species I observed during my site visit, but which were not recorded by Whitehead (2021).

24. Further information on the Threatened and At Risk species that were recorded is provided in the following paragraphs.

Table 1: List of freshwater avifauna species recorded in and around the Project area (Source: Whitehead (2021)).

SPECIES	NZ THREAT CLASSIFICATION[8]	GUILD	MLC
Black-billed gull	At Risk – Declining	Aerial gulls & terns	x
Southern black-backed gull	Not Threatened	Aerial gulls & terns	x
Black-fronted tern	Threatened – Nationally Endangered	Aerial gulls & terns	
Banded dotterel	At Risk – Declining	Shallow water wader	x
White-faced heron	Not Threatened	Deep water wader	
Spur-winged plover	Not Threatened	Deep water wader	x
South Island pied oystercatcher	At Risk – Declining	Deep water wader	x
Pied stilt	Not Threatened	Deep water wader	x
NZ scaup	Not Threatened	Open water diver	

[7] Whitehead, A. (2021). Freshwater birds at the Manapōuri Lake Control [Memo (Report No. 2021113CH) prepared by NIWA, dated 12 May 2021].

[8] Robertson et al. (2021). Conservation status of New Zealand birds, 2021 (New Zealand Threat Classification Series 36). Department of Conservation.

SPECIES	NZ THREAT CLASSIFICATION[8]	GUILD	MLC
Black shag	At Risk – Relict	Open water diver	x
Little shag	At Risk – Relict	Open water diver	x
Australasian shoveler	Not Threatened	Dabbling waterfowl	
Black swan	Not Threatened	Dabbling waterfowl	x
Grey teal	Not Threatened	Dabbling waterfowl	x
Paradise shelduck	Not Threatened	Dabbling waterfowl	
Canada goose	Introduced & Naturalised	Dabbling waterfowl	
Mallard	Introduced & Naturalised	Dabbling waterfowl	x
Swamp harrier	Not Threatened	Riparian wetland	x
Welcome swallow	Not Threatened	Riparian wetland	x

Table 2: List of terrestrial avifauna species recorded in the wider area (denotes species not recorded in Whitehead 2021)*

SPECIES	NZ THREAT CLASSIFICATION
NZ pipit*[9]	At Risk – Declining
Grey warbler	Not Threatened
South Island fantail	Not Threatened
Skylark	Introduced & Naturalised
Australian magpie	Introduced & Naturalised
Yellow hammer	Introduced & Naturalised
Chaffinch	Introduced & Naturalised
Goldfinch	Introduced & Naturalised
Redpoll	Introduced & Naturalised
Dunnock	Introduced & Naturalised
Starling	Introduced & Naturalised
Blackbird	Introduced & Naturalised
Song thrush	Introduced & Naturalised

25. **Black-billed gulls** utilise braided river habitats for feeding and breeding during the summer. They typically feed on invertebrates in riverine habitats and adjacent paddocks during the breeding season, migrating to coastal areas in the winter. Black-billed gulls are colonial nesters that primarily breed on sparsely vegetated gravel bars on inland rivers. However, colonies often change location and densities from year to year[10].

[9] Observed at Mararoa Weir Lookout (Weir Road) during my site visit on 21 June 2024.

[10] McClellan, R.K., Habraken, A. (2019) Black-billed gull. Miskelly, C.M. (Ed). *New Zealand Birds Online*. www.nzbirdsonline.org.nz/species/black-billed-gull

26. Black-billed gull have been reported at numerous locations within the wider Waiau catchment both during informal (e.g., eBird) and formal surveys.[11,12,13,14,15,16,17] Whitehead (2021) reported black-billed gulls as the most abundant freshwater bird species observed at the MLC, with colonies of up to 3250 adult birds present (refer to Appendix 1 for survey data). Whitehead (2021) suggested the low number of black-billed gulls observed in 2020 was likely the result of high lake levels and river flows in the Waiau catchment which meant that breeding habitat at the MLC was submerged at the beginning of the nesting period. Potential breeding habitat at MLC include the artificial constructed "bird island", as well as the exposed gravel areas, particularly the bars. These areas can also be used by roosting birds.

27. **Black-fronted tern** are colonial breeders that predominantly breed on river terraces and gravel bars of braided riverbeds of the eastern South Island. They feed by taking aquatic and terrestrial invertebrates and fish on the wing over riverine habitats, as well as from terrestrial habitats adjacent to the river.

28. At MLC, black-fronted terns have been recorded in low numbers (i.e., ≤20 birds observed at a time), in the eBird database, but have not been recorded during formal surveys. A 'probable' record[18] of black-fronted tern nesting at MLC was recorded in 2015, however this was not confirmed. Breeding colonies have been recorded[11,16,17] at downstream sites in the Lower Waiau River. Thus, MLC provides roosting and foraging habitat for black-fronted tern, and potentially some limited nesting habitat.

29. **Banded dotterel** breed predominantly in riparian areas, river terraces and gravel bars of braided rivers. They preferentially feed in shallow pools and riffles associated with minor channels, typically on sand and fine gravel substrates in water less than 10 mm deep, but also feed in terrestrial habitats.

[11] BML (2009). Manapōuri Tailrace Amended Discharge: Avifauna Assessment [Report prepared for Meridian Energy Ltd by Boffa Miskell Ltd].

[12] McClellan, R. (2006). Management and ecology of Southland's black-billed gulls.

[13] McClellan, R. (2009). The ecology and management of Southland's black-billed gulls [PhD thesis]. University of Otago.

[14] McClelland, T. (1997). Waiau River aquatic birds March 1997. Report prepared by Environmental Resources for ECNZ.

[15] McClelland, T. (1999). Waiau River aquatic bird survey summary May 1999. Report prepared by Environmental Resources for Meridian Energy.

[16] McClelland, T. (2002). Bird monitoring programme Waiau River (Southland). Report prepared by Environmental Resources for Meridian Energy.

[17] Sagar, P. M. (1994). Aquatic birds of the Waiau River November 1993 and March 1994. Report prepared by NIWA for Southland Regional Council.

[18] eBird record for 'Waiau Wier' 25/10/15

30. At MLC, banded dotterels have been recorded in low numbers (≤6) in the eBird database but have not been recorded during formal surveys. A 'probable' record[18] of banded dotterel nesting at MLC was recorded in 2015, however this was not confirmed. They are also present in the Lower Waiau river. Thus, at MLC the exposed gravel areas provide roosting and potentially nesting habitat for banded dotterel, while the shallow pools and riffles associated with minor channels provide foraging habitat.

31. **Shag** are open water divers that forage on fish and utilise riparian trees for nesting and roosting. Black and little shag were recorded in and around the Project site (refer to Table 1 above and Appendix 1). The riparian trees and exposed gravel beds at MLC may provide roosting habitat for shags, while the deeper open waters of the Waiau Arm will provide foraging habitat.

32. **South Island pied oystercatcher** feed in habitats associated with minor channels and lake margins, but also forage in terrestrial habitats on river terraces. They breed in riverine and coastal microhabitats, including riparian areas, river terraces, gravel bars and wetlands. South Island pied oystercatchers (**SIPO**) also frequently nest in adjacent farmland.

33. South Island pied oystercatcher have been recorded at MLC (refer to Table 1 above and Appendix 1). Breeding activity has been confirmed[19] at MLC, while roosting has been observed on the exposed gravel areas (pers. obs.) and adjacent ploughed paddocks[20]. The minor channels, river margins and adjacent farmland provide foraging habitat.

34. While not observed on the MLC site, the spoil disposal site may provide habitat for **NZ pipit**. This species is widespread in rough open habitats and is often seen along coastlines and rivers in alpine areas in the South Island. They are common in farmland, open shrublands, in tussock grasslands and around wetlands. Their nest is a grass woven cup found in rank grass, under tussocks and ferns. Their diet consists of grains, seeds and small invertebrates.

[19] eBird records for 'Waiau Wier' – 2 chicks on 21/10/18 and 2 chicks on 25/10/15

[20] eBird record for 'Waiau Wier' 8/9/17

Avifauna habitats

35. Most avifauna species have the following habitat needs:

(a) Roosting habitat – When birds roost, they go somewhere to rest or sleep. These sites may be used for varying lengths of time by individual birds, from minutes to hours, and birds are free to leave these habitats at any time. This habitat may be the same or different to that used for nesting.

(b) Nesting habitat – A nest site is the physical location of the nest. Over the breeding season this will contain eggs and chicks. Breeding birds have an ongoing association with the nesting habitat throughout the breeding season as they incubate the eggs and generally feed the young until they fledge.

(c) Foraging habitat – A location or resource where birds obtain food.

36. A summary of the available habitats and potential species that may associate with these at and adjacent to the MLC site is provided in Table 3 below. When viewing the wider landscape, these habitats are also available elsewhere and are not solely confined to the Project site. For instance, braided rivers systems which include areas of exposed gravels, as well as major and minor river channels, are available nearby both upstream (Mararoa River) and downstream (lower Waiau River) of the MLC which can be utilised for foraging and roosting by SIPO, black-billed gulls, banded dotterel and black-fronted tern. With regards to riparian trees, the Waiau Arm is lined with willow trees that can be used by roosting shag species, while ungrazed exotic grasslands are located nearby between Weir Road and the Mararoa River and which may be utilised by nesting NZ pipit and spur-winged plover.

37. Thus, the habitats utilised by avifauna at MLC are not limited within the wider landscape, and nor are they likely to be at their carrying capacity.

Table 3: MLC available avifauna habitats and associated species

HABITAT	SPECIES
Exposed gravel areas	• Roosting / nesting habitat for SIPO, black-billed gulls, banded dotterel.
Major and minor river channels	• Shallow river edges provide foraging habitat for banded dotterel, SIPO, pied stilt, black-fronted tern, black-billed gulls.

HABITAT	SPECIES
	• Deeper river edges provide foraging habitat for SIPO, pied stilt, black-fronted tern, black-billed gulls. • Deeper channels providing foraging habitat for black-fronted tern and shags.
Riparian trees (willow)	• Roosting / nesting habitat for shag species
Ungrazed exotic grassland and young planted Eucalyptus trees	• Nesting habitat for NZ pipit and spur-winged plover • Foraging habitat for native and introduced passerine species
Wetlands	• Foraging habitat for pūkeko and NZ pipit
Grazed pasture	• Foraging habitat for NZ pipit • Foraging / nesting / roosting habitat for SIPO • Roosting / foraging habitat for black-billed gull and black-fronted tern

ASSESSMENT METHODOLOGY

38. The Freshwater Ecology Report[4] considered the following potential effects from the project on freshwater avifauna:

(a) Disturbance associated with the movement of heavy machinery associated with the project;

(b) Impacts of high levels of suspended sediments contaminants (SSC) through:

(i) Reducing food availability for pursuit and plunge-diving species (e.g., black-billed gulls, black-fronted terns, shags) by reducing their ability to see prey items, and

(ii) Altering prey communities (e.g., changes to macrophyte, macroinvertebrate and fish community composition and/or abundance);

(c) Impacts of deposited fine sediments (DFS) on wading species (e.g., dotterels, pied stilts, South Island pied oystercatcher, white-fronted herons) that forage in slow-flowing shallow water if prey availability is affected.

39. As noted in Section 6.6 of the Freshwater assessment, the determination of these effects on freshwater birds was based largely on expert opinion. While the level of each potential effect was not explained or defined in the assessment, based on the

terminology used in that report I have assumed that they align with the following (Source: Quality Planning website[21]):

(a) Nil Effects – No effects at all;

(b) Less than Minor Adverse Effects – Adverse effects that are discernible day-to-day effects, but too small to adversely affect other persons;

(c) Minor Adverse Effects – Adverse effects that are noticeable but will not cause any significant adverse impacts;

(d) More than Minor Adverse Effects – Adverse effects that are noticeable that may cause an adverse impact but could be potentially mitigated or remedied;

(e) Significant Adverse Effects that could be remedied or mitigated – an effect that is noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied;

(f) Unacceptable Adverse Effects – Extensive adverse effects that cannot be avoided, remedied or mitigated.

40. In comparison, I used Environmental Institute of Australia and New Zealand (EIANZ) ecological impact assessments guidelines[22] to address the s92 questions and additional potential effects that were not previously considered. This approach uses a matrix to determine the overall level of ecological effect by combining the magnitude of the effect in association with the ecological values (refer to Appendix 2 for EIANZ method details, criteria and matrix).

ASSESSMENT OF EFFECTS

41. As outlined in the AEE[23], the Project will involve the following:

(a) Construction of a new channel which is parallel to, and outside the permanently active bed of the current main channel in the Waiau Arm;

[21] https://www.qualityplanning.org.nz/node/837

[22] Roper-Lindsay et al. (2018). Ecological impact assessment (EcIA). EIANZ guidelines for use in New Zealand: Terrestrial and freshwater ecosystems (2nd ed.). Environment Institute of Australia and New Zealand.

[23] T&T (2023). Proposed Manapōuri Lake Control Improvement Project Resource Consent Applications and Assessment of Effects on the Environment [Report prepared by Tonkin & Taylor Ltd for Meridian Energy Ltd].

(b) Excavation of approximately 225,000 m^3 of gravel and bed material, over a length of approximately 1 km;

(c) Elevated levels of suspended sediment generated by the Project will flow into the LWR, affecting both SSC and DFS;

(d) Temporary loss of a 14.5 ha area which will be used as a spoil disposal site, as well as an area of approximately 20,000 m^2 is identified as the Contractor's establishment area;

(e) Upgrade of existing access tracks;

(f) Works proposed to be undertaken within a 10-month window of January to October 2025. The overall construction period within the 10-month window is envisaged to be 4–5 months based on work occurring on a 7-days-per-week and up to 24-hours-per-day basis. The 24-hour operation will require artificial flood lighting outside of daylight hours.

42. Following completion of the channel excavation within Waiau Arm, rehabilitation activities will include:

(a) Removal of temporary bunding by spreading material on riverbank flats;

(b) Contouring of spoil areas to allow runoff to be appropriately directed;

(c) Replacement of topsoil cover on spoil areas;

(d) Re-grassing or planting of spoil areas.

43. The Freshwater assessment[4] concluded that the effects of disturbance and changes in suspended sediment and/or DFS outside the breeding season (i.e., avoiding the period from September to January) are likely to be minimal, with many of the freshwater species observed at the MLC, including the Threatened species (i.e., black-fronted tern), largely being absent during that period due to their migrating outside of the Waiau catchment. On the basis that the works would avoid the breeding season (September to January), it was determined that the effects would be less than minor on freshwater birds. However, if works were to occur during the breeding season, then the effects were considered to be Minor.

44. Further to that, I note while most individuals of these migratory species (e.g., black-fronted tern, banded dotterel, SIPO) will move away during the non-breeding season, some birds will remain resident throughout the year. For those individuals, likely to be relatively low numbers, they may be exposed to disturbance, elevated levels of suspended sediment and/or DFS. Nevertheless, I consider that there is suitable foraging and roosting habitat for these species nearby (e.g., Mararoa River), and that those locations have sufficient capacity to accommodate these additional birds during that period.

45. It should be noted that disturbance to avifauna may be as a result of noise, vibration, movement or light and can result in displacement, decreased feeding rates, unattended nests (leading to incubation failure and increased opportunities for predators), and energy and time costs.[24,25,26,27,28,29] Numerous studies have reported various distances at which different bird species are disturbed by human activities.[30,31,32,33,34,35,36] The distance at which a bird flees from perceived danger is referred to as the flight initiation distance (FID). Weston et al's[36] review of FIDs included several species recorded within or adjacent to the MLC:IP, thus providing the most relevant measures for this project on which to base potential disturbance distances (Table 4). Pied stilt was recorded as having the highest mean FID distance (36.9 m), and NZ pipit the lowest (12.4 m).

[24] Borgmann, K. L. (2010). A review of human disturbance impacts on waterbirds. Audubon California.

[25] Bowles, A. E. (1995). Responses of wildlife to noise. In Wildlife and Recreationists: Coexistence Through Management and Research (pp. 109–156). Island Press.

[26] Kaldor, B. (2019). Bird disturbance from human activity: Potential effects from recreational activities on sea and shore birds. Avon-Heathcote Estuary Ihutai Trust.

[27] Lord et al. (2001). Effects of human approaches to nests of northern New Zealand dotterels. Biological Conservation, 98(2), 233–240.

[28] Price, M. (2008). The impact of human disturbance on birds: A selective review. In Too Close for Comfort: Contentious Issues in Human–Wildlife Encounters'. (Eds D. Lunney, A. Munn and W. Meikle.) pp 163–196.

[29] Walls, G. (1999). Visitor impacts on freshwater avifauna in New Zealand (Conservation Advisory Science Notes 240). Department of Conservation.

[30] Glover et al. (2011). Towards ecologically meaningful and socially acceptable buffers: Response distances of shorebirds in Victoria, Australia, to human disturbance. Landscape and Urban Planning, 103(3), 326–334.

[31] Goss-Custard et al. (2006). Critical thresholds of disturbance by people and raptors in foraging wading birds. Biological Conservation, 127(1), 88–97.

[32] Haase, L. J. (1995). The effects of disturbance on estuarine birds [Unpublished MSc thesis]. University of Canterbury.

[33] Rodgers, J. A., & Schwikert, S. T. (2002). Buffer-zone distances to protect foraging and loafing waterbirds from disturbance by personal watercraft and outboard-powered boats. Conservation Biology, 16(1), 216–224.

[34] Rodgers, J. A., & Smith, H. T. (1995). Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology, 9(1), 89–99.

[35] Thomas et al. (2003). Effects of human activity on the foraging behavior of sanderlings *Calidris alba*. Biological Conservation, 109(1), 67–71.

[36] Weston et al. (2012). A review of flight-initiation distances and their application to managing disturbance to Australian birds. Emu, 112(4), 269–286.

Table 4: Mean flight initiation distances (FID; as reported in Weston et al. (2012)[36]) for species within and adjacent to the Project site

SPECIES		MEAN FID (m)
Pied stilt	*Himantopus himantopus*	36.9
Black shag	*Phalacrocorax carbo*	32.3
White-faced heron	*Egretta novaehollandiae*	31.2
Southern black-backed gull	*Larus dominicanus*	24.4
Black-fronted dotterel	*Elseyornis melanops*	23.3
Banded dotterel	*Charadrius bicinctus*	23.0
Little shag	*Phalacrocorax melanoleucos*	19.8
Pipit	*Anthus novaeseelandiae*	12.4

46. McVeagh & John (2019)[37] undertook a trial to test the effectiveness of implementing vehicle and machinery exclusion zones around shorebird nests, including banded dotterel and pied stilt. Several key findings of that study included:

(a) Incubating birds were more tolerant of moving vehicles than ones which stopped near to a nest.

(b) A human alighting from a stationary vehicle was more likely to elicit a disturbance reaction than a stationary vehicle alone.

(c) The greatest "flush" distances were recorded for vehicles driving straight at the nest (rather than oblique) as well as humans walking straight at the nest (rather than oblique).

47. McVeagh & John[37] recommended a 50 m exclusion zone around banded dotterel based on responses elicited from birds on nests (very small sample size) that were directly approached by vehicles / machinery and people. Whereas responses elicited from birds on nests that were approached obliquely by vehicles / machinery and people was reduced to <20m.

48. As such, I consider that the magnitude of effect associated project-related disturbance, changes in suspended sediment and/or DFS and disturbance outside the breeding season will be Negligible, resulting in an overall Low to Very Low level of effect on freshwater avifauna (refer to Table 5 below).

[37] McVeagh, J., & John, D. (2019). How well do riverbed-nesting shorebirds tolerate machinery? Greater Wellington Regional Council.

Table 5: Potential levels of effect on freshwater avifauna as a result of project-related disturbance, changes in suspended sediment and/or DFS outside the breeding season

SPECIES	ECOLOGICAL VALUE[38]	MAGNITUDE OF EFFECT[39]	LEVEL OF EFFECT[40]
Black-fronted tern	Very High	Negligible	Low
Black-billed gull	High	Negligible	Very Low
Banded dotterel	High	Negligible	Very Low
SIPO	High	Negligible	Very Low
Black shag	Moderate	Negligible	Very Low
Little shag	Moderate	Negligible	Very Low
Australasian shoveler	Low	Negligible	Very Low
Black swan	Low	Negligible	Very Low
Grey teal	Low	Negligible	Very Low
NZ scaup	Low	Negligible	Very Low
Pied stilt	Low	Negligible	Very Low
Spur-winged plover	Low	Negligible	Very Low
Southern black-backed gull	Low	Negligible	Very Low
Swamp harrier	Low	Negligible	Very Low
Welcome swallow	Low	Negligible	Very Low
Canada goose	Negligible	Negligible	Very Low
Mallard	Negligible	Negligible	Very Low

49. In the s92 response[2], I considered the potential effects on the indigenous avifauna occupying the spoil disposal site and the potential effects of the Project on species that use the wider area to roost.

50. In terms of the spoil disposal site, this is a relatively flat area of exotic grassland (e.g., Yorkshire fog, sweet vernal, perennial ryegrass, crested dogstail, and cocksfoot) and young planted Eucalyptus sp. trees. A number of wetlands were identified[41] on the site, however the construction footprint now avoids all but one of these, which in and of itself was assessed as having Low ecological value from a terrestrial vegetation perspective.

51. In relation to the avifauna, I consider the spoil disposal area to provide limited and marginal opportunities for:

[38] As per EIANZ criteria in Table 10 on page 26

[39] As per EIANZ criteria in Table 11 on page 26

[40] As per EIANZ matrix provided in Table 9 on page 25

[41] BML (2023). Manapōuri Lake Control Improvement Project: Wetland Assessment Report [Report prepared by Boffa Miskell Ltd for Meridian Energy Ltd].

(a) Roosting habitat for SIPO, pied stilt, southern black-backed gull;

(b) Foraging habitat for banded dotterel, most likely in association with the wetlands;

(c) Breeding habitat for spur-winged plover and NZ pipit.

52. I noted that over time, such potential habitat use will decrease due to the growth of the planted Eucalyptus trees which will not be conducive to these species' requirements. Nevertheless, even the loss of this area in its current state will result in a Negligible magnitude of effect due to it providing only marginal habitat for the species identified, with higher value habitat available elsewhere, and all but one of the wetlands being avoided. When combining this magnitude of effect with High (banded dotterel, SIPO and NZ pipit) or Low (pied stilt, southern black-backed gull, spur-winged plover) ecological value, the overall level of effect of the project on species potentially utilising spoil disposal site will be Low to Very Low (refer to Table 6 below).

Table 6: Potential levels of effect on avifauna as a result of loss of habitat within the spoil disposal site

SPECIES	ECOLOGICAL VALUE[38]	MAGNITUDE OF EFFECT[39]	LEVEL OF EFFECT[40]
Banded dotterel	High	Negligible	Very Low
NZ pipit	High	Negligible	Very Low
SIPO	High	Negligible	Very Low
Pied stilt	Low	Negligible	Very Low
Spur-winged plover	Low	Negligible	Very Low
Southern black-backed gull	Low	Negligible	Very Low

53. In terms of the potential effects of the Project on species that use the wider area to roost, I considered the freshwater species that were identified in Table 1 above (page 5).

(a) Swamp specialist and riparian wetland species (e.g., swamp harrier and welcome swallow) are associated with wetland vegetation along the Te Anau and Manapōuri lakes and margins, while tall trees adjacent to these freshwater habitats provide roosting habitat for some open water divers (e.g., shags). In the s92 response[2], I stated that these habitats will not be impacted, however based on my site visit, I observed that several willow trees are located within the Project footprint and as such will be lost. Nevertheless, the

loss of a small number of exotic willow trees will not impact these species as there is an abundance of willow trees along the Waiau Arm that can be used for roosting.

(b) Open water divers, dabbling waterfowl, waders, and aerial gulls and terns utilise shallow edge and shoreline habitats for roosting (and foraging). The channel excavation will result in the loss of several areas of potential roosting habitat for these species (refer to areas circled yellow in Figure 1 below), however similar habitat remains available nearby, including the gravel bank immediately below the MLC structure, as well as in the wider landscape (e.g., nearby Lower Waiau and Mararoa Rivers). Furthermore, as assessed by Damwatch[42] and shown in the visual simulations[43] included in the resource consent application, the operation of the new channel will result in lower flow rates through the existing channels under normal operation. As such, this may result in an increase in exposed areas of gravels (including the area to the south of the existing channel shown in Figure 1 below), thereby providing more shallow edge and shoreline habitats for roosting and open water divers, dabbling waterfowl, waders, and aerial gulls and terns to utilise. However, as with existing gravels, these areas will be inundated as part of normal lake control operations.

(c) Overall, I consider the magnitude of effect of the project on roosting birds will be Negligible. When combining this magnitude of effect with Very High (black-fronted tern) to Low ecological value, the level of effect of the project on roosting species will be Low to Very Low (refer to Table 7 below).

[42] Damwatch. (2023). Proposed Manapōuri Lake Control Improvement Project: Construction Planning – Proposed Methodology [Report prepared by Damwatch for Meridian Energy Ltd].

[43] BML (2023). Manapōuri Lake Control Improvement Project: Landscape Effects Assessment Graphic Supplement [Report prepared by Boffa Miskell Ltd for Meridian Energy Ltd].

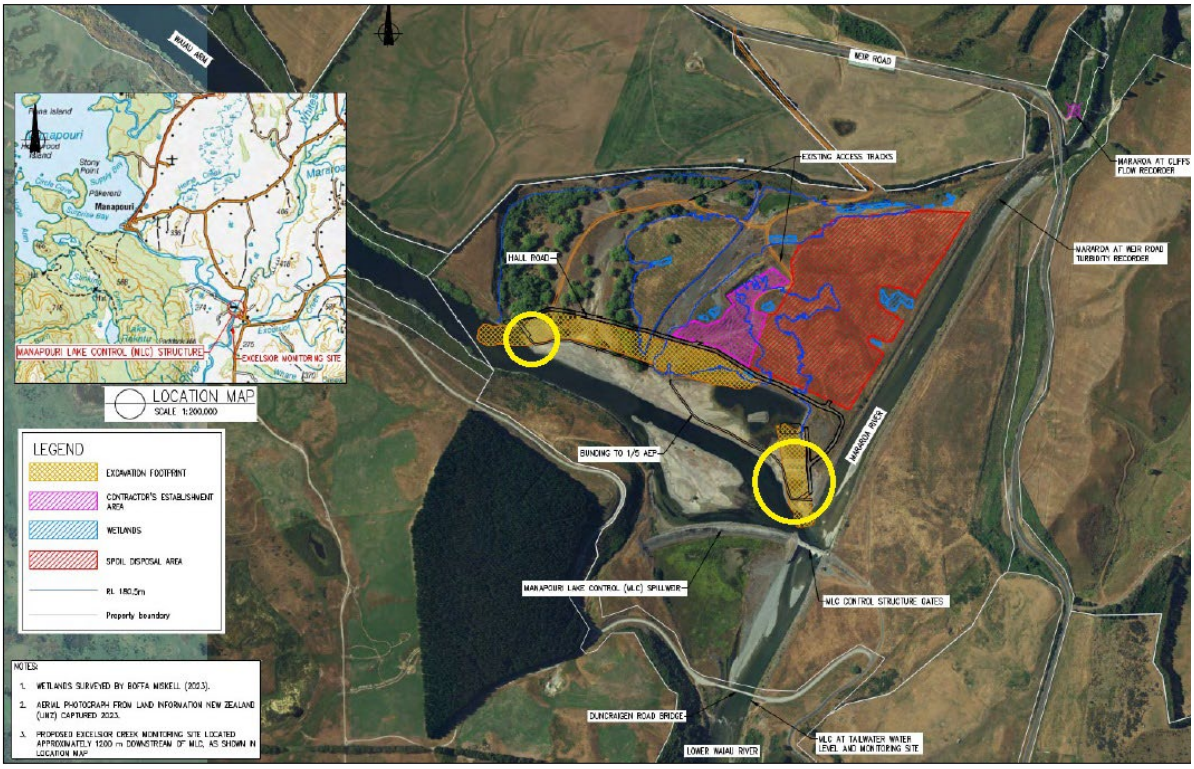

Figure 1: Project overview. Yellow circles denote area of potential roosting habitat that will be lost under the footprint

Table 7: Potential levels of effect on freshwater avifauna as a result of loss of roosting habitat within the project footprint

SPECIES	ECOLOGICAL VALUE[38]	MAGNITUDE OF EFFECT[39]	LEVEL OF EFFECT[40]
Black-fronted tern	Very High	Negligible	Low
Black-billed gull	High	Negligible	Very Low
Banded dotterel	High	Negligible	Very Low
SIPO	High	Negligible	Very Low
Black shag	Moderate	Negligible	Very Low
Little shag	Moderate	Negligible	Very Low
Australasian shoveler	Low	Negligible	Very Low
Black swan	Low	Negligible	Very Low
Grey teal	Low	Negligible	Very Low
NZ scaup	Low	Negligible	Very Low
Pied stilt	Low	Negligible	Very Low
Spur-winged plover	Low	Negligible	Very Low
Southern black-backed gull	Low	Negligible	Very Low
Swamp harrier	Low	Negligible	Very Low
Welcome swallow	Low	Negligible	Very Low
Canada goose	Negligible	Negligible	Very Low
Mallard	Negligible	Negligible	Very Low

54. A further potential effect not previously considered relates to the potential effects of the use of artificial lights on avifauna if construction works are to occur 24 hours a day, seven days a week. As noted in Section 7.9.2 of the AEE[23], it is anticipated that lighting sources will be moveable and not fixed and designed to direct lighting downward. In addition, as identified by Damwatch[42] (Section 6.3.3), two generator sets will be required to operate the lighting.

55. Thus, if lighting were to be used for the duration of the estimated construction programme (i.e., 4–5 months), there is the potential to impact avifauna that may roost nearby as a result of noise-related disturbance and increased visibility to predators.

56. Nocturnal avifauna surveys have not been conducted, and as such there is no data available regarding which species might be roosting in and adjacent to the Project site at night. As such, I have used the diurnal roosting / resting behaviours as a proxy to assess the impact on nocturnal activities.

57. On the basis, I consider it highly likely that any birds disturbed by the generator noise or artificial light would move to nearby available roosting habitat (identified in Table 3 on page 9) to avoid these impacts. Furthermore, given the low number of birds that this is likely to affect, I determined that the magnitude of effect on the species will be Negligible, resulting in a Low to Very Low level of effect (refer to Table 8 below).

Table 8: Potential levels of effect on avifauna as a result of the operation of artificial lighting during construction

SPECIES	ECOLOGICAL VALUE[38]	MAGNITUDE OF EFFECT[39]	LEVEL OF EFFECT[40]
Black-fronted tern	Very High	Negligible	Low
Black-billed gull	High	Negligible	Very Low
Banded dotterel	High	Negligible	Very Low
NZ pipit	High	Negligible	Very Low
SIPO	High	Negligible	Very Low
Black shag	Moderate	Negligible	Very Low
Little shag	Moderate	Negligible	Very Low
Australasian shoveler	Low	Negligible	Very Low
Black swan	Low	Negligible	Very Low
Grey teal	Low	Negligible	Very Low
NZ scaup	Low	Negligible	Very Low
Pied stilt	Low	Negligible	Very Low

SPECIES	ECOLOGICAL VALUE[38]	MAGNITUDE OF EFFECT[39]	LEVEL OF EFFECT[40]
Spur-winged plover	Low	Negligible	Very Low
Southern black-backed gull	Low	Negligible	Very Low
Swamp harrier	Low	Negligible	Very Low
Welcome swallow	Low	Negligible	Very Low
Canada goose	Negligible	Negligible	Very Low
Mallard	Negligible	Negligible	Very Low

Avifauna assessment summary

58. Using the EIANZ methodology, I have assessed the overall effects of the Project on avifauna to be Low to Very Low (refer to Table 5, Table 6, Table 7 and Table 8). According to EIANZ guidelines[22], the overall level of effect can then be used to guide the extent and nature of the ecological management response required as follows:

    (a) Very High adverse effects require a net biodiversity gain.

    (b) High and Moderate adverse effects require no net loss of biodiversity values.

    (c) Low and Very Low effects should not normally be a concern. If effects are assessed taking impact management developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure Low or Very Low effects.

59. As such, I have recommended the following consent conditions to ensure the overall levels of effect remain Low to Very Low for avifauna.

CONSENT CONDITIONS

60. Section 8.4 (Schedule 1: General Conditions) of the AEE[23] outlined the proposed consent conditions, which included the following for condition (5) for avifauna:

> *Any works in the period commencing 15th September and ending 31st January (inclusive) shall not disturb roosting and nesting areas of the black fronted tern, black billed gull, banded dotterel or black fronted dotterel*

61. It is my opinion that this proposed condition needs to be revised to more accurately reflect the potential effects that it was developed to manage. For instance, it is unclear what constitutes disturbance, particularly in the context of an “area” rather than the birds themselves. Furthermore, given the ability of roosting birds to find alternative roost sites, it is my opinion that any such consent condition should relate to breeding activity, not roosting. Thus, based on the researched disturbance distances discussed earlier in this memo, I recommend that proposed consent condition 5 be revised as follows:

> *(a) Within 10 days prior to the commencement of construction works (including establishment works) occurring during the period commencing 15th September and ending 31st January (inclusive), a survey shall be undertaken by a Suitably Qualified Person to determine if any black fronted tern, black-billed gull, banded dotterel, black fronted dotterel or NZ pipit are nesting within the footprint to be disturbed by the works during that period.*
>
> *(b) No works shall occur within 50 m of a nesting bird identified in the survey in clause (a). Once nesting is complete, the 50 m exclusion zone at that nest no longer applies.*

RESPONSE TO S92 FURTHER INFORMATION REQUEST

62. As outlined in the preceding section of my evidence, I provided responses in relation to the potential effects on the indigenous avifauna occupying the spoil disposal site, as well as the potential effects of the Project on species that use the wider area to roost.

63. In both cases, I used the EIANZ impact assessment methodology and determine the potential effects of those activities to be Low to Very Low on freshwater birds (summarised in Table 5, Table 6, Table 7 and Table 8).

64. A further s92 question related to providing a further explanation regarding what “minor” meant in the context of the freshwater assessment.

65. As outlined in paragraph 39 (page 10) of my evidence, the Freshwater assessment did not provide an explanation or definition in regards to the levels of effect, however I have assumed that they are based on the RMA terminology (as listed in paragraphs 39(a) to 39(f) of my evidence. In that context, minor adverse effects are defined as being “*noticeable but will not cause any significant adverse impacts*”.

66. This description of the level of effect aligns with the levels of effect that I determined using the EIANZ method.

RESPONSES TO ISSUES IN SUBMISSIONS

67. I have reviewed the submissions received by the Council on the application which raise issues within my area of expertise.

68. At paragraph 8.a.ii. of its submission (14), the Department of Conservation (DOC) states that the Application did not identify and address the potential adverse effects on Threatened and At Risk indigenous terrestrial biodiversity including black fronted terns, black-billed gulls, and banded dotterel.

69. My assessment of effects is provided in paragraphs 43 to 57 of my evidence and has included black fronted terns, black-billed gulls, and banded dotterel. As summarised in those paragraphs and Table 5 to Table 8, I consider the levels of effects on these species will be Low to Very Low.

70. At paragraph 13, DOC states that if construction activities continue for 24 hours a day, seven days per week without cessation, the associated artificial lighting and noise could impact upon the behaviour of Threatened and At Risk birds including potential impacts on predation/feeding, and migratory cues.

71. As such, DOC requested a provision be made in the conditions for daily and weekly breaks from construction activities to provide respite for Threatened and At Risk.

72. I consider it highly likely that any birds disturbed by the generator noise or artificial light would move to nearby available roosting habitat to avoid these impacts, and that the overall level of such an effect on birds will be Low to Very Low (refer to Table 8 on page 19). Given the temporary and short term nature of such an effect, I do not consider it necessary to make a provision in conditions for daily and weekly breaks from construction activities.

73. Both the Waiau Fisheries and Wildlife Habitat Enhancement Trust (Submissions 8) and the Waiau Working Party (Submission 12) requested that any exposed islands created within the Waiau Arm be maintained to provide suitable nesting habitat for black-billed gulls.

74. I am supportive of the recommendation in the MLC:IP Landscape Assessment[43] that the final form of these be finished to avoid linear engineered forms and ensure sinuous organic shapes which reflect natural patterns subjected to natural elements and processes. This could be done in a manner that provides nesting habitat for species such as black-billed gulls, as requested in the Waiau Working Party and Waiau Habitat Trust submission points, and as such, in principle, I support a consent condition requiring this.

75. However, given the nature of this waterbody in terms of the controlled flows, these areas will be inundated as part of normal lake control operations, and for that reason, along with the overall Very Low level of effect of the project on black-billed gull, I do not consider it necessary that such islands be maintained as nesting habitat by the Applicant.

76. As stated previously, Low to Very low levels of effect do not require any mitigation or offsetting; rather, these levels of effect can be managed through the consent conditions as recommended in paragraph 61 above.

RESPONSE TO SECTION 42A REPORT

77. I have reviewed the section 42A Officer's Report prepared by Bianca Sullivan, resource management consultant with Environment Matters Limited, on behalf of Environment Southland, and the supporting technical report of Dr Thornsen (Attachment 2 to the Officer's Report).

78. As outlined in paragraph 3.2.34 of the section 42A report, Dr Thorsen has reviewed my assessment and agrees with the approach and findings. Furthermore, Dr Thorsen also supports the inclusion of the consent condition to ensure no works occur within 50 m of nesting birds, as outlined above in paragraph 61 of my evidence.

79. I note that at paragraph 25 of his report, Dr Thorsen states that he does not believe any further consent conditions are required to address the potential effects of the project on avifauna. At paragraph 19 he goes on to state that he is in agreement with my assessment that the creation and maintenance of exposed islands within the Waiau Arm, as suggested by the Waiau Groups, is not necessary to address the project's effects on birds.

80. In summary, there is no disagreement between myself and Dr Thorsen with respect to potential effects of the MLC:IP on avifauna, and how they are proposed to be managed through the updated consent conditions.

CONCLUSIONS

81. Using the EIANZ methodology, I have determined that the potential effects of the MLC:IP on avifauna will be Low to Very Low. Such levels of effect do not require offsetting; rather, they can be managed through the implementation of appropriate consent conditions, as outlined above in paragraph 61 of my evidence.

82. Both myself and Dr Thorsen are in agreement that the proposal by the Waiau Groups to create and maintain exposed islands within the Waiau Arm is not required based on the potential level of effects that the proposed MLC:IP will have on avifauna.

Dr Leigh Bull

3/9/24

APPENDIX 1 – FRESHWATER SPECIES RECORDED DURING FORMAL SURVEYS AT MLC (SOURCE: WHITEHEAD 2021)

Table 3: Abundance of freshwater bird species observed during formal surveys at the Manapōuri Lake Control. Columns represent data from the individual surveys identified in Table 1. Note that the McClelland surveys (2000, 2001) only recorded black-billed gulls at the MLC and it is unknown whether other species were present.

Species	October 2000	October 2001	December 2009	November 2020	December 2020
Black-billed gull	1435	1255	3250	37	107
Black shag			1	0	0
Grey teal			5	0	0
Little shag			0	0	0
Mallard			0	0	30
Pied stilt			2	0	10
South Island pied oystercatcher			54	0	0
Southern black-backed gull			2	0	0
Spur-winged plover			4	0	0
Swamp harrier			1	0	0

APPENDIX 2 – EIANZ METHOD

The EIANZ guidelines[22] use the New Zealand threat classification as a criterion for assigning ecological value as outlined in Table 10. Robertson et al. (2021)[8] provides the most recent threat classifications for avifauna and as such has been used to assign values to individual species.

Table 11 lists the criteria and descriptions for determining the magnitude of effect as described in the EIANZ guidelines. For this assessment, we have taken a species, rather than habitat, focus and applied the criteria or proportion thresholds below, to assist with determining the magnitude of effect (text italicised and bolded in Table 11):

- Very High: >50% of the population[44] affected or habitat lost.
- High: 20–50% of the population affected or habitat lost.
- Moderate: 10–20% of the population affected or habitat lost.
- Low: 1–10% of the population affected or habitat lost.
- Negligible: <1% of the population affected or habitat lost.

For the purposes of this assessment, in determining overall effects of the proposal, the Ecological District (Upukerora) scale is considered most appropriate.

Table 9: Criteria for describing the level of effect (Roper-Lindsay et al., 2018)

LEVEL OF EFFECT		ECOLOGICAL AND / OR CONSERVATION VALUE				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
MAGNITUDE	**Very High**	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

[44] At the scale of the Upukerora Ecological District

Table 10: Criteria for assigning ecological value to species (Roper-Lindsay et al., 2018).

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Very High	*Nationally Threatened* (Nationally Critical, Nationally Endangered, Nationally Vulnerable, Nationally Increasing[45]) species found in the ZOI[46] either permanently or seasonally
High	Species listed as *At Risk – Declining* found in the ZOI either permanently or seasonally.
Moderate	Regionally Recovering or Naturally Uncommon species found in the ZOI either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
Low	Regionally Not Threatened
Negligible	Exotic species, including pests, species having recreational value.

Table 11: Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018)

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR ***Loss[47] of a very high proportion of the known population or range of the element / feature.***
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR ***Loss[47] of a high proportion of the known population or range of the element / feature.***
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed; AND/OR ***Loss[47] of a moderate proportion of the known population or range of the element / feature.***
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns; AND/OR ***Having a minor effect on the known population or range of the element / feature.***
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the "no change" situation; AND/OR ***Having a negligible effect on the known population or range of the element / feature.***

[45] Nationally Increasing is category that was devised by DOC (Michel, 2021) in 2021 to resolve a problem that would arise if the population of a taxon assessed as At Risk Recovering A should stabilise. Threatened – Nationally Increasing is assigned to "Small population that have experienced a previous decline (or for which it is uncertain whether it has experienced a previous decline) and that is forecast to increase >10% over the next 10 years or 3 generations, whichever is longer" (Rolfe et al., 2021). Thus, while such a threat category is not identified in Roper-Lindsay et al. (2018), we have included it along with all other *Threatened* classifications in to the Very High ecological value category.

[46] Roper-Lindsay et al. (2018) define the Zone of Influence (ZOI) as "the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities."

[47] In the context of mobile fauna, the term "loss" can include displacement from an area.