

**BEFORE THE ENVIRONMENT COURT
I MUA I TE KOOTI TAIAO O AOTEAROA**

UNDER the Resource Management 1991

IN THE MATTER of of appeals under Clause 14 of the First Schedule of the Act

BETWEEN

TRANSPower NEW ZEALAND LIMITED
(ENV-2018-CHC-26)

FONterra CO-OPERATIVE GROUP
(ENV-2018-CHC-27)

HORTICULTURE NEW ZEALAND
(ENV-2018-CHC-28)

ARATIATIA LIVESTOCK LIMITED
(ENV-2018-CHC-29)

WILKINS FARMING CO
(ENV-2018-CHC-30)

(Continued next page)

**STATEMENT OF EVIDENCE OF DR KELVIN LLOYD ON BEHALF OF THE
SOUTHLAND REGIONAL COUNCIL
14 December 2018**

Judicial Officer: Judge Borthwick and Judge Hassan

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**GORE DISTRICT COUNCIL, SOUTHLAND DISTRICT
COUNCIL & INVERCARGILL DISTRICT COUNCIL**
(ENV-2018-CHC-31)

DAIRYNZ LIMITED
(ENV-2018-CHC-32)

H W RICHARDSON GROUP
(ENV-2018-CHC-33)

BEEF + LAMB NEW ZEALAND
(ENV-2018-CHC-34 & 35)

DIRECTOR-GENERAL OF CONSERVATION
(ENV-2018-CHC-36)

SOUTHLAND FISH AND GAME COUNCIL
(ENV-2018-CHC-37)

MERIDIAN ENERGY LIMITED Act 1991
(ENV-2018-CHC-38)

ALLIANCE GROUP LIMITED
(ENV-2018-CHC-39)

FEDERATED FARMERS OF NEW ZEALAND
(ENV-2018-CHC-40)

HERITAGE NEW ZEALAND POUHERE TAONGA
(ENV-2018-CHC-41)

STONEY CREEK STATION LIMITED
(ENV-2018-CHC-42)

THE TERRACES LIMITED
(ENV-2018-CHC-43)

CAMPBELL'S BLOCK LIMITED
(ENV-2018-CHC-44)

ROBERT GRANT
(ENV-2018-CHC-45)

**SOUTHWOOD EXPORT LIMITED, SOUTHLAND
PLANTATION FOREST COMPANY OF NZ,
SOUTHWOOD EXPORT LIMITED**
(ENV-2018-CHC-46)

**TE RUNANGA O NGAI TAHU, HOKONUI RUNAKA,
WAIHOPAI RUNAKA, TE RUNANGA O AWARUA & TE
RUNANGA O ORAKA APARIMA**
(ENV-2018-CHC-47)

PETER CHARTRES
(ENV-2018-CHC-48)

RAYONIER NEW ZEALAND LIMITED
(ENV-2018-CHC-49)

**ROYAL FOREST AND BIRD PROTECTION SOCIETY
OF NEW ZEALAND**
(ENV-2018-CHC-50)

Appellants

AND

SOUTHLAND REGIONAL COUNCIL

Respondent

Introduction

- 1 My full name is Kelvin Michael Lloyd. I am employed by Wildland Consultants Ltd as a Principal Ecologist, based in Dunedin, where I have been employed by Wildlands since 2004.
- 2 I hold the degrees of Bachelor of Science with First Class Honours, and Doctorate of Philosophy, both obtained from the University of Otago, where my studies were undertaken at the Department of Botany. Subsequent to University study I was awarded a three-year Post-Doctoral Fellowship from the Foundation for Research, Science and Technology, during which I was employed by Landcare Research Ltd in Dunedin.
- 3 I am an author of 20 scientific papers published in peer-reviewed national and international scientific journals, as well as several popular articles. I have also presented aspects of my research at national and international scientific conferences. I have lectured in plant ecology at 3rd year level at the University of Otago. I remain an honorary research associate of Landcare Research Ltd and continue to publish research papers in collaboration with other scientists as time permits. I am a member of the New Zealand Ecological Society, the New Zealand Botanical Society, the Ornithological Society of New Zealand, the New Zealand Biosecurity Institute, the New Zealand Native Forest Restoration Trust, and the New Zealand Plant Conservation Network.
- 4 My work as an ecological consultant has covered a wide range of ecosystems, vegetation, and habitat types, including wetlands, grasslands, shrublands, forests, and alpine vegetation. This work has included ecological investigations of areas of vegetation throughout New Zealand, including sites in Southland, Otago, Canterbury, Buller, Westland, Marlborough, Nelson, Northland, Auckland, Hawkes Bay, Wairarapa, Horowhenua, Wellington, and Chatham Islands. I am an author of over 245 contract reports covering these assessments and I have prepared expert evidence in 28 Environment Court or similar cases in relation to these projects.
- 5 I have over 20 years' experience as a Dunedin-based ecologist and have undertaken numerous ecological assessments of wetlands, in the Southland Region and elsewhere, during the course of my work as an ecologist.

- 6 I have undertaken numerous ecological assessments in the Southland Region, including assessments at Waituna, Tiwai Peninsula, Invercargill, Otatara, Maitara, Mt Hamilton, Mid Dome, Slopedown, Catlins, Rakiura, Milford Sound, and other sites in Fiordland. I also provided ecological expertise to the Department of Conservation with respect to their processing of concession applications for the 'Fiordland Link' monorail and 'Milford-Dart tunnel' in northern Southland.
- 7 I recently mapped potential natural ecosystems across the entire Southland Region, including mapping of 58 primary ecosystems and three secondary ecosystems. This included mapping of 15 wetland ecosystem types.
- 8 I have considerable experience in wetland ecology, having undertaken assessments of numerous wetlands in Southland, Otago, and the Mackenzie Basin, and provided expert evidence on wetland significance in the Otago, West Coast, and Hawkes Bay Regions.
- 9 I have had no prior involvement in preparation of the proposed Southland Water and Land Plan.
- 10 I have been engaged by the Southland Regional Council (**Council**) to prepare evidence on terrestrial and wetland ecology for these proceedings.

Code of Conduct

- 11 I confirm that I have read the Code of Conduct for expert witnesses as contained in the Environment Court Practice Note 2014. I have complied with the Code of Conduct when preparing my written statement of evidence, and will do so when I give oral evidence.
- 12 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence. The reasons for the opinions expressed are also set out in my evidence.
- 13 Other than where I state I am relying on the evidence of another person, my evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope

- 14 I have been asked by the Council to provide evidence in relation to indigenous biodiversity and wetlands in Southland, specifically relating to current state and trends.
- 15 My evidence addresses:
- (a) An overview of the current state of indigenous biodiversity in Southland;
 - (b) An overview of wetlands in New Zealand;
 - (c) An overview of wetlands in Southland including current state, important wetlands, and recent trends; and
 - (d) Horticulture New Zealand's appeal on the definition of 'wetland' and 'natural wetland'.
- 16 In preparing this evidence, I have read and considered a number of documents, all of which are cited where relevant in the text of my evidence. I have also read relevant pages of the Initial Planning Statement (updated s32 evaluation).

Executive Summary

- 17 Southland is an ecologically diverse region that still retains considerable indigenous biodiversity, with its indigenous forests, wetlands, rivers, estuaries, and lagoons providing habitat for a wide range of threatened indigenous fauna.
- 18 Despite this, Southland has suffered significant loss of habitat in lowland areas, especially on the Southland Plains and in the inland basins of Southland. Successive estimates of land cover in the national land cover data base have all shown decreases in the proportion of indigenous cover, and this has been prominent in Southland Region.
- 19 Wetlands are distinctive ecosystems that are important as habitat for indigenous biodiversity and for the ecosystem services they provide that benefit humankind, such as maintenance of water quality and storage of carbon.
- 20 Wetlands have been significantly reduced in extent on a national basis, and are poorly protected. Swamp and marsh wetlands have undergone the largest decreases in extent, while less productive bog and fen

wetlands have suffered less loss. Southland is a national stronghold for bog and fen wetlands.

- 21 Important large wetlands in Southland include the Awarua-Waituna wetland complex; the New River estuary; other estuaries; Kakapo Swamp in the Te Anau Basin; peat bogs on the Southland Plains; and numerous large wetland complexes in eastern Fiordland and the Te Anau Basin.
- 22 These wetlands provide significant habitat for a wide range of wetland birds, including many threatened species.
- 23 Recent analyses have shown that there is ongoing loss of wetland extent in Southland, especially on the Southland Plains, and almost all on private land holdings.
- 24 In relation to the Horticulture New Zealand appeal, which seeks to change the definition of a 'natural wetland' through adding two exclusions, I consider that artificial wetlands can provide significant habitat value for indigenous vegetation and fauna.

Current State of Indigenous Biodiversity in Southland - An Overview

- 25 The Southland Region is ecologically diverse, reflecting strong gradients in soil fertility, soil moisture, geology, topography, and climate. The region has sizeable areas of lowland habitat on the Southland Plains and inland basins, and extensive mountainous landscapes in Fiordland.
- 26 Fiordland, with its incised fiords, numerous mountain ranges, and wet climate, has been more resistant to invasion by mammalian pest animals, and thus remains an important habitat for populations of threatened indigenous avifauna such as kea (*Nestor notabilis*; Threatened-Nationally Endangered¹), South Island kaka (*Nestor meridionalis* subsp. *meridionalis*; Threatened-Nationally Vulnerable), rock wren (*Xenicus gilviventris* 'southern'; Threatened-Nationally Endangered), southern Fiordland tokoeka (*Apteryx australis* subsp. *australis*; Threatened-Nationally Endangered), northern Fiordland tokoeka (*Apteryx australis* 'northern Fiordland'; Threatened-Nationally

¹ Threat classifications for birds are from: Robertson H.A., Baird K., Dowding J.E., Elliott G.P., Hitchmough R.A., Miskelly C.M., McArthur N., O'Donnell C.J., Sagar P.M., Scofield R.P., and Taylor G.A. 2017: Conservation status of New Zealand birds, 2016. *New Zealand Threat Classification Series 19*. Department of Conservation, Wellington. 23 pp.

- Vulnerable) and tawaki/Fiordland crested penguin (*Eudyptes pachyrhynchus*; Threatened-Nationally Vulnerable).
- 27 The Department of Conservation maintains pest-free islands in Dusky Sound and Doubtful Sound, which are important refuges for birds such as kakapo (*Strigops habroptilus*) and nesting sea birds.
- 28 Southland's forested areas, including Fiordland and eastern and southern Southland, provide habitat for both long tailed bat (*Chalinolobus tuberculatus*; Threatened-Nationally Critical²) and southern lesser short-tailed bat (*Mystacina tuberculata*; At Risk-Recovering), while its braided rivers are nationally important as breeding habitat for colonies of black-billed gull (*Larus bulleri*; Threatened-Nationally Critical).
- 29 Southland's estuaries and coastal wetlands on the south-eastern coast, in the inhabited part of Southland, also provide critical habitat for indigenous avifauna, particularly large assemblages of wading birds and wetland birds.
- 30 Coastal areas in Southland provide important habitat for threatened species such as yellow-eyed penguin (*Megadyptes antipodes*; Threatened-Nationally Endangered) and New Zealand sea lion (*Phocarctos hookeri*; Threatened-Nationally Critical³).
- 31 The current pattern and extent of indigenous ecosystems and habitats in the Southland Region is broadly similar to the pattern and extent in other regions of New Zealand.
- 32 There has been very significant loss of indigenous biodiversity in the lowland areas east of Fiordland, but indigenous biodiversity is more intact in Fiordland and other upland parts of Southland Region. This pattern of loss relates to indigenous vegetation and habitat being cleared from more productive easily-accessible flat or gently-rolling lowland landforms for agriculture, while steeper, less productive, more difficult to

² Bat threat status is from: O'Donnell C.F.J., Borkin K.M., Christie J.E., Lloyd B., Parsons S. and Hitchmough R.A. 2018: Conservation status of New Zealand bats, 2017. *New Zealand Threat Classification Series 21*. Department of Conservation, Wellington. 4 pp.

³ Baker C.S., Chilvers B.L., Childerhouse S., Constantine R., Currey R., Mattlin R., Van Helden A., Hitchmough R., and Rolfe J. 2016: Conservation status of New Zealand marine mammals, 2013. *New Zealand Threat Classification Series 14*. Department of Conservation, Wellington. 18 pp.

access hill country and mountain slopes have retained more of their indigenous vegetation cover and associated habitat values.

- 33 These patterns of loss are illustrated by the Threatened Environment Classification, which categorises Level IV land environments on a national basis according to the degree that they are covered by indigenous vegetation and the degree to which they are legally protected (for example as conservation land, reserves administered by other agencies, and QEII covenants).
- 34 Across New Zealand there are 500 Level IV land environments, defined according to a model that used climate, soil, and topographical data that is relevant to the distribution of New Zealand forests⁴. As land environments do not cover rivers, lakes, and marine habitats, the Threatened Environment Classification is limited to terrestrial and wetland habitats.
- 35 In the Southland Region, land environments in lowland habitats (including some coastal habitats) and inland basins have the most reduced indigenous cover (<30%), whereas most of the upland parts of Southland have 'less reduced and better protected' land environments, with more than 30% indigenous cover remaining and at least 20% protected (**Attachment 1**).
- 36 In contrast to land environments, ecological districts are mutually-exclusive areas based on similar landforms and vegetation that have been mapped as 268 discrete ecological districts across New Zealand, within 85 larger ecological regions⁵. Four ecological districts in Southland each have less than 20% of their original vegetation cover remaining: the Taringatua Ecological District, Waipahi Ecological District, Gore Ecological District, and Southland Plains Ecological District (**Attachment 2**).
- 37 Lowland podocarp forest has been particularly reduced in the Southland Region, with the Southland Plains and Oreti Plains, formerly vegetated

⁴ Leathwick J., Morgan F., Wilson G., Rutledge D., McLeod M., and Johnston K. 2002: Land Environments of New Zealand: a technical guide. Ministry for the Environment, Wellington. 237 pp.

⁵ McEwen M. 1987: Ecological regions and districts of New Zealand. New Zealand Biological Resources Centre Publication No. 5. Department of Conservation, Wellington.

in various types of podocarp/broadleaved forest, now containing only small, widely scattered remnants of such forest.

- 38 Similar to other parts of New Zealand, Threatened and At Risk plant species are proportionally more likely to be found in lowland habitats in Southland, in wetlands and along the coast. Nationally, these ecosystems provide habitat for 44% of New Zealand's threatened plants⁶.

Trends

- 39 Successive estimates of land cover in the land cover database, a national scale map of broad vegetation cover classes, have all shown decreases in the proportion of indigenous cover, and Southland has been one of the regions where this decrease has been more prominent⁷.

Wetlands in New Zealand - An Overview

- 40 Wetlands are permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions⁸. They are important for many reasons, including provision of ecosystem services (functions that benefit humankind, including for example, maintenance of water quality and storage of carbon) and providing habitat for indigenous plants and fauna.
- 41 Wetlands are distinct from other ecosystems by virtue of their soil types and hydrology, and (consequent on those features) the types of indigenous vegetation and fauna that they provide habitat for. They can be divided into different classes according to water origin, flow, drainage, fluctuation, and permanence, and according to their substrate, nutrient status, and relative acidity⁹.
- 42 Nine hydrosystems have been defined to classify wetlands in New Zealand: palustrine (freshwater), riverine, lacustrine (associated with lakes), estuarine, marine, inland saline, plutonic (underground),

⁶ Ministry for the Environment 1997: The state of New Zealand's environment. Ministry for the Environment, Wellington.

⁷ Cieraad E., Walker S., Price R., and Barringer J. 2015: An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments.

⁸ Resource Management Act 1991, section 2 definition of 'wetland'.

⁹ Johnson P.N. and Gerbeaux P. 2004: Wetland types in New Zealand. Department of Conservation, Wellington. 184 pp.

geothermal, and nival (associated with snowfields and glaciers) hydrosystems.

- 43 Palustrine wetlands are the most extensive¹⁰ hydrosystem, including swamp, marsh, ephemeral, fen, pakihi, and bog wetland classes.
- 44 Palustrine wetlands are key habitats for indigenous biota, particularly birds, fish, and plant species, many of which are classified as nationally Threatened or At Risk. They provide important ecosystem services such as carbon accumulation, storage and production of clean water, flood reduction, and filtration of nutrients and sediment.
- 45 Only 6% of New Zealand's wetlands occur within protected areas, and the majority of these protected areas have the status of Stewardship Area, which is not as strong as other types of protected area, such as reserves (under the Reserves Act 1977), ecological areas, conservation parks, and national parks¹¹.

Current state of wetlands in NZ

- 46 Wetland ecosystems have been reduced significantly at a national scale, and as a result are a high priority for protection.
- 47 Wetlands and sand dunes are the only two ecosystem types identified as national priorities for the protection of rare and threatened indigenous biodiversity on private land¹².
- 48 In a 2011 study it was estimated that only 10% of the original national extent of indigenous wetland vegetation remains, but the proportion is higher in the South Island (16% remaining) than in the North Island (4.9% remaining)¹³.
- 49 The level of legal protection of wetlands has increased in New Zealand over the last two decades, but this increase mainly relates to pakihi/gumland wetlands (which do not occur in Southland Region) and

¹⁰ Johnson P.N. and Gerbeaux P. 2004: Wetland types in New Zealand. Department of Conservation, Wellington. 184 pp.

¹¹ Robertson H.A. 2016: Wetland reserves in New Zealand: the status of protected areas between 1990 and 2013. *New Zealand Journal of Ecology* 40: 1-11.

¹² Ministry for the Environment/Department of Conservation 2007: Protecting our places. Information about the statement of national priorities for protecting rare and threatened biodiversity on private land. Ministry for the Environment, Wellington.

¹³ Ausseil A-G.E., Chadderton W.L., Gerbeaux P., Stephens R.T.T., and Leathwick J.R. 2011: Applying systematic conservation planning principles to palustrine and inland saline wetlands of New Zealand. *Freshwater Biology* 56: 142-161.

swamps¹⁴. Bog wetlands are relatively well-protected relative to their historic extent, but swamps, fens, and marshes are not.

- 50 The New Zealand Biodiversity Strategy 2000 (**NZBS**) is one of the methods by which New Zealand implements its international obligations concerning indigenous biodiversity. NZBS Goal Three is set out below:

Halt the decline in New Zealand's indigenous biodiversity. Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments, and do what else is necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity.

- 51 Due to the severe depletion of wetlands, it was considered by the authors of the 2011 study¹⁵ that all remaining wetlands need to be protected if Goal Three of the NZBS is to be achieved.

- 52 The different palustrine wetland classes have fared differently in terms of loss of extent. Swamps and marshes have undergone the greatest loss of extent, while fens and bogs had experienced a relatively lower proportion of loss¹⁶. This pattern relates to the relative fertility and productivity of these systems, with swamps and marshes occurring on mineral soil with higher productivity, and fens and bogs on peat soils with lower productivity. Land development for farming and agricultural intensification therefore achieves a better rate of return in the higher productivity drained swamp and marsh habitats.

¹⁴ Robertson H.A. 2016: Wetland reserves in New Zealand: the status of protected areas between 1990 and 2013. *New Zealand Journal of Ecology* 40: 1-11.

¹⁵ Ausseil A-G.E., Chadderton W.L., Gerbeaux P., Stephens R.T.T., and Leathwick J.R. 2011: Applying systematic conservation planning principles to palustrine and inland saline wetlands of New Zealand. *Freshwater Biology* 56: 142-161.

¹⁶ Ausseil A-G.E., Chadderton W.L., Gerbeaux P., Stephens R.T.T., and Leathwick J.R. 2011: Applying systematic conservation planning principles to palustrine and inland saline wetlands of New Zealand. *Freshwater Biology* 56: 142-161.

Wetlands in Southland

Current state

- 53 It has previously been estimated that 47,231 hectares of wetlands are present in the Southland Region, comprising 10.8% of the Region's pre-human wetland extent (450,985 hectares) and 18.9% of New Zealand's current wetland extent¹⁷.
- 54 Southland is notable as a national stronghold for bog and fen wetlands, with Southland bogs occupying 32% of the national extent, and Southland fens comprising 23% of the national extent¹⁸.
- 55 Wetlands are most commonly found in lowland and coastal environments in Southland Region. Wetlands are therefore vulnerable to anthropogenic land use effects because lowland and coastal areas are where human activities are concentrated. Drainage of both swamp and bog wetlands has been a significant issue affecting the wetlands remaining in lowland Southland¹⁹.

Important wetlands in Southland

- 56 Important large wetlands in Southland include the Awarua-Waituna wetland complex; the New River estuary; other estuaries; Kakapo Swamp in the Te Anau Basin; peat bogs on the Southland Plains; and numerous large wetland complexes in eastern Fiordland and the Te Anau Basin.
- 57 Large wetland complexes are often significant habitat for indigenous fauna, as they provide many different structural vegetation types, including dense wetland vegetation that provides shelter, refuge, and nesting habitat, diverse plant species providing good habitats for invertebrates, and bodies of open water providing habitat for aquatic

¹⁷ Ausseil A-G.E., Gerbeaux P., Chadderton W.L., Stephens T., Brown D., and Leathwick J. 2008: Wetland ecosystems of national importance for biodiversity: criteria, methods, and candidate list of nationally important inland wetlands. *Landcare Research Contract Report LC0708/158*. Prepared for the Department of Conservation.

¹⁸ Ausseil A-G.E., Gerbeaux P., Chadderton W.L., Stephens T., Brown D., and Leathwick J. 2008: Wetland ecosystems of national importance for biodiversity: criteria, methods, and candidate list of nationally important inland wetlands. *Landcare Research Contract Report LC0708/158*. Prepared for the Department of Conservation.

¹⁹ Campbell D., Clarkson B. and Clarkson B. 2003: Issues facing Southland's wetlands – recommendations for future management. CBER Contract Report No 26. Prepared for the Department of Conservation and Environment Southland, Invercargill.

fauna, with abundant invertebrates and/or fish providing food sources for indigenous lizards and birds.

- 58 For example, the c.18,900 hectare Awarua-Waituna wetland complex south of Invercargill is one of the largest wetlands in New Zealand, and is a wetland of international importance that contains numerous Threatened, At Risk, and locally uncommon plants, birds, and fish. It was selected as New Zealand's first Ramsar site, meeting eight of the nine Ramsar criteria.
- 59 The Ramsar convention (1971) is an international treaty that encourages the wise use of wetlands and enables the formal recognition and ongoing protection of internationally significant wetlands²⁰. Currently there are five other New Zealand wetlands recognised under the Ramsar convention, all located outside Southland Region.
- 60 The Awarua-Waituna wetland complex has a high diversity of bird species (greater than any other Southland site), is an important overwintering area for New Zealand shorebirds (e.g. southern New Zealand dotterel; *Charadrius obscurus obscurus*) and wetland birds (e.g. Australasian bittern; *Botaurus poiciloptilus*), and an important summer feeding area for trans-equatorial migratory bird species such as bar-tailed godwit (*Limosa lapponica baueri*)²¹. It is also an important site for Threatened and At Risk marine, estuarine, and freshwater fish species, numerous Threatened and At Risk invertebrate species, and habitat or likely habitat for four At Risk indigenous lizard species²².

Recent trends

- 61 To facilitate national state of the environment reporting, wetland extent has been compared from 2001/02 and 2015/16 across New Zealand. In Southland, 1,656 wetland polygons were identified, of which 83% experienced no change, 4.2% experienced partial loss, and 1.6%

²⁰ <https://www.ramsar.org>

²¹ Wildland Consultants 2018: Whakamana te Waituna biodiversity plan. *Wildland Consultants Contract Report No 4701*. Prepared for the Whakamana te Waituna Charitable Trust. 79 pp.

²² Wildland Consultants 2018: Whakamana te Waituna biodiversity plan. *Wildland Consultants Contract Report No 4701*. Prepared for the Whakamana te Waituna Charitable Trust. 79 pp.

experienced complete loss²³. The remaining proportions were due to error and improvements in mapping. Southland examples of partial and complete loss were all caused by agricultural development.

- 62 A recent study of trends in palustrine wetland extent in the more developed parts of Southland (i.e. excluding Fiordland and Rakiura) found that, between 1990 and 2012, there was extensive wetland loss, with 3,452 hectares of wetlands cleared, comprising a 10.5% loss based on the 1990 extent of 32,814 hectares²⁴.
- 63 By far the greatest proportion of the 1990-2012 loss occurred on the Southland Plains, including extensive wetland loss near the Awarua wetland Ramsar site (**Attachment 3**). An additional 3,943 hectares of wetlands were classified as 'at risk' by this study, due to the presence of adverse effects related to drainage and degradation of wetland vegetation.
- 64 The loss of wetlands described in this study was almost all on private land, and the extent of wetland loss between 1990 and 2012 on private land was 21%, with an additional 24% of the wetlands described in this study considered to be at risk (wetlands that were not fully cleared but which had a visible presence of drains, partial loss of dominant vegetation type, and a degree of fragmentation).
- 65 Importantly, the Southland study found that the rate of loss of wetland extent in Southland has not declined in the study period, despite changes to the regulatory and policy environment in that period supposedly giving wetlands greater protection (such as the national priorities for the protection of rare and threatened biodiversity on private land, which specifically targeted wetlands). Clearance for agricultural and horticultural development was the main driver of the wetland clearance observed in Southland, and is consistent with international patterns.
- 66 The results of this study are in accord with my knowledge of recent pressures on wetlands in Southland through assessments I have made

²³ Landcare Research 2017: An analysis of wetland loss between 2001/02 and 2015/16. Landcare Research Contract Report LC2798. Prepared for the Ministry of the Environment.

²⁴ Robertson H.A., Ausseil A-G., Rance B., Betts H., and Pomeroy E. In press. Loss of wetlands since 1990 in Southland, New Zealand. *New Zealand Journal of Ecology* 43: in press.

of development activities such as pastoral intensification, electricity generation infrastructure, and exotic afforestation potentially affecting wetland habitats.

- 67 The recently-lowered water level at Waituna Lagoon has been associated with down-shore migration of lagoon-shore vegetation²⁵.

Horticulture New Zealand appeal

- 68 The Horticulture New Zealand appeal seeks changes to the definition of a 'natural wetland' and/or 'wetland' included in the proposed Southland Water and Land Plan (**pSWLP**).

- 69 The pSWLP contains the following definition of a 'natural wetland':

Natural wetland

Includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions, but excludes:

(a) wet pasture, damp gully heads, or where water temporarily ponds after rain or pasture containing patches of rushes;

(b) effluent ponds;

(c) artificial storage facilities and detention dams;

(d) artificial watercourses such as conveyance and drainage canals;

(e) reservoirs for firefighting, domestic or community water supply; and

(f) engineered soil conservation structures.

- 70 Horticulture New Zealand seeks that two further exclusions are made with respect to the definition of 'natural wetland', for sediment traps and artificial wetlands.

- 71 In my opinion, sediment traps would already be covered as 'detention dams' in the existing exclusions, and thus do not need to be added separately, although, for clarification, they could be added in brackets, i.e. (including sediment traps).

²⁵ Johnson P.N. and Partridge T.R. 1988: Vegetation and water level regime at Waituna Lagoon, Southland.

- 72 I consider that 'artificial wetlands' should not be listed as an exclusion to the definition of 'natural wetland'. Artificial wetlands include wetland vegetation that has been restored through creation of particular hydrological regimes and planting of appropriate indigenous vegetation. Artificial wetlands could also include wetlands with intact hydrology that are planted in appropriate indigenous vegetation. Such wetlands, while not naturally formed, could nevertheless provide significant habitat for indigenous vegetation and fauna.

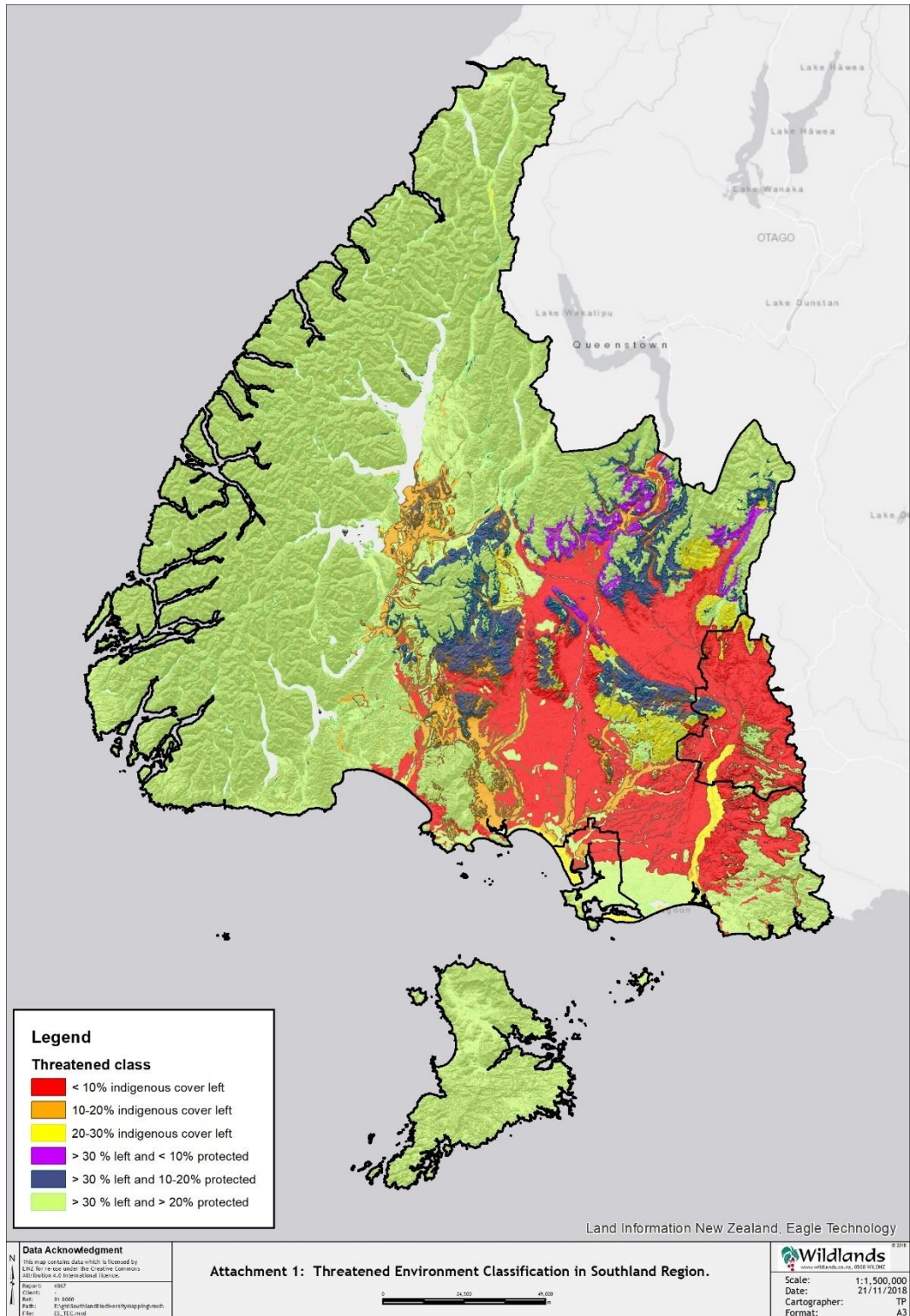
DATED this 14th day of December 2018

A handwritten signature in black ink that reads "Kelvin Lloyd". The signature is written in a cursive style with a large, stylized 'K' and 'L'.

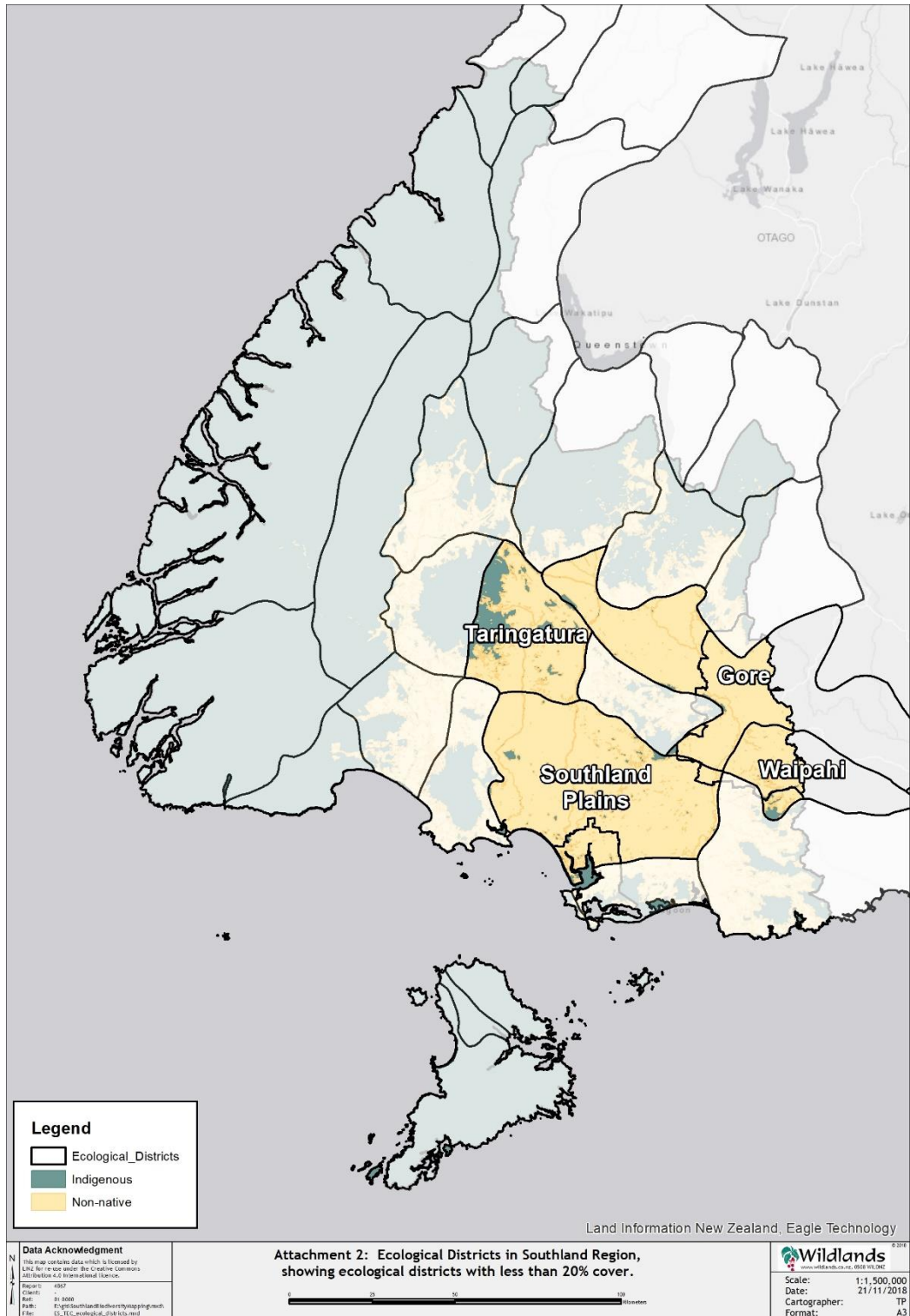
Dr Kelvin Lloyd

Attachment 1

Threatened Environment Classification of Southland Region



Attachment 2 Ecological Districts in Southland Region



Attachment 3

Map showing wetland loss and modification (risk) in the vicinity of the Awarua-Waituna Ramsar wetland site (from Robertson *et al.* in press)

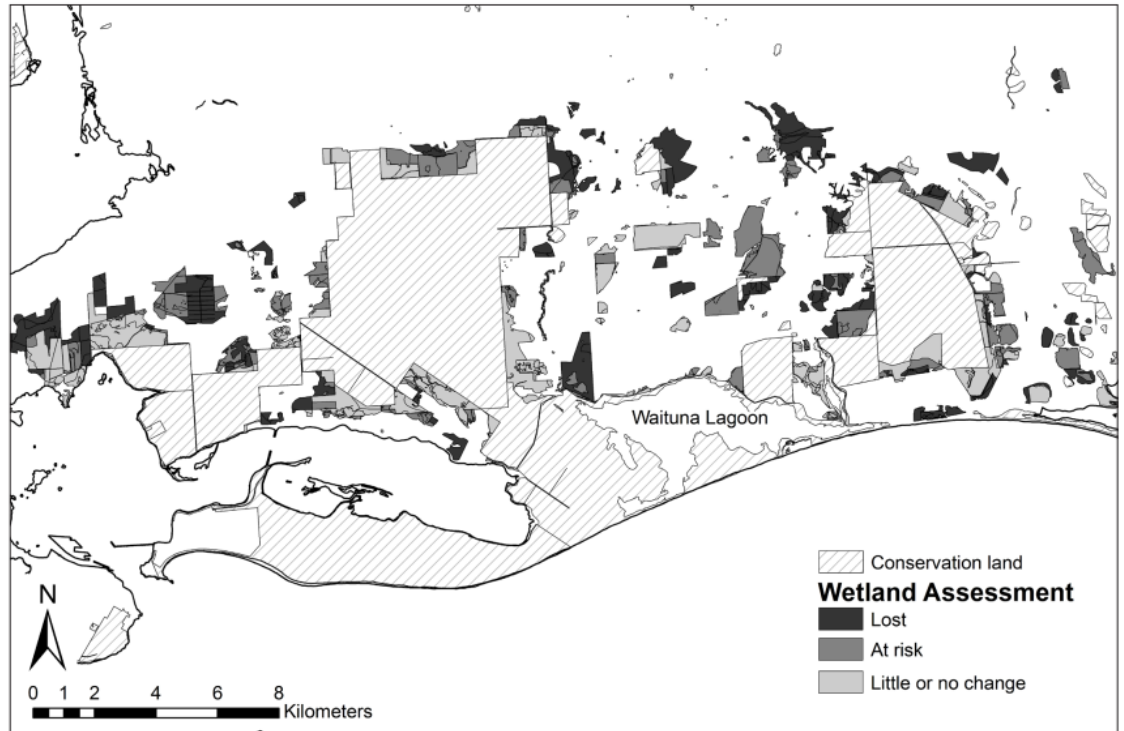


Figure 3. Geographical extent of land use change (wetlands lost and at risk) in the vicinity of Awarua Wetland (conservation land) and Waituna Lagoon, Southland, New Zealand.