Appendices

Appendix 1: Section 24A investigation report (Skelton, 2019)

Report to the Minister for the Environment

by

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1 October 2019

New Zealand Government

Acknowledgements

Peter Skelton wishes to acknowledge the considerable assistance he has received from Ministry for the Environment officials Robert McClean, Carly O'Connor and Rowan Taylor in both the investigation work and the preparation of this report.

This document may be cited as: Skelton, Peter (2019) *Investigation of Freshwater Management and Allocation Functions at Otago Regional Council - Report to the Minister for the Environment*. Wellington: Ministry for the Environment.

Cover photo: Falls Dam and the Hawkdun Range, Central Otago (R McClean, 25 June 2019)

Contents

Executive Summary

The Otago region is at a critical juncture for freshwater planning.

Existing planning provisions to manage freshwater are inadequate and the expiry of the Otago mining privileges (deemed permits) is only two years away. There are also growing challenges for the state of the freshwater resource in Otago in view of the high level of water abstraction and the significant alteration of natural flows, ecosystems and habitat for indigenous flora and fauna.

The Minister for the Environment has asked me to investigate the freshwater management and allocation functions exercised by the Otago Regional Council.

This report provides an overview of the state of the planning regime for freshwater in Otago. It examines the existing Regional Policy Statement and the existing Water Plan, and the Council's organisational capability and capacity.

The investigation has been informed by input from the Otago Regional Council, including its Chief Executive and staff; Aukaha (representing Kāi Tahu); and a range of stakeholders, including local farmers and water users, environmental groups, the Department of Conservation (DOC), Federated Farmers, the Otago Fish and Game Council, and two district council mayors.

The immediate issue facing the Council is the challenge of developing a fit for purpose planning framework ahead of the expiry of the deemed water permits on 1 October 2021.

It will be important to complete a new regional policy statement and a new land and water regional plan before undertaking the assessment of any new or replacement water consent applications. This will enable applications to be considered under the new freshwater planning framework and will halt the current unsatisfactory situation of ad hoc 'planning by consent'. This report recommends a pathway for achieving this.

In the interim, I consider the Minister for the Environment should recommend that the Otago Regional Council gives high priority to a planning process (which it has already commenced) to provide short-term measures for managing freshwater until the new regional policy statement and the new land and water regional plan are completed. This includes Plan Change 6AA, the Omnibus Plan Change, and a robust resource consenting regime which will avoid the granting of long term consents during this interim period.

While interim measures are necessary, the major focus of the Council should be the significant upgrade of the planning framework. I consider that the Minister for the Environment should recommend to the Otago Regional Council that it takes all necessary steps to develop a fit-for-purpose freshwater management planning regime. This regime should give effect to the relevant national instruments and set a coherent framework for assessing all water consent applications, including those that are made to replace any deemed permits.

To achieve this, the Minister should recommend that the Otago Regional Council adopts a comprehensive programme of work which will involve a complete review of the Regional Policy Statement by November 2020, and a new land and water regional plan by 31 December 2023.

It will be essential that the Council's policy and planning programme remains on track. To ensure that this occurs, I recommend that the Otago Regional Council provides 6-monthly progress reports to the Minister summarising the:

- organisational capability and capacity in science, planning, consenting, monitoring, enforcement and land management
- development of the new regional policy statement and new land and water regional

plan, and

- freshwater consenting activity.

A comprehensive freshwater planning framework, however, will not be in place before the deemed permits expire. I am therefore recommending that the Minister for the Environment initiates the necessary legislative process to change the date for expiry of the deemed permits in section 413(3) of the Resource Management Act 1991 from 1 October 2021 to 31 December 2025. This will ensure that the replacement consent applications are assessed against a robust policy framework.

Since this inquiry began, I have noted a significant change for the better in the way the Otago Regional Council and the stakeholders are now working together towards developing an effective and sustainable freshwater management framework in the region. In particular, I have observed the way the Council and Kāi Tahu are developing a close partnership relationship.

Introduction

Letter of appointment

By letter dated 16 May 2019, I have been engaged by the Hon David Parker, Minister for the Environment (the Minister), acting under section 24A of the Resource Management Act 1991 (the Act or the RMA), to investigate whether the Otago Regional Council (the Council or ORC) is adequately carrying out its functions under section 30(1) of the RMA in relation to freshwater management and allocation of resources. This includes implementation of the current National Policy Statement for Freshwater Management 2017 (NPS-FM).

A copy of the letter of appointment is attached to this report as Appendix 1.

Timeline

In a subsequent letter, dated 2 September 2019, the Minister agreed to my request for the report back time to be extended to 1 October 2019 (copy attached as Appendix 2).

My role

For transparency, I wish to make it clear that, while I am an appointed Councillor on the Canterbury Regional Council, I have undertaken this investigation in my private capacity. My Regional Council responsibilities, together with my former roles as an Environment Court Judge and a university Professor of Environmental Law, are relevant only insofar as they have enabled me to bring certain insights and experience to the investigation.

Council co-operation

In carrying out this investigation, I have had free access to all relevant Council information, including a large number of documents. I have also had the full co-operation of Otago Regional Councillors and staff, and I am confident that I have been able to make all the necessary inquiries to enable me to complete this investigation.

Focus of the investigation

The Minister wants to know if the Council has, or will have, an RMA-compliant planning and consenting framework in place to process and make decisions on new water permit applications by 1 October 2021. This is when the region's remaining 356 historic deemed permits expire, together with approximately 180 standard water permits.

This investigation has therefore focused on the Council's Regional Plan: Water for Otago (the Water Plan) and its associated documents and processes, including the Regional Policy Statement (RPS) and the Council's science, plan-making, and consenting capacities. The Terms of Reference for the investigation are set out in Appendix 3.

Scope of the investigation

The investigation centres on the Manuherekia, Arrow, and Cardrona (MAC) river catchments. However, it also considers the need for an RMA-compliant water planning and consenting regime across all Otago catchments, particularly where deemed permits and over-allocation occur together, as in the Taieri catchment.

The investigation has examined:

1. the adequacy of the current planning framework from an RMA and NPS-FM standpoint
2. the adequacy of the performance by the Council of functions relating to planning for the management of water quality and water quantity issues in the Otago Region
3. whether, in the Manuherekia, Upper Cardrona and Arrow catchments, the planning framework will be appropriate and sufficient to consider applications for new water permits once deemed permits expire
4. the adequacy of the Council's resources, including its capacity to develop and implement an adequate planning framework that gives effect to the NPS-FM
5. the views of Kāi Tahu and stakeholders.

The investigation has involved reviewing relevant documents and interviewing a range of relevant Council staff, Aukaha staff (representing Kāi Tahu), stakeholders and interested parties. Appendix 4 to this report lists the people I have interviewed either in person or by telephone for the purposes of compiling this report. The process included:

1. a context-setting field trip to the Manuherekia catchment accompanied by Council staff
2. two Council workshop sessions to inform and update Councillors about the investigation and seek their views
3. various workshops and discussions with Council staff, including the chief executive, policy, strategy, science and planning managers and senior policy, planning and science staff
4. discussions with Aukaha, representing Kāi Tahu
5. discussions with the following stakeholders and interested parties:
   (a) Department of Conservation
   (b) Federated Farmers Otago
   (c) Otago Fish and Game Council
   (d) Central Otago District Council (the Mayor)
   (e) Waitaki District Council (the Mayor)
   (f) Otago Water Resource Users Group
   (g) Central Otago Winegrowers
   (h) Manuherekia Catchment Water Strategy Group (former Chair)
   (i) Upper Clutha Water Group
   (j) Irrigation NZ, plus local irrigators and their consultants
   (k) Central Otago Environmental Society
   (l) An unaffiliated Manuherekia resident and author

Term of investigation

The investigation began on 25 June 2019 and has been completed with the presentation of this report to the Minister on 1 October 2019.

Context

Managing freshwater quality, quantity and ecology

The freshwater in our streams, rivers, lakes and aquifers is a national treasure which needs to be carefully managed to ensure that it can continue to meet a multiplicity of needs without becoming degraded or depleted. These include the habitat needs of our first freshwater users, the indigenous fish, fowl and invertebrates, and the more recent demands created by human activities, such as the need for clean drinking water, recreation, hydroelectricity generation, and farm irrigation.

The task of managing these needs and demands is challenging. One set of challenges relates to water quality. It requires the management of nutrient discharges, sediment and other water contaminants that arise from human activity. Another set of challenges relates to water quantity. It requires measures to ensure that the amount of water extracted for human use does not endanger the minimum flow needed for ecological processes, such as providing habitat for wildlife, and for recreational use.

These are pressing issues throughout much of New Zealand and particularly in Otago where tension exists between historic water use and current attempts to manage it. Hence this investigation. Responsibilities for managing water quality, and for setting minimum flow levels and allocating water takes, are set down in New Zealand's major planning statute, the Resource Management Act 1991 (RMA).

RMA planning regime

Under the planning regime introduced by the RMA in 1991, the use of natural and physical resources is managed by regional and district councils. They do this through objectives, policies, rules and other methods specified by regional policy statements (RPS), regional plans, and district plans – in that order.

This hierarchical set of policies and plans determines which activities or environmental effects are permitted and which are not. Those which are not permitted may only be undertaken pursuant to a resource consent which stipulates conditions that the consent holder must comply with in order to avoid, remedy or mitigate particular adverse environmental effects.

In Otago, the Otago Regional Council is responsible for managing freshwater in approximately one hundred catchments. These include New Zealand's second and fourth longest rivers, the Mata-Au (Clutha) and the Taieri; and many small catchments with names like Gentle Annie, Dead Horse Creek, and Poison Creek.

National Policy Statement for Freshwater Management (NPS-FM)

Where matters of national significance are involved, the RMA authorises the Minister to direct councils to set relevant environmental objectives, policies and rules. This national direction is achieved through national policy statements (NPS) and national environmental standards (NES). In 2011, the then Minister for the Environment established an NPS-FM which has since been revised twice, with a further revision pending

Regional water plans are required, by 2025, to show mapped areas called freshwater management units (FMUs) and, for each, to define its important values and set clear objectives and limits for water quality and quantity. These must comply with the detailed requirements of the NPS-FM, and councils must report annually on their progress towards this in progressive implementation programme reports (PIPs).

The Essential Freshwater package

On 5 September 2019, the Government proposed some further changes to the way water is managed under the RMA. The proposed Essential Freshwater package includes a revised NPS-FM and a new NES for freshwater, which together will:

- strengthen Te Mana o Te Wai as the framework for freshwater management
- better provide for ecosystem health (water, fish and plant life)
- better protect wetlands and estuaries
- better manage stormwater and wastewater, and protect sources of drinking water
- control high-risk farming activities and limit agricultural intensification
- improve farm management practices.

Resource Management Amendment Bill – freshwater hearings panel

On 23 September 2019 the Government introduced the Resource Management Amendment Bill. This Bill provides for a chief freshwater commissioner who will convene freshwater hearings panels to conduct public hearings of submissions on freshwater policies and plans prepared to give effect to the new NPS-FM. The freshwater policies and plans are required to be notified by 31 December 2023.

Implication of revised national direction and legislation

These recent changes require all councils to impose tighter controls on freshwater management and to accelerate all policy and plan changes needed to give effect to the NPS-FM by 31 December 2025. The implication for ORC is that the consideration of any applications for replacements of the deemed permits by 1 October 2021 will now have to take place within the context of a more accelerated and intensive programme of NPS-FM-driven plan changes working to shorter deadlines than previously.

Regional Plan: Water for Otago

In its 2018 PIP, the Council indicated that its Water Plan does not yet give effect to the 2017 NPS-FM but is expected to do so by 2025, consequent on a series of plan changes. However, in the Ministry for the Environment's summary of all PIPs from councils across the country it is noted that ORC's compliance with the NPS-FM by 2025 might not be able to be achieved given the amount of work the Council has yet to do.

Currently, most of Otago's 100 or so catchments are, by the Council's own estimation, over-allocated. This means the permits for water abstraction in those catchments allow more water in total to be taken than the catchment can sustain without adverse environmental effects. The Water Plan's Schedule 2 sets minimum flow and allocation limits for only 14 catchments, with the rest covered by comparatively permissive region-wide rules which set the default minimum flow at 50 per cent of mean annual low flow (MALF) – well below the national average of 75 per cent MALF.

Significantly, these rules do not apply to about a third of Otago's water takes which are authorised by the historic deemed permits. These are not subject to any of the Water Plan's allocation restrictions (see 'deemed permits' section below).

The Water Plan became operative in 2004 and has had 15 plan changes since then (see Appendix 7). Four of these plan changes set minimum flow and allocation limits for some of the larger catchments (e.g. the Taieri, upper Manuherekia, Luggate, and Pomahaka). The most recent of the plan changes (PC5A - Lindis: Integrated water management) was notified in 2013 and is still under appeal in the Environment Court where appellants have disputed its proposed minimum flow limit.

Another plan change (PC6A) on water quality became operative in 2014 but also provided for a deferment of the rules for limiting nutrient discharges until April 2020 in order to give water users time to adapt. The Council is now proposing to extend this deferment period through a new plan change (PC6AA) after recently identifying implementation problems with these rules. PC6AA will defer the nutrient rules until April 2026.

In the meantime, the Council intends to notify another plan change, known as the Omnibus Plan Change, in March 2020. This will, among other things, provide some interim water quality provisions to address some of the deficiencies in PC6A, and will also provide interim policy guidance for the issuing of freshwater resource consents.

In 2018, proposed plan change (PC7) would have set minimum flow and allocation limits in three Central Otago catchments (Manuherekia, Arrow, and Cardrona). It was withdrawn by the Council amid concerns from both water users and Council staff that the limits were not based on robust hydrological data and models. The decision to withdraw the plan change was not unanimous, and was opposed by Kāi Tahu and some environmental stakeholders whose view was that PC7 is a step in the right direction which would be able to be improved by future plan changes.

However, I consider this withdrawal was a responsible course of action to take, given the scientific uncertainty which is now being addressed. The Council has engaged the National Institute of Water and Atmospheric Research (NIWA) to provide an improved flow model for the Manuherekia catchment, referred to as the Cumulative Hydrological Effects Simulator (CHES) Model. It has expressed the intention of notifying plan changes for the three Central Otago catchments as soon as the data and modelling permit.

Even with these proposed and actual changes, however, a number of NPS-FM requirements will still not be addressed by the Water Plan. Further plan changes will be needed before all of the region's catchments are covered by FMU management plans with values, objectives and limits for minimum flow levels, allocation and water quality attributes.

The Council has recently completed the first stage of this work by dividing the region into eight FMUs which cover all of its catchments, and further subdividing some of these into rohes, or sub-FMUs. However, the Council has still to develop, in consultation with Kāi Tahu and the FMU communities, a full set of values, objectives and limits for each FMU and rohe and to then incorporate these via plan changes into the Water Plan. That work is now beginning in some FMUs, with, for example, a community meeting held on 25 September 2019 to discuss water values in the Manuherekia rohe.

Deemed permits

In addition to the 1,400 or so water takes authorised by 883 resource consents in Otago, there are nearly 600 further water takes authorised by 356 deemed permits. Prior to the RMA, these permits were known as "mining privileges" and were held as a property right (see Appendix 5: History of Regulations - the Otago Mining Privileges).

Under section 413(3) of the RMA[1], all of these permits will expire on 1 October 2021. Many of their owners are expected to apply for replacement resource consents at least six months before then. As things currently stand, in catchments without specific flow and allocation limits, the replacement applications would have to be assessed under the Water Plan's default limits which may not be adequate to control environmental effects in a number of catchments.

The first mining privileges were established in 1858 to give gold-miners access to water and adjacent land for sluicing purposes. Later, they were re-purposed for farm irrigation. During the first half of the twentieth century, many mining privilege licences were acquired by the Government to enable economic development and employment creation through large-scale irrigation and dam construction works, such as the Falls Dam and the irrigation network in the Manuherekia catchment. While some mining privileges remained in private hands, by the 1980s, most belonged to the Crown.

Over time, the statutes governing mining privileges shifted from various mining acts and amendments to the Public Works Act, then the Water and Soil Conservation Act 1967 and finally, in 1991, the RMA. This final transition occurred during the economic liberalisation of the 1980s and early 1990s when the Crown was privatising public assets, including irrigation infrastructure.

The Crown's mining privilege licences were sold to local farmers and private irrigation companies who, to protect their investment, negotiated a 30-year exemption from any restrictions that might have been imposed under the impending RMA.

When the RMA came into effect, it provided for the mining privilege water takes as deemed water permits - as distinct from standard RMA water and discharge permits - and ensured the continuation of their mining privilege conditions until the expiry date of 1 October 2021.

Until that expiry date, the RMA requires decisions on any replacement resource consents to have regard to the previous deemed permit water right. Any plan change, during this time, which reduces a deemed permit water right may only be instigated by the permit holder. Permit holders who consider that their right to take or discharge water has been infringed by the Council may seek compensation up to, but not beyond, the expiry date.

In Otago, several hundred deemed permits were replaced by resource consents in the period leading up to the adoption of the Water Plan in 2004. In the absence of catchment-level flow and allocation limits, many of these consents were issued with relatively permissive conditions, often for terms of 30-35 years. This has continued piecemeal to the present day. Two water permits issued earlier this year have 35-year terms extending to 2054.

The Council's consenting team has recently indicated that, where there are no catchment-specific flow and allocation limits, it now intends to limit replacement consent terms to 5-10 years, on a case by case basis. However, many permit-holders still expect 25-35 year consents and, at present, there is no plan rule limiting consent terms.

Since the Water Plan became operative in 2004, the Council has promoted a policy of "use it or lose

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[1] "Every deemed permit resulting from a mining privilege under subsection (1)(c) or (d) shall be deemed to include a condition to the effect that it finally expires on the 30th anniversary of the date of commencement of this Act."

it", encouraging the remaining deemed permit holders to use their water in order to demonstrate their volume of 'historic' usage when they apply to replace the permits. In some catchments, notably the Manuherekia, this "use it or lose it" message has reportedly had the effect of encouraging increased usage, including wasteful usage.

The Water Plan also has an "efficient use" requirement which has reportedly encouraged some deemed permit holders to shift away from flood or border dyke irrigation to more sophisticated spray and pivot irrigation, the funding of which requires greater productivity from more intensive land and water use. Dairy farming, for example, has increased in the Manuherekia from no dairy platforms in 2008 to at least 15 (refer to Table 1 below) now identified in the Agribase[2] database.

Table 1: Otago catchments with the most deemed permits (as at 17 September 2019) and number of dairy farms in the region

Catchments with deemed permits	Deemed Permits *(takes)*	RMA Water Permits *(takes)*	Median Expiry Date of RMA water permits	Whether over-allocated	Whether subject to Schedule 2 allocation and flow limits	Dairy farms
Taieri	**74** *(103)*	**160** *(233)*	**2037** (2019-2023)	Yes	Yes	76
Manuherekia	**71** *(124)*	**122** *(225)*	**2023** (2019-2052)	Yes	Yes (part of river - Falls Dam to Ophir)	15
Lindis	**19** *(31)*	**17** *(28)*	**2029** (2021-2043)	Yes	Pending (notified and under appeal)	0
Cardrona	**14** *(27)*	**31** (55)	**2038** (2020-2050)	No	Yes	0
Lowburn Creek	**13** *(41)*	**1** (2)	**2046**	No	Yes	0
Arrow	**12** *(18)*	**8** (19)	**2030** (2021-2048)	No	Yes	0
Luggate	**12** *(16)*	**1** (1)	1 Oct **2021**	Yes	Yes	0
All others (ca 50)	**141** *(223)*	**544** (836)		Approx. 60%	Approx. 30%	411
Totals	**356** ***(583)***	**884** **(1399)**				**502**

Sources: Otago Regional Council (consent and plan data); Agribase (dairy farm data)

With two years to go until their expiry, there are still 356 deemed permits in the Otago region – 275 for surface water takes and 81 for groundwater abstraction. They are spread thinly over approximately 60 catchments, though the bulk of them are concentrated in seven catchments, namely: the Taieri (74), Manuherekia (71), Cardrona (14), Lindis (19), Lowburn (13), Arrow (12), and Luggate (12). Four of these, the Taieri, Manuherekia, Lindis, and Luggate catchments are considered by the Council to be over-allocated.

[2] AgriBase is a national spatial farms database owned and maintained by AsureQuality, a state-owned enterprise which provides specialist food assurance services covering the entire food supply chain. Agribase holds information on approximately 142,000 live (current) New Zealand farms, including 828 dairy farms throughout Otago.

The Council is expecting 96 unused deemed permits to be surrendered by the hydroelectricity company, Trustpower. This will leave approximately 270 still needing to be retired or replaced in the next two years. In addition to the deemed permits, nearly 180[3] standard RMA water permits are also due for replacement on or before 1 October 2021.

In total then, the Council may receive up to 450 water resource consent applications in the next 18 months, including from catchments which are over-allocated and have no local minimum flow and allocation limits.

3 This includes 20 consents which expired between 2016 and 1 October 2019 but, subject to RMA section 124 guidelines, are still in effect until decisions are made on their replacement consents which were applied for before the expiry dates.

Overview of the Otago planning framework

Before commenting on the Regional Policy Statement and Regional Water Plan in more detail, I wish to report some observations about the state of the freshwater environment. While a comprehensive account of the state of the freshwater environment throughout the Otago region is beyond the scope of this investigation, a Ministry for the Environment summary for four key catchments (i.e. the Taieri, Manuherekia, Arrow, and Cardrona) is provided in Appendix 6 to this report.

As noted there, trend data for a number of environmental indicators are either absent or too recent to be interpreted clearly. However, from the data available, some general observations can be made. These observations have contributed to my assessment of the adequacy of the Council's planning framework and associated science capability and capacity. Key points to note are set out below.

Water quality

While the overall water quality of most Otago rivers in the Land, Air, Water Aotearoa (LAWA) database[4] is considered "good", there is evidence of some degradation in those catchments or parts of catchments where intensification has occurred, such as in some of the tributaries or lower reaches of some rivers, including the Manuherekia, Cardrona, parts of the Taieri, and around Lake Hayes in the Arrow catchment.

In the Manuherekia catchment, for example, water quality shows declining trends for phosphorus, *E. coli* and turbidity. In the Arrow catchment, the condition of Lake Hayes may be close to a tipping point. Eutrophication and pathogens are an issue, with swimming warnings becoming more frequent, and Macroinvertebrate Community Index (MCI)[5] scores for the inflows to Lake Hayes also indicate water quality issues.

In the Cardrona catchment, nitrogen and *E. coli* appear to be the main water quality issue. MCI scores highlighted probable impact on water quality and/or habitat conditions. The Taieri catchment has variable quality along its length, with *E. coli* and phosphorus being the main water quality parameters of concern. Lake Waihola is particularly sensitive (due to its shallow nature) and has some signs of poor water quality and eutrophic status.

Water flows

There is a high level of water abstraction in Central Otago. For instance, it is estimated that 75% of the available flow in the Manuherekia River is taken for irrigation and stock water. This compares with about 25% in other regions of New Zealand. In the Manuherekia catchment, which has the Falls Dam, multiple water storage sites and a complex network of water races, water quantity is poorly understood, but likely to be severely over-allocated in terms of abstractions and flow.

The Arrow is also considered to be severely over-allocated, though actual usage of water is low compared to paper allocation. The Cardrona River too is considered by ORC to be over-allocated. It has a natural drying stretch which recharges groundwater while impeding the summertime passage of trout and migratory fish passage. Although the Taieri catchment has water storage on some tributaries and has minimum flow limits set at multiple places throughout the catchment, the river

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4 LAWA is a partnership between the 16 regional and unitary councils, the Cawthron Institute, and the Ministry for the Environment. It is the most comprehensive source of water quality data in New Zealand.

5 Macroinvertebrate Community Index (MCI) is an index used to measure the water quality of fresh water streams. The presence or lack of macroinvertebrates such as insects, worms and snails in a river or stream can give a biological indication of the health of that waterway.

sometimes reaches these minimum flows and is described on the LAWA website as 'heavily over-allocated, largely as a result of the use of historic deemed permits to allocate water."[6]

The high level of water abstraction in some Central Otago catchments has significantly altered the natural flows, ecosystems and fish habitats of some streams and rivers. The full extent of these changes is difficult to quantify without naturalised baseline hydrological and ecological data, but work is currently addressing this through NIWA's CHES model, commissioned by the Council, and also through research by Aukaha. This research will involve cultural health monitoring and habitat modelling at 90 freshwater sites during this coming summer, 30 each in the Manuherekia, Cardrona, and Taieri catchments.

Ecology and endangered species

Wetlands have been particularly affected by historic land use, with 81% having been lost in the Manuherekia catchment, 84% in the Arrow, 83% in the Cardrona and 71% in the Taieri. The condition of remaining wetlands is not well known but appears to vary. The Taieri catchment has a large wetland-lake complex in its lower catchment that holds international significance.

In some river catchments, flow and habitat changes, together with the ingress of trout, have had a severe impact on endemic non-migratory galaxiids, several of which are threatened or endangered. I was informed by a Council freshwater scientist that there have been dramatic declines, and the loss of entire populations, in recent decades in a number of catchments, including the Manuherekia and the Taieri.

The Manuherekia catchment contains rare, endemic, fish species that may be in serious trouble, including one unique galaxiid species that is found only in the Manuherekia catchment. It also has a poor representation of more common species. In the Arrow, fish diversity is very low, with only one native species having been recorded. In contrast, the Cardrona River has at least seven fish species, including rare galaxiids, as well as freshwater mussels and koura. The Taieri catchment supports a diversity of fish life, of more than 20 species, including many rare species.

The Otago Regional Policy Statement

The Otago Regional Policy Statement (RPS) was made partially operative on 14 January 2019. A number of the provisions are currently subject to High Court proceedings, including policies concerning mineral and petroleum exploration and offsetting for indigenous biological diversity.

I do not intend to comment on the overall quality of the RPS, noting that some outstanding matters are before the High Court, but I would expect freshwater management to be more prominent in the RPS which aspires to five primary outcomes:

1. resource management in Otago is integrated
2. Kāi Tahu values and interests are recognised, and kaitiakitaka (kaitiakitanga) is expressed
3. Otago has high quality natural resources and ecosystems
4. communities in Otago are resilient, safe and healthy
5. people are able to use and enjoy our natural and built environment.

These outcomes direct the framework of the RPS which covers issues of integrated management, Kāi Tahu values, natural resources and ecosystems, resilience, climate change, infrastructure, energy

[6] LAWA website: https://www.lawa.org.nz/explore-data/otago-region/water-quantity/surface-water-zones/taieri-catchment/

resources, urban growth, hazardous substances, the built environment, historic heritage, and managing adverse effects.

The primary objectives relating to freshwater in the RPS are Objectives 3.1 and 3.2. In the appeals version of the plan, these objectives state:

> **Objective 3.1** The values (including intrinsic values) of Otago's ecosystems and natural resources are recognised, and maintained, and/or enhanced where degraded
>
> **Objective 3.2** Otago's significant and highly-valued natural resources are identified, and protected, or enhanced where degraded.

Under Objective 3.1, Policy 3.1.1 fresh water states:

> Safeguard the life-supporting capacity of fresh water and manage fresh water to:
>
> a. Maintain good quality water and enhance water quality where it is degraded, including for:
>   i. Important recreation values, including contact recreation; and,
>   ii. Existing drinking and stock water supplies;
>
> b. Maintain or enhance aquatic:
>   i. Ecosystem health;
>   ii. Indigenous habitats; and,
>   iii. Indigenous species and their migratory patterns.
>
> c. Avoid aquifer compaction and seawater intrusion;
>
> d. Maintain or enhance, as far as practicable:
>   i. Natural functioning of rivers, lakes, and wetlands, their riparian margins, and aquifers;
>   ii. Coastal values supported by fresh water;
>   iii. The habitat of trout and salmon unless detrimental to indigenous biological diversity; and
>   iv. Amenity and landscape values of rivers, lakes, and wetlands;
>
> e. Control the adverse effects of pest species, prevent their introduction and reduce their spread;
>
> f. Avoid, remedy or mitigate the adverse effects of natural hazards, including flooding and erosion; and,
>
> g. Avoid, remedy or mitigate adverse effects on existing infrastructure that is reliant on fresh water.

Policy 3.1.3 also provides for water allocation and use:

> Manage the allocation and use of fresh water by undertaking all of the following:
>
> a. Recognising and providing for the social and economic benefits of sustainable water use;
>
> b. Avoiding over-allocation, and phasing out existing over-allocation, resulting from takes and discharges;
>
> c. Ensuring the efficient allocation and use of water by:
>   i. Requiring that the allocation does not exceed what is necessary for its efficient use;
>   ii. Encouraging the development or upgrade of infrastructure that increases efficiency;
>   iii. Providing for temporary dewatering activities necessary for

construction or maintenance.

Other relevant policies include 3.1.4 water storage; 3.1.7 soil values; 3.1.9 ecosystems and indigenous biological diversity; 3.2.13 and 3.2.14 in relation to outstanding freshwater bodies.

Methods 3.1.3(h) and (i) for regional plans state "to provide for resource users, people and communities that rely on freshwater within environmental limits" and "to set limits and targets to give effect to the National Policy Statement for Freshwater Management 2014".

I also note that provision is made for the habitat of trout and salmon unless detrimental to indigenous biological diversity (ie, Policy 3.1.9(b)(ii)). This has high relevance to a number of Otago catchments where I understand native fish are challenged not only by water flows and related ecological conditions, but also by competition with trout.

The Council acknowledges that the RPS does not fully give effect to the NPS-FM 2017 and I note that it will require a substantial additional update to give effect to the forthcoming reviewed NPS-FM. I consider for example, that there will need to be an explicit chapter relating to land use and freshwater management. At this stage, I understand the proposed revised NPS-FM will require amendments to the RPS relating to:

- Te Mana o Te Wai (section 3.2)
- integrated management directed at managing effects from urban development (section 3.4).
- avoiding loss and degradation of wetlands (section 3.15)
- maintaining ecosystem health in streams (section 3.16).

Other provisions will also be required as a result of the forthcoming national directions for urban development, highly productive land, and indigenous biodiversity.

In addition, the new national planning standards (planning standards) apply to all regional councils, and unitary authorities with separate regional policy statements. These must comply with all planning standards apart from the requirement for e-planning, by 3 May 2022 or at notification of a proposed RPS, whichever is sooner.

The new format will require significant changes to the current Otago RPS in terms of section headings, structure, definitions, and monitoring provisions. Further, a section heading for 'National direction instruments' is compulsory. This will contain all the operative national policy statements, national environmental standards, and regulations.

Regional Plan: Water for Otago

The Regional Plan: Water for Otago provides a framework for the management of water in the region and was made operative on 1 January 2004. It applies to lakes, rivers, groundwater, and wetlands. The plan includes some provisions for assessing applications for replacement water consents once the deemed permits expire and it takes an effects-based approach to managing water quality. It focuses on controlling contaminant and sediment discharges, rather than regulating or managing land use activities themselves.

I consider that overall this plan does not give effect to the NPS-FM nor does it provide a comprehensive framework within which to support the deemed permit replacement process. A number of gaps in the Water Plan have been identified through discussions with ORC staff, Kāi Tahu and stakeholders, including:

- inadequate approach to flow and allocation limit setting, including failure to underpin with appropriate hydrological modelling and freshwater science
- failure to recognise or address over-allocation in plan provisions
- lack of provisions for aquatic biodiversity and habitat, particularly threatened species such as non-migratory galaxiids
- a risk of adverse effects on waterbodies arising from the efficiency policy which appears to have encouraged at least some users to maximise rather than minimise their water use.

Allocation

Policy 6.4.2 of the plan defines the primary allocation limit for each catchment as the greater of the catchment limits set in:

- Schedule 2A (includes limits for Taieri and Manuherekia); or
- 50% of the 7-day Mean Annual Low Flow (MALF); or
- The sum of the consented maximum takes.

This (particularly the ability to determine primary allocation based on the sum of the consented maximum takes), in combination with Policy 6.4.2A (which provides for granting "*from within primary allocation, no more water than has been taken under the existing consent in at least the preceding five years"*) can provide a perverse incentive to maximise water use prior to applying for consents to replace expiring deemed permits, in order to obtain maximum allocation. In a situation where deemed permits are to be replaced on a "use it or lose it" basis, this can lead to spilling of unused water, as reported in discussions with Kāi Tahu and several other stakeholders.

Allocation is a significant issue in the Manuherekia catchment where the level of abstraction significantly exceeds the primary allocation in the plan, with paper allocation an order of magnitude higher[7] than Schedule 2A.

Minimum flows, residual flow and efficiency

Minimum flow setting in the region has been protracted and remains in process for a number of catchments including those that contain the majority of the remaining deemed permits.

Where minimum flows have been set, whether or not they are sufficient is questionable due to a lack

[7] ORC Briefing Note: Minimum flows plan change for priority Otago catchments and deemed water permit replacement process.

of consistent methodology and insufficient hydrological investigations and investment in the freshwater science which underpins ORC's limit-setting process. (Policies 6.4.3 and 6.4.4 and Method 15.9.1.3).

With respect to deemed permits, the Mitchell Daysh consent review notes that the existing planning framework does not appear to provide clarity and certainty on the minimum flows that are likely to be applied. As a consequence, minimum flows will be contentious in respect of each application.

Policy 6.4.7 relates to the requirement to maintain a residual flow at the point of take.[8] The policy does not adequately protect instream values or reliability of supply, and does not consider downstream effects.

Policy 6.4.0A relates to water efficiency in terms of water transport, storage and application. However, the policy neither requires nor guides users to reduce the volume of water used. Without this, the adoption of more efficient application methods can enable the irrigation of larger areas and intensification of farming operations with no reduction in water take.

This has the potential to increase economic dependence on existing water takes and, in combination with the allocation policies outlined above (which enable deemed permit replacement consents to be based on inflated historic use), can heighten the risk of adverse environmental outcomes in terms of contaminant and sediment discharges. This risk is further heightened by the plan's failure to regulate land use activities (eg, intensive winter grazing, dairy intensification).

Provisions pertaining to threatened species, fish passage and fish screening

Maintaining an up-to-date inventory of native fish is a core requirement for the effectiveness of a regional water plan. DOC has advised that the Threatened Species Schedule in the Water Plan is out-of-date (see Table 2 below).

8 "The need to maintain a residual flow at the point of take will be considered with respect to any take of water, in order to provide for the aquatic ecosystem and natural character of the source water body."

Table 2: Freshwater Fish Status in the Water Plan

SCHEDULE 1AA: OTAGO RESIDENT NATIVE FRESHWATER FISH THREAT STATUS

1AA Schedule of Otago Resident Native Freshwater Fish - Threat Status

Common name	Scientific name	Threat Status
Lowland longjaw galaxias	*Galaxias cobitinis*	Nationally Critical*
Canterbury mudfish (Kōwaro)	*Neochanna burrowsius*	Nationally Critical
Teviot flathead galaxias	*Galaxias* 'Teviot'	Nationally Critical*
Dusky galaxias	*Galaxias pullus*	Nationally Endangered*
Alpine galaxias	*Galaxias* aff. *paucispondylus* 'Manuherikia'	Nationally Endangered*
Eldon's galaxias	*Galaxias eldoni*	Nationally Endangered*
Central Otago roundhead galaxias	*Galaxias anomalus*	Nationally Vulnerable*
Clutha flathead galaxias	*Galaxias* sp. D.	Nationally Vulnerable*
Smeagol galaxias	*Galaxias* aff. *gollumoiodes* 'Nevis'	Nationally Vulnerable*
Longfin eel (tuna)	*Anguilla dieffenbachii*	Declining
Giant kokopu (Taiwharu)	*Galaxias argenteus*	Declining
Galaxias gollumoides	*Galaxias gollumoides*	Declining
Lamprey (kanakana)	*Geotria australis*	Declining
Torrentfish (Piripiripōhatu)	*Cheimarrichthys fosteri*	Declining
Koaro	*Galaxias brevipinnis*	Declining
Inanga (inaka)	*Galaxias maculatus*	Declining
Bluegill bully	*Gobiomorphus hubbsi*	Declining
Redfin bully	*Gobiomorphus huttoni*	Declining

*NB: Fish marked with an * are only found in the Otago Region.

Source: Regional Plan – Water for Otago

DOC has provided a more recent table of non-migratory Galaxias in the Otago region and their current threatened species status (see Table 3 below). Notable changes in fish status are:

- **The Central Otago roundhead** galaxias, *Galaxias anomalus* (found in the Taieri and Manuherekia tributaries) are now nationally endangered, previously nationally vulnerable
- **The Clutha flathead** galaxias, *Galaxias* sp. D. (found in the Cardrona River, Lindis River, Clutha tributaries above Lake Dunstan, Bannock Burn, Manor Burn, Pool Burn and Benger Burn) are now nationally critical, previously nationally vulnerable, and
- **The Gollum** galaxias, *Galaxias gollumoides* (found in the Clutha/Mata-Au), are now nationally vulnerable, previously declining.

Table 3: Non-migratory galaxias in the Otago region

Taxa	Common name	Distribution in Otago
Nationally Critical		
Galaxias "species D"	Clutha flathead galaxias (Clutha River)	Cardrona River, Lindis River, Clutha tributaries above Lake Dunstan, Bannock Burn, Manor Burn, Pool Burn, Benger Burn
Galaxias "Teviot"	Teviot flathead galaxias (Teviot River)	Teviot River tributaries
Galaxias cobitinis	Lowland longjaw galaxias	Kauru and Kakanui Rivers
Nationally Endangered		
Galaxias anomalus	Central Otago roundhead galaxias	Taieri and Manuherekia tributaries
Galaxias eldoni	Eldon's galaxias	Taieri and Tokomairiro River tributaries
Galaxias pullus	Dusky galaxias	Lower Clutha and Taieri River tributaries
Galaxias "Nevis"	Nevis galaxias (Nevis River)	Nevis River
Galaxias aff. *paucispondylus* "Manuherikia"	Alpine galaxias (Manuherikia River)	Manuherikia River above Falls Dam
Nationally Vulnerable		
Galaxias depressiceps	Taieri flathead galaxias	Shag, Waikouaiti, Taieri, Tokomairiro river tributaries, Akatore Creek
Galaxias gollumoides	Gollum galaxias	Clutha/Mata Au
Galaxias "Pomahaka"	Pomahaka galaxias (Pomahaka River)	Pomahaka River
Galaxias "southern"	Southern flathead galaxias (Southland, Otago)	Upper Clutha River tributaries
Galaxias aff. *paucispondylus* "Southland"	Alpine galaxias (Southland)	Von and Lochy Rivers

Source: Department of Conservation

The nationally endangered Alpine galaxia (Manuherekia River) *Source: Creative Commons*

DOC also advises that the fish passage and screening provisions of the plan are inadequate, falling short of national best practice and failing to provide specific measures to protect non-migratory galaxiid fish, such as fish barriers and eradication methods to exclude invasive species.

The damming provision (rule 12.3.2) is seen by DOC as permissive in providing a pathway for multiple small dams to be constructed as a permitted activity. In a small catchment this is likely to impact on non-migratory galaxiids by removing or reducing their habitat.

There are clearly opportunities to strengthen the existing provisions and afford greater protection to the region's unique galaxiid species.

National planning standards requirements for regional plans

In addition to having to comply with the NPS-FM, the Water Plan will need to be updated to comply with the national planning standards (in particular *3. Regional Plan Structure Standard).* I am advised that the timeframes are: within 10 years of the planning standards coming into effect (2019), or notification of a proposed regional plan (but not a change or variation) for submissions, whichever is sooner.

The planning standards encourage an integrated region-wide approach to planning for a region's resources. A catchment-scale approach is provided for in the structure. Cost and resource implications for councils can be reduced by adopting 'regional-scale' responses where appropriate, and overlaying catchment-scale processes where required. Environmental benefits can be achieved by ensuring regional provisions are in place to prevent further degradation of freshwater resources until limit-setting processes can be initiated.

The standards do not prevent a separate Water Plan being created, but all the other required parts of the regional plan standard will need to be included. I note that most regions have, or are moving to, integrated regional plans.

Current Council capacity and capability

For the Water Plan to give effect to the NPS-FM, the Council needs sufficient capacity in not just one, but all, of the following key areas: policy and planning, science, consenting and CME (compliance, monitoring and enforcement). Although ORC is fiscally strong, these key areas are seriously under-resourced and will need significantly more investment if the Council is to cope with the resource management tasks that currently face it, including compliance with the NPS-FM.

The new Council senior managers are aware of this and are beginning to address the capacity gaps within their current budget envelopes, but more investment is vital to fully address all of the identified shortfalls in capacity and capability. The Council's CEO Sarah Gardner is also aware of this and has told me that this investment will be provided for in forthcoming annual and long term planning processes.

Science capacity and capability

Critical to the success of ORC's water management planning and implementation is a robust scientific evidence base. At present, the Council has 9.4 full-time equivalent (FTE) scientist positions comprising the science manager, 2 groundwater scientists, 2 freshwater ecologists, 2 minimum flows scientists, 1.4 hydrologists, and 1 air quality scientist.

An independent review[9], commissioned by the Council, recently reported that, for a region the size of Otago, this number of scientists is quite inadequate to support all of the Council's critical resource management functions. The reviewers also identified a shortage of scientific technical support staff. Approximately two technical staff are needed per FTE scientist to collect, process, store, and analyse data. ORC has insufficient technical staff to support even the current under-strength science team.

The reviewers' key findings were:

- capacity gaps in land, wetlands, coastal and catchment modelling are top priorities
- freshwater science (both quality and quantity) is under-resourced
- science, monitoring and data, overall, are under-resourced compared with other councils,

The high priority gaps are in:

- **land environments** (farm systems, irrigation, nutrient modelling, soil quality, sediment generation/transport)
- **coastal environments** (wetlands and estuaries)
- **catchment modelling** (land and water quality limits setting)
- **biodiversity** (terrestrial and wetland ecosystems)
- **cultural values** (Kāi Tahu environmental indicators and monitoring).

Looking specifically at water, the reviewers found a shortage, provisionally estimated at 2-3 water quantity FTEs (1 senior, 1 scientist, 1 support), for work on practical hydrology (flow naturalisation) and hydro-ecology (minimum flows), and a shortage, provisionally estimated at 2-3 water quantity FTEs (1 senior, 1 scientist, 1 support), for work on catchment processes and limits setting.

Overall, the review recommended a doubling of the Council's scientists from 9.4 to 19.4 FTE positions, including:

9 Aquanet Consulting Ltd. (2019) *Otago Regional Council Science Capability and Capacity Review.* Presentation to the Executive Leadership Team, 20 August 2019.

- **a water quantity/hydrology team** with 6.4 scientists
- **a water quality/ecology team** with 5 scientists
- **a catchment process team** with 2 scientists (1 land, 1 modelling)
- **a biodiversity and coastal wetlands team** with 3 scientists.

The reviewers acknowledge the difficulty in finding suitably qualified staff at a time when the Essential Freshwater package is creating high nationwide demand for water and catchment expertise. They note therefore that strategic use of external consultants will be critical to the successful delivery of the Council's water resource management programme.

The reviewers also note that the deficiencies in science staffing are exacerbated by deficient staff training, a lack of development pathways and consequent staff turnover leading to loss of institutional knowledge. The impacts of lost institutional knowledge are exacerbated by a lack of robust data collection and databases to which staff can refer.

From my discussions with staff, the Council expects to take in-house ownership of the CHES hydrological flow model for the Manuherekia which is being developed by NIWA under contract. The final model will include various layers, each with differing assumptions and baselines, including a natural flows layer which will model ecological baselines in the absence of water storage and abstractions. The development of the CHES model is behind deadline due to the complexity of the Manuherekia catchment and its network of water races. However, once completed, the model is expected to be able to be adapted for the modelling of other river systems in the region.

Other parties are also contributing to the Council's scientific database on the Manuherekia. As mentioned earlier, Aukaha is undertaking cultural health monitoring and habitat modelling over the 2019-2020 summer, when the river is at its lowest flows; and the Manuherekia irrigators have made available their hydrological model, developed several years ago by Golder Associates.

The Council is aware of the capacity and capability deficiencies discussed here and has already begun advertising three new water science positions. However, without a substantial increase in in-house scientific capacity I consider that the Council will be insufficiently prepared to meet the NPS-FM Water Plan notification deadline of December 2023, and will certainly not have all the catchment data it needs to set allocation and flow limits before the expiry of the deemed permits on 1 October 2021.

Planning Policy capacity

At present, to cover all its planning and policy functions, I understand that the Council employs seven planners with varying levels of seniority and experience and also contracts the services of consultant policy planning staff with extensive water planning experience.

The water policy and planning workload between now and 2023 is beyond the resources of such a small team and will require additional experienced planning staff. From my discussions with staff and management, it would appear that the planning team will need five additional planners to meet the coming workload – three with experience in water plan writing, and two with the skills to facilitate FMU community consultations on water values.

These are challenging requirements. Experienced water resource planners are in short supply nationally and will become even harder to recruit as the Essential Freshwater package drives up demand for their services across the country. Earlier this year, the Council received only four responses when it invited tenders from experienced plan writers to assist with its draft plan change for the Manuherekia catchment. Three of the responses were from outside the region and none had particular experience in water planning.

I consider that without a significant increase in resourcing and proactive recruitment initiatives by the

Council, the necessary planning capacity will not be achieved.

Consenting capacity

The Council's consenting capacity and processes were reviewed earlier this year in an independent report[10] commissioned by the Council's chief executive. Among the report's findings was that there has been an upswing in consent applications in the past two years, with annual numbers now exceeding those of the previous peak year of 2012.

The reviewers concluded that this trend is almost certain to continue as new planning requirements under the NPS-FM come into effect and the deemed permits approach their expiry date. They considered that the Council's consenting and science capacity was insufficient to deal with the increase. They observed that:

> First, there does not appear to be much internal expertise in respect of processing of applications relating to water quality (farming land use consents/diffuse discharge consents). Secondly, there is a potential gap with respect to the processing of replacement consents for the deemed permits.

The reviewers recommended that the Council appoint two additional consent officers and that it dedicate part of one senior level job description to regularly projecting and planning for future consent application volumes.

The Council's response to this recommendation has been to advertise for additional consenting staff and to develop a programme of continually updated projections of consent volume. The Council's consenting managers are confident that they will have sufficient capacity to deal with the influx of replacement resource consent applications. As a back-up resource, in the event of staff overload, they have contracted Mitchel Daysh Ltd to process the more complex consent work.

I am satisfied that the Council is taking on board the recommendations of the independent report and improving its consenting capacity and processes.

Compliance, monitoring and incident response capacity

According to Council management, the compliance team does not have the capacity to deal with the additional workload that will arise when the regional water quality rules of Plan Change 6A (PC6A) become operative. For this, the monitoring team will need to be doubled from the current five staff to 10.

As noted earlier the PC6A rules were decided back in 2013 with a deferred implementation date of April 2020. However, they are now recognised as deficient so the Council is proposing to further defer implementation until April 2026 while it makes the necessary interim corrections through an omnibus Water Plan change early next year.

I understand that the Council also needs dedicated incident response officers to deal with the increasing number of incidents (almost 1,200 per year – or 24 per week) which are currently diverting compliance officers away from their core roles.

Accommodation capacity

An additional constraint on the Council's staffing capacity which ought to be acknowledged is the physical inability of the current offices in Dunedin to house additional staff on the scale discussed

[10] Maw P, Daysh S. 2019. *Consents Function Review*. A report prepared for the Otago Regional Council by Wynn Williams and Mitchel Daysh Limited.

here. If staff capacity-building is not to be delayed or compromised, temporary office premises for some staff may need to be considered in the short to medium term.

Kāi Tahu perspectives

Kāi Tahu expects a partnership relationship with the Council and to share in the policy-making process on resource management matters. Although the iwi has a positive relationship with ORC, it considers that, to date, it's environmental and relationship aspirations have not been met by the Council. In the past, it was treated less as a partner and more as a stakeholder, interested party, applicant, submitter or appellant, depending on the issue. When treated as one party among many, in groups such as the Manuherekia Technical Advisory Group (TAG), Kāi Tahu's voice and values are inevitably diminished.

However, this may be changing. ORC Chief Executive, Sarah Gardner, supports a partnership role for Kāi Tahu and the Council recently made two seats available for them at the Policy Committee (a Committee of the whole Council), enabling them to participate in the setting of FMU and rohe (sub-FMUs) boundaries. Kāi Tahu played a key role in ensuring that the boundary of the Mata-Au FMU encompasses the entire Clutha catchment from the mountains to the sea.

Kāi Tahu employs a stand-alone commercial consultancy, Aukaha, to advocate for its environmental and cultural aspirations in resource management, to facilitate consultation with Kāi Tahu Papatipu Rūnanga, and to support Māori hauora (health) and wellbeing. Aukaha has protocols with the ORC Council and all district councils in Otago setting out the process for facilitating Kāi Tahu engagement in the Council's resource consent and plan change processes. [11]

My discussions for this investigation were with Aukaha's Chair, staff and advisors at their offices in Stuart Street, Dunedin.

ORC's current planning framework

Aukaha has concerns about the adequacy of the current water planning framework from an RMA and NPS-FM standpoint. It does not see the Water Plan and its associated consenting practices as providing adequate direction or protection. Major concerns include:

- piecemeal processing of resource consents with no assessment of cumulative effects
- inadequate provision for ecological and cultural values, including:
    - the lack of a natural ecological baseline for water flows when determining the "existing environment" and
    - the acceptance of consent applications for water use that do not address ecological values, fish habitat and species distribution
- the "use it or lose it" policy which has incentivised permit holders to ramp up their metered water use in order to create a false history of inflated use when applying for new consents
- the "efficiency gains" policy which, instead of saving river water, perversely incentivises greater use of it, leading to more intensive farming and greater economic dependence on irrigation.

Aukaha considers that the "use it or lose it" policy has encouraged permit holders to "game the

[11] Aukaha, formerly known as Kāi Tahu ki Otago Ltd (KTKO Ltd), was established in 1997 to represent Kāi Tahu in RMA consent matters. It is wholly owned by the four Papatipu Rūnanga of Otago - Te Rūnanga o Moeraki, Kāti Huirapa Rūnaka ki Puketeraki, Te Rūnanga o Ōtākou, and Hokonui Rūnanga (ngā Rūnanga/Rūnaka).

system" in preparation for the replacement of their deemed permits. Knowing that their excessive "paper" allocation will be replaced by one based on historic water use, rather than on "what the river needs", the permit holders' natural response has been to maximise their historic use.

Similarly, Aukaha sees the plan's "efficiency gains" policy as also encouraging greater water use. Instead of encouraging farmers to use less water for their existing activities, it encourages them to expand their activities with more efficient use of their water takes. This is because to pay for the expensive spray irrigation systems, such as centre pivots, which replace flood or border dyke irrigation, farmers must use more intensive farming practices and irrigate previously dry paddocks.

ORC's performance of functions

In Aukaha's view, the Council has yet to develop adequate planning and consenting processes for the management of freshwater use, despite discussing this and the deemed permit issue with Kāi Tahu since the early 1990's. Aukaha considers that since 2004, the ORC's consenting practices have been deficient in failing to publicly notify consent applications with "more than minor" effects and granting RMA water permits for unreasonable durations of 25-35 years.

Aukaha also noted that ORC has managed water and natural resources in general under the paradigm of Otago exceptionalism, expressed as "we are different" with no place for central government interference. One result has been a failure to acknowledge over-allocation as an issue.

Manuherekia, Upper Cardrona, and the Arrow (MAC) catchments

Aukaha does not consider the Water Plan fit for purpose for the assessment of applications for replacement water consents once the deemed permits expire. It opposed the withdrawal of the 2018 MAC plan change only because, despite the data inadequacies, this plan was a step in the right direction after such a long period of inaction. However, Aukaha is now undertaking work in the catchment to contribute to the information base for a revised MAC plan change.

Aukaha is sceptical of the CHES model, having serious doubts about the data quality and data gaps, and the assumptions of the model itself. There is some concern that the Council's adoption of the CHES model as the basis for setting flow and allocation limits is a foregone conclusion, despite it still having not been independently assessed or approved by the Technical Advisory Group (TAG).

Aukaha also noted that many other catchments with deemed permits, not covered by the MAC plan change, will remain problematic for the Council to resolve by the expiry date of 1 October 2021.

Council capacity

Aukaha considers that the council is struggling to meet its RMA responsibilities and is not adequately resourced for the scientific and planning challenges of giving effect to the NPS-FM by 2025, or of addressing deemed permits by 1 October 2021. The Chairman of Aukaha, Edward Ellison, expressed the following in a recent letter:

> We believe it is critical, given the state of planning instruments in the region and the pending influx of deemed permit replacement applications, that decisions get made in the right order. Statutory changes and national direction, including the newest proposals, will determine the form and content of a revised Regional Policy Statement, which in turn will direct amendments to the relevant regional plans, enabling decisions on deemed permits to be made within a framework that is appropriately future focussed.
>
> We need to be able to see that pathway clearly, which has been a significant difficulty over the last year as we have discussed. Knowing the timeframes around each statutory process will enable us to plan and constructively resource our responses, working with

our local authority partner. We are mindful that momentum must be maintained and that concluding all processes in an efficient and timely manner is a priority.

Fundamental to making decisions in the right order is to ensure that deemed permit replacement applications are decided after all other processes have been completed. We understand that this would necessarily involve introduction of a legal mechanism that addresses the pending 2021 deadline for replacement resource consents. We need to know that deemed permit replacement decisions will be effectively "on hold" awaiting establishment of a robust decision-making framework.[12]

State of the Environment

Aukaha has raised serious concern about the state of the threatened galaxiid species in Otago rivers. It is the position of Aukaha that the starting point for establishing a minimum flow and allocation regime should be based on naturalised baseline flows which reflect the river's original state, rather than modified baseline flows which understate the impacts of water use on natural values.

Aukaha will conduct cultural health monitoring and habitat modelling over the summer (2019/2020) in the Manuherekia Catchment. This information will be used to inform the Councils' flow modelling.

Stakeholder perspectives

The stakeholders spoken to addressed a wide range of perspectives and insights. This summary does not reflect the views of any one stakeholder in particular, unless stated otherwise, but conveys my impression of the variety of views around the particular questions posed in the Terms of Reference for this investigation.

Adequacy of the current planning framework from an RMA and NPS-FM standpoint

All stakeholders who expressed a view on the planning framework acknowledged that it does not yet give effect to the NPS-FM and will need further plan changes to achieve this. However, they differed in their views on whether the framework, as it currently stands, is adequate for assessing RMA water and discharge consents.

The Federated Farmers and the Otago Water Resource Users Group (OWRUG) consider the current plan to be generally adequate for replacing water consents and deemed permits, provided it is implemented properly by knowledgeable staff. They expressed the view that implementation is being undermined by staff turnover which has resulted in a loss of in-house knowledge and, in their view, misinterpretation and misapplication of some plan provisions.

The Department of Conservation, NZ Fish and Game, and the Central Otago Environmental Society (COES) considered the planning framework to be inadequate from an RMA perspective. They contend that the current framework does not give due consideration to all of the matters required by the RMA, particularly as it does not yet have catchment-level minimum flow and allocation limits in a number of over-allocated catchments.

Fish and Game also noted that the purpose of residual flows in the Water Plan (Policy 6.4.7) is overly restrictive in its focus on 'aquatic ecosystems and natural character' while ignoring amenity and cultural values.

These stakeholders also shared the view that the plan's efficiency provisions were encouraging

[12] Reference: Edward Ellison, Chairman – Aukaha to Peter Skelton, 19 September 2019.

increased use of irrigation water and driving environmentally undesirable land use intensification.

They were of the view that new, or forthcoming (replacement) water consent applications should be put on hold while these issues are addressed through necessary plan changes.

An unaffiliated local landowner, Mr William Cockerill, informed me that over the last 30 years there has been significant change in land and water use in the Manuherekia catchment. He has observed the attrition of the Central Otago dryland landscape as a consequence of irrigation enabled by deemed permits. As an example of the change in water use, the historic Black's Station at Ophir had a gold dredging operation which held 10 heads of water under a mining privilege.[13] This privilege was divided between two brothers - one ended up inheriting four heads of water and the other obtaining the remaining six heads. As a sheep farm, one of the four heads was used for watering stock, with this later increasing to about two heads. However, when the farm was sold for a dairy farm 10 years ago, it was sold with the value of the property having the original four heads. The dairy farm now uses much of the four heads of water for irrigation. Mr Cockerill's view is that the effect has been a significant change in land use enabled by irrigation under deemed permits during the transitional period.

The Council's performance regarding planning for discharges of contaminants to land and water, and taking, using, damming or diverting water

All stakeholders who expressed a view on the Council's performance of their statutory functions under the RMA, considered it to be under-performing with respect to water management.

A common concern was that, in recent years, the Council has withdrawn from community and stakeholder engagement on water use, showing a lack of leadership or guidance. Now it is attempting to recover lost ground, but against challenging timeframes and national requirements and still with no clear sense of what it is seeking to achieve.

COES and Fish & Game saw the various consultation groups set up by the Council as being focused primarily on irrigator needs with community and environmental input either ignored or minimised.

They also raised concern about consents with 'more than minor' effects being processed by the Council on a non-notified basis. These stakeholders felt the Council was reluctant to consider environmental groups as affected parties, and failed to adequately consider instream values, such as amenity, recreational, and cultural (Kāi Tahu) values of waterbodies.

The environmental stakeholders also criticised the Water Plan's efficiency criterion which has encouraged farmers to convert to spray irrigation often taking on considerable debt to do so, and intensifying both water and land use, with potential adverse effects in the catchment.

They also shared similar concerns about the Council's "use it or lose it" policy, which COES characterised as having triggered a "rush to ruin" by creating an incentive to use more water in order to prove historical usage for consent replacements. An example was given of one property in Chatto's Creek being water-logged by deliberate spilling of water by adjacent irrigator properties over 3 sets of 14 days in autumn (42 days in all).

[13] One 'head' equates to one cubic foot of water per second or approximately 100 cubic metres per hour.

Whether the planning framework in the Manuherekia, Arrow and Cardrona catchments will be appropriate and sufficient to consider applications for new water permits once deemed permits expire

Federated Farmers, the Otago Water Resource Users Group (OWRUG) and some irrigators from the Manuherekia considered the planning framework appropriate and sufficient to consider new applications, but the other stakeholders did not.

Understandably, the Manuherekia Water Users Group and other deemed permit holders are looking for certainty about the process to transition from deemed permits to replacement resource consents. A number of irrigators were not supportive of any extension of the deemed permit deadline, citing the uncertainty of time delays as a factor in the reluctance of banks to finance irrigation development.

Contrasting views were expressed by other stakeholders on how to define the starting point for setting flow limits and for assessing environmental effects. These views related to the baseline for hydrological modelling when determining a minimum flow and allocation regime to establish ecological flows.

Water users expressed a view that the starting point should be the river in its existing state (ie, subject to damming and current levels of abstraction). Other stakeholders, including DOC, Fish and Game, and COES, shared Aukaha's view that the starting point should be the river in its natural state without damming and abstraction. The Council's Water Plan should use that as the baseline for setting a minimum flow and allocation regime, based on robust modelling.

These stakeholders also criticised the Council's lack of a method to determine historic usage, the assessment of effects at the point of take rather than the whole river, and its inadequate assessment of cumulative effects.

On the withdrawal of the MAC plan change in 2018, all stakeholders agreed that the evidence base for the proposed allocation and flow limits was scientifically flawed. However, COES felt that the plan change should have gone ahead anyway on the basis that it would at least improve on the current situation. The irrigators supported the withdrawal of the proposed plan change.

The adequacy of Council resources, including its capacity to develop and implement an adequate planning framework that gives effect to the NPS-FM

All stakeholders had a similar view that the Council has not invested adequately in its science, technical, planning, and consenting capabilities. As a consequence, the Council lacks robust scientific models and data to set minimum flow and allocation limits, and also sufficient planning and consenting staff to develop the necessary plan changes and implement them.

Findings and recommendations

This report focuses on the issues for freshwater planning and the particular challenges posed by Otago's deemed permits. Although its findings and recommendations are directed towards the ORC, some will also have relevance more broadly for freshwater planning across New Zealand.

Findings - catchment planning, science and deemed permits

- The Council's existing water planning framework has suffered from a lack of investment in science, planning, and hydrological modelling.
- There is a lack of clear and robust minimum flows and a failure to address over-allocation.
- The existence of the deemed permits has also limited the ability of the Water Plan to manage water quality and quantity.[14]
- There is large variation in the planning frameworks for the region's catchments to deal with the expiry of deemed permits.
- Only the Pomahaka catchment is underway for transition to an RMA consenting process with an established primary allocation limit, minimum flows for primary allocation, supplementary allocation blocks, and minimum flows for supplementary allocations. This catchment, however, has only three deemed permits. Progress is also being made on the Arrow and Cardrona catchments which have started a planning process to set minimum flows and allocations
- Most other catchments are not so prepared. A minimum flow and allocation regime was proposed for the Lindis catchment some five years ago but has yet to be decided on by the Environment Court.
- A minimum flow and allocation regime for the Manuherekia catchment is still about two years away and even further is the Taieri catchment where hydrological modelling has yet to be started. The status of the Taieri catchment is significant since it includes the highest number of deemed permits (75).
- Due to the under investment in science and planning, I do not consider that the ORC is in a position to provide for the smooth transition from water allocation based on mining privileges to allocation based on RMA consents which are subject to appropriate flow and allocation limits before 1 October 2021. This is a major concern since we are now in 2019 – 'Year 28' of the 30 year transition period for the deemed permits.

National Direction and Legislation

- National direction under the RMA is due to be strengthened. While this investigation was underway, the Government unveiled a range of new initiatives.[15]
- While most of these proposals are 'draft' and have been released for consultation, the

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[14]As stated in Policy 6.2.8 of the Water Plan, 'opportunities for establishing minimum flow regimes on a number of streams and rivers are constrained by mining privileges (now called deemed permits)'.

[15] Proposed National Policy Statement for Freshwater Management and proposed new National Environmental Standards for Freshwater; new freshwater planning process under the Resource Management Amendment Bill 2019; proposed National Policy Statement on Urban Development to replace the existing National Policy Statement on Urban Development Capacity; proposed National Policy Statement for Highly Productive Land. The Government is also planning to release a proposed National Policy Statement for Indigenous Biodiversity later in 2019.

combined impact of the proposed national direction and potential legislative changes will have a fundamental impact on the future planning framework in Otago.

- The Council will need to make a substantial investment to update the RPS and the Water Plan to provide for existing and proposed national direction and legislative changes.
- The RPS will need to adopt the National Planning Standards three years from when the planning standards come into effect (3 May 2022), or at notification of a proposed RPS, whichever is sooner.
- The RPS will require amendments to identify areas of highly productive land within the Otago region under Proposed Policy 1, National Policy Statement for Highly Productive Land. Strengthened urban development provisions are also likely to be required.
- A reviewed Water Plan will need to be notified by 31 December 2023 to give effect to the NPS-FM. This will also be required to be restructured into the National Planning Standards template.
- The forthcoming freshwater planning process, currently proposed under the Resource Management Amendment Bill, will make a significant contribution to RMA practice in New Zealand and will become a primary vehicle to give effect to the NPS-FM.
- I am hopeful that legislation to implement the new freshwater planning process will be enacted by mid-2020 in time to progress the urgently required Otago planning programme. This will be of critical importance.
- One particular matter that will require attention in the design of the freshwater planning process is how the RPS will be progressed as a whole. Under section 59 of the RMA, the RPS must be designed to achieve 'integrated management of the natural and physical resources of the whole region.' This purpose is supported by the National Planning Standards requirements. If only the freshwater-related changes to the RPS are to be 'carved out' and sent to the freshwater planning process, then this could potentially undermine the integrated management structure of the RPS. It seems to me the scope of how the RPS and other combined RMA planning documents are treated in the Resource Management Amendment Bill under the freshwater planning process needs to be reconsidered in order to ensure integrated management.

Future planning framework

A new planning framework is required for Otago. This framework, amongst other things, needs to provide a robust process for assessing any applications that are made to replace the deemed permits and set plan provisions, as guided by national direction, especially the NPS-FM.

In the Otago context, it is also important that consent applications are processed on the basis of a more adequate and robust planning framework that involves a minimum flow and allocation regime. This has relevance to both deemed permits and existing resource consents that are due to expire before the new planning framework is in place.

Importantly, the establishment of plan provisions for minimum flows and allocation must come before the processing of resource consents to replace the deemed permits. This is a critical matter.

Further, all the deemed permits within a sub-catchment should be considered together as a 'block'. Ad-hoc or individual processing of consents in advance of a robust policy and rule framework should be avoided.

Ideally, the planning framework will:

- provide certainty for the community with clear timeframes and processes

- avoid undue delay and duplication of planning effort and multiple community consultations
- establish minimum flows and limit setting based on robust science and hydrological modelling, including fair allocation within ecological limits
- ensure implementation of the NPS-FM and other national direction
- provide for the principles of the Treaty of Waitangi and the interests of Kāi Tahu in resource management.

After my discussions with a number of holders of deemed permits, I am confident that, provided they are given certainty of direction, there is sufficient good will among them to participate in the planning programme recommended in this report.

In the light of discussions I have had with the consenting staff at ORC it is my understanding that any water consents granted from now, whether new or replacement consents, will be granted for a short-term of 5 to 10 years. This is to ensure that, in the longer term, resource consents will be aligned with the new planning framework. The intent will be to avoid 'locking in' long term water resource use that will make it difficult to achieve new freshwater limits and allocation when set in the reviewed land and water regional plan.

Short-term interim planning initiatives

Before making my formal recommendations to the Minister, I need to refer again to some planning work that is already underway in the form of two plan changes. I have referred to this briefly earlier in this report. The first is Plan Change 6AA to be notified in October 2019 to amend the starting date for discharge provisions affecting water quality in the region that are due to take effect from 1 April 2020.

Because the discharge provisions are defective and, in particular, because they rely on an Overseer version that no longer exists, the Council is proposing to extend the date when these provisions take effect to April 2026 by Plan Change 6AA. I understand that this date is likely to become academic, because the present defective rules in plan 6A will be replaced by new rules in the omnibus plan change which is anticipated to be notified in March 2020. Plan Change 6AA is necessary now because the water quality rules due to come into effect on 1 April 2020 are recognised to be defective.

The second plan change known as the 'omnibus plan change' is due to be notified in March 2020. My current understanding of the contents of this plan change is that it is intended to immediately remedy the deficiencies in the water management provisions of the current operative plan, in particular those relating to water quality, and provide for interim provisions relating to the management of freshwater resource consent applications.

In addition to the above, the ORC is developing a planning programme going forward that I have discussed with staff and which I will now summarise.

Future comprehensive framework

By November 2020 ORC intends to publicly notify a complete review of its current Regional Policy Statement, first to give effect to the National Planning Standards and secondly to provide, amongst other things, objectives and policies for water management across the region ahead of a review of its Water Plan. The intention is to have this reviewed RPS operative before the reviewed Water Plan is notified.

By 31 December 2023, ORC intends to notify a complete review of its Water Plan to provide for a new Land and Water Regional Plan for Otago. This plan is to include region-wide objectives, strategic policies, region-wide activity policies, and provisions for each of the FMU sections that will cover all the catchments within the region.

Given this timeframe, which I note is a tight one, it is clear that the new plan will not be ready in time to deal with applications for new and replacement consents arising from the expiry of the deemed permits. The result will be that these consent applications are assessed under the Water Plan's current default minimum flow limits which, as noted earlier, are inadequate.

Possible extension of Otago deemed permits expiry

I consider that the only way to ensure that new and replacement consent applications will be assessed under the new planning framework is to defer the expiry date for deemed permits in Otago to a period when it can reasonably be expected that the new land and water plan will be in place. In my view extending the expiry date is justified on several grounds:

- first, it will enable the new planning framework to be put in place beforehand so that future resource consent applications can be properly assessed.
- secondly, it will ensure that all new and replacement water permits are subject to catchment level minimum flow and allocation limits
- thirdly, subjecting all consent applications to the new plan will avoid "planning by resource consent" in which ad-hoc resource consent decisions are made in the context of an inadequate planning regime
- fourthly, extending the deemed permits in conjunction with the interim measures and a revised planning framework will provide certainty for Kāi Tahu, permit holders, and stakeholders about the planning pathway going forward.

I also note that time is required for investment in the science that underpins the planning and this is needed to properly inform the plan rules and the assessment of future resource consent applications for freshwater.

Further, I gathered from my discussions that an extension is likely to be supported by the Council, Aukaha and at least several of the stakeholders who also see merit in having consent applications assessed under a fit for purpose planning framework.

I also note that this proposed extension would apply only to the Otago region and so is of limited interest or application in a national sense.

Recommendations

In the light of the above comments and earlier discussions in this report I now make the following recommendations to the Minister for the Environment:

1. that pursuant to section 24A of the RMA, the Minister recommends to the Otago Regional Council that it provide an adequate interim planning and consenting framework without delay to manage freshwater in the intervening period up to 2025. This will include Plan Change 6AA and the Omnibus Plan Change
2. that pursuant to section 24A of the RMA, the Minister recommends to the Otago Regional Council that it takes all necessary steps to develop a fit for purpose freshwater management planning regime that gives effect to the relevant national instruments and sets a coherent framework for assessing all water consent applications including those that are made to replace any deemed permits
3. that pursuant to section 24A of the RMA, in order to achieve recommendation 2, the Minister recommends to the Otago Regional Council that it adopts the following policy and planning programme of work:

    - by November 2020 a complete review of the current Regional Policy Statement is publicly notified with the intention that it be made operative before the review of its Water Plan is notified
    - by 31 December 2023 a new land and water regional plan for Otago is publicly notified. This plan is to include region-wide objectives, strategic policies, region-wide activity policies, and provisions for each of the FMU sections that will cover all the catchments within the region

4. that pursuant to section 27 of the RMA, the Minister requires the Otago Regional Council to provide 6-monthly progress reports in relation to the following matters:

    - progress made in developing science, planning, consenting, monitoring and enforcement, and land management organisational capability and capacity
    - progress in achieving recommendations 1, 2 and 3
    - a summary of freshwater resource consenting activity for the reporting period

5. that the Minister initiates the necessary legislative process to change the date for expiry of the deemed permits in section 413(3) of the RMA, from 1 October 2021 to 31 December 2025, being the date by which the Otago Regional Council's new land and water regional plan is to be operative. For the avoidance of doubt this recommendation to amend section 413(3) of the RMA applies only to the Otago region

6. that if the new freshwater planning legislative process is delayed for any reason, consideration be given to promoting special legislation for the Otago region to establish a special hearing process to achieve completion of the Otago Regional Policy Statement by 2022 and the new land and water regional plan by 2025. This special legislation would need to provide for the hybrid hearings panel model and restricted appeals to the Environment Court.

Dated at Christchurch this 1st day of October 2019

P R Skelton

Honorary Professor Peter Skelton CNZM; D.Nat.Res (Hon); LLB; FEIANZ

Appendix 1

Letter of Engagement

Hon David Parker BCom, LLB

Attorney-General
Minister for Economic Development
Minister for the Environment
Minister for Trade and Export Growth

Associate Minister of Finance

16 May 2019

19-M-00702

Honorary Professor Peter Skelton

skeltonp@xtra.co.nz

Dear Peter

Resource Management Act 1991, section 24A investigation, Otago Regional Council

In accordance with 24A of the Resource Management Act 1991 (RMA), I am appointing you to investigate whether the Council is on track to adequately perform its functions under section 30(1) of the Act, in relation to freshwater management and allocation of resources.

The investigation will focus on whether Council has, or will have, an appropriate planning framework in place that gives effect to the National Policy Statement on Freshwater Management, in time to consider all applications for new water permits before deemed permits expire. It will also look at what support Council might need to achieve this.

The scope and timing of the investigation is outlined in the attached Terms of Reference.

Robert McClean, Manager, RMA Practice, will be in contact with you to provide information on the investigation process. If you have any questions about this investigation before then, please contact Robert on 0220676655 or Robert.McClean@mfe.govt.nz.

Your appointment will be subject to any necessary procurement, contracting and remuneration processes as required by the Ministry for the Environment.

Yours sincerely

Hon David Parker

Minister for the Environment

Appendix 2

Letter of extension

Hon David Parker BCom, LLB

Attorney-General
Minister for the Environment
Minister for Trade and Export Growth

Associate Minister of Finance

02 SEP 2019

19-M-01732

Honorary Professor Peter Skelton
skeltonp@xtra.co.nz

Dear Honorary Professor Peter Skelton

Resource Management Act 1991, section 24A investigation, Otago Regional Council

Thank you for your letter dated 20 August 2019 requesting an extension of the final report back date for this investigation to 1 October 2019.

I am pleased that the investigation is making good progress and I understand the complexity of the matters that the subject of your inquiry. I agree with you about the importance of the forthcoming decisions of the Environment Court relating to the Lindis catchment, which involve both water limits and allocation (including the deemed permits).

I also agree on the need to ensure that your report provides direction on the development of a new freshwater planning framework for Otago that aligns with the current initiatives to be outlined in the forthcoming discussion document on freshwater policy.

For the reasons outlined above, I agree to extend the final report back date to 1 October 2019. I have attached the revised Terms of Reference to this letter.

Yours sincerely

Hon David Parker
Minister for the Environment

Appendix 3

Terms of Reference for Section 24A Investigation of Otago Regional Council Performance under the Resource Management Act 1991

Purpose of Investigation

1. The purpose of this investigation is to identify whether the Otago Regional Council (ORC or the Council) are adequately carrying out their functions under section 30(1) of the Resource Management Act 1991 (RMA) in relation to freshwater management and allocation of resources.
2. This investigation is focused on the exercise of the Council function in relation to its planning framework, and its ability to process and transition deemed permits in a consistent way under the RMA and National Policy Statement for Freshwater Management (NPS-FM). This matter relates particularly to the Manuherekia, Upper Cardrona and Arrow rivers before the deemed permits expire in 2021.

Context

3. When the Resource Management Act 1991 (RMA) was enacted mining privileges granted or authorised under the Water and Soil Conservation Amendment Act 1971, and the Water and Soil Conservation Act 1967, were deemed to be water permits, discharge permits or a permit that confers on its owner rights over land in respect of which the holder is not the owner. These permits expire on the 30th anniversary of the date of commencement of the Act (this will be 1 October 2021).
4. Around 300 deemed permits remain in the Otago region. A significant number of the permits that have not yet been transitioned to standard resource consents are in the catchment areas of the Manuherekia, Upper Cardrona, and Arrow rivers.
5. In 2018, the ORC intended to notify a significant plan change to set minimum flow rates for the Arrow, Cardrona and Manuherekia catchments. This proposed plan change was halted and the Council is now planning to prepare a comprehensive minimum flows and allocation plan change in December 2025.
6. In August and December 2018, the Minister for the Environment (the Minister) wrote to ORC expressing concerns about the decision not to proceed with the plan change and met with ORC to discuss this on 22 March 2019. The Minister also noted an expectation that the ORC establish a framework that provides for a plan change to set minimum flows, ahead of the deemed permit expiry.
7. To date, no plan change has been notified. Until this occurs all applications to replace deemed permits will be considered under the current operative plan which does not contain minimum flow rates or other specific limits.
8. As the timeframe from notification to decisions on an RMA plan is 2 years, there is an increasing likelihood that the large volume of applications to replace the deemed permits will occur under the existing operative plan.
9. The Minister requires an understanding of the ability of ORC to carry out their functions

under section 30(1) of the RMA in relation to freshwater management and allocation of resources. In particular, the adequacy of the current planning framework and the capability of the ORC to process and make decisions on consents in a manner consistent with the obligations on the Council to set minimum water flows and allocation limits in their regional plan (as required by the National Policy Statement for Freshwater Management 2014 (NPS-FM)) .

Scope of the Investigation

10. The investigation will address the following:
    1. adequacy of the current planning framework from a RMA and NPS-FM standpoint;
    2. adequacy of the performance by ORC of functions relating to planning for discharges of contaminants to land and water, and taking, using, damming or diverting water. This will focus particularly on the Manuherekia, the Upper Cardrona and Arrow Rivers, and whether the planning framework will be appropriate and sufficient in time to consider applications for new water permits once deemed permits expire;
    3. adequacy of ORC resources, including its capacity to develop and implement an adequate planning framework that gives effect to the NPS-FM;
    4. Treaty partners and stakeholder perspectives; and
    5. any other relevant contextual matters.

Methodology

11. The investigator will:
    1. spend the time needed with ORC to inform Councillors of the investigation and then undertake discussions with council staff with a focus on Senior Leadership, Planning Policy Manager, relevant Policy Planners, and technical staff;
    2. the discussions with the ORC will be based around a set of investigation questions, prepared by the investigator. These questions will be pre-circulated to the ORC and the interested parties consulted;
    3. undertake any additional research and analysis to the discussions required to complete the investigation;
    4. seek the views of Ngāi Tahu as tangata whenua;
    5. seek the views of the Department of Conservation, Federated Farmers (Otago Division), Otago Fish and Game Council, and any other stakeholders the investigator deems necessary;
    6. complete a draft findings report, including recommendations for the Minister for the Environment on the options for addressing any issues identified in the investigation; and
    7. finalise and present a copy of the report to the Minister for the Environment.

Term of investigation

12. The investigation must begin no later than 1 July 2019 and be completed by 1 October 2019.
13. The Investigator must report back to the Minister with their final opinion by 1 October 2019.

Costs

14. The cost of the salary of the investigator will be covered by the Ministry for the Environment.

Appendix 4

The list of interviewees

Organisation	Interviewee	Position
Otago Regional Council	Sarah Gardner Andrew Newman Peter Constantine Peter Winder Julie Everett-Hincks Joanna Gilroy Anita Dawes Sylvie Leduc Tom de Pelsemaeker Peter Ravenscroft	Chief Executive Acting GM Policy, Science & Strategy Planning Consultant Acting General Manager Regulatory Science Manager Consenting Manager Acting Manager Policy Senior Policy Analyst Senior Planner Environmental Resource Scientist – Freshwater
Central Otago District Council	Tim Cadogan	Mayor
Waitaki District Council	Gary Kircher	Mayor (telephone discussion)
Aukaha, Kāi Tahu	Edward Ellison Phillip Broughton Maria Bartlett Gail Tipa Kathryn Gale	Chair Rūnaka Executive Member Planner Consultant Kairangahau Māori Freshwater Researcher
Central Otago Winegrowers	Nick Paulin	President
Manuherekia Catchment Water Strategy Group	Allan Kane	Former Chair
Upper Clutha Water Group	Mandy Bell	Chair
Local irrigators	Gary Kelliher Matt Hickey Geoff Crutchley	Acting Chair, Manuherekia River Ltd (MRL) Scientific consultant Chair, Maniototo Irrigation Company

Appendix 4

The list of interviewees - continued

Organisation	Interviewee	Position
Federated Farmers	Simon Davies Andrew Patterson Sally Dicey Kim Rielly	Otago chair High Country chair Consultant Resource Management Planner Regional Policy Manager, South Island
Otago Water Resource Users Group (OWRUG)	Ken Gillespie Chris Hansen Tony Strain Susie McKeague Graeme Martin	Chair, OWRUG & Chair, Hawkdun/Idaburn Irrigation Co. Chair, Arrow Irrigation Co. Arrow Irrigation Co. Consultant for MAC catchments Adviser
Otago Fish & Game	Niall Watson Monty Wright Nigel Paragreen Ian Hadland Colin Weatherall	Former CEO Chair Environmental Officer CEO Councillor
DOC	Marie Long Neil Deans John Roberts	Director, RMA planning & regulatory Policy - freshwater liaison South Island Manager
Irrigation NZ	Elizabeth Soal	CEO
Central Otago Environmental Society	Ray Wright Evelyn Skinner Graye Shattky Matthew Sole	Acting Chair
Individuals	William Cockerill	

Appendix 5

History of regulation – the Otago mining privileges

Authored by Robert McClean, Ministry for the Environment

Early gold mining legislation

Early gold mining legislation established and maintained a miner's right to use water. This right is often called a 'mining license' or 'mining privilege'. Under the RMA, the water right is called a deemed permit.

The earliest gold mining legislation dates from 1858 and was drafted in response to the discovery of gold in Nelson. The Gold Fields Act 1858[16] provided the power to grant leases for mining. This included the use of water.[17] Under section 7 of that Act, it was stated:

> It shall be lawful for the Governor in Council to demise to any person, for any term not exceeding fifteen years from the making of the Lease, any auriferous Crown Land for mining purposes, and also to grant water rights and other easements for such purposes, and to fix the amount to be paid by way of Rent or Royalty for the same respectively.

This provision set the basis for the granting of mining leases (later called privileges) by the Crown.

After the discovery of gold in Otago in 1861, a new Gold Fields Act was established in 1862 along with regulations for the administration of the Otago gold fields. The key sections of the Otago gold fields regulations relating to water are set out at the end of Appendix 5. The regulations prescribed:

- authorisation by a Court Warden for the construction of any water race
- the priority system based on 'superiority of right' determined by priority of occupation. This became connected to the date and time of a certificate or authority granted by a Warden
- the owner of a superior right could regulate less-superior rights during periods of insufficient water supply
- the Warden could regulate water supply during periods of low flow, provided that the allocation did not affect the superior right holder
- sluice heads (or 40 inches of water) are to be measured by the use of a gauged water box with dimensions of 12 feet long, 10 inches deep, and 20 inches wide
- the number of sluice heads allowed was established as one sluice head for 1 or 2 miners, two sluice-heads for 4 or additional miners; and so on at the rate of one sluice head to every additional two miners
- the holders of water rights were not allowed any water to run to waste; but such water was to be appropriated to the use of the next holder of a right, according to the date of their respective registrations
- two sluice heads of water were, if required, allowed to flow in the natural course of a creek or river for general use at all times.

This approach to regulating water use on the goldfields was codified in law in the Gold Fields Act 1866.

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16 Gold Fields Act 1858: http://nzlii.org/nz/legis/hist_act/gfa185821a22v1858n74240/.

17 V.B. Gray, *An Examination of the Administrative System on the Otago Goldfields 1861-8*, MA Thesis, 1949.

This Act defined a 'sluice head' as equalling '40 inches of flowing water' and crystallised the nature of a miner's right whereby the Warden of the Court could authorise the construction of water races. One 'head' equates to one cubic foot of water per second or approximately 100 cubic metres per hour.

The Act also provided that 2 sluice heads of water be allowed to flow in the natural course of the stream 'if required' for general use. The Gold Fields Act 1866 also attempted to tackle the issue of miners' rights and land ownership and provided that the right to mine and use water was preserved even if the land was sold. It also allowed for the use of water (as part of a miner's right) to be sold.

Gold mining legislation after 1866 maintained the miners' rights system to water.[18] Annual renewal provisions were introduced and after 1882 owners of mining privileges had to reapply to the Court Warden for a fresh licence, but without the loss of priority.

Shift from mining to farm irrigation

With the decline in mining in the later 19th century, water races became adapted for farm irrigation over large areas of Central Otago. This purpose was recognised in mining legislation from 1877 onwards which provided that water could be taken for irrigation, mill and industrial uses (in addition to water for gold mining). Permission could also be obtained to change the purpose of the water take from mining to irrigation or industrial uses. These provisions were supported by the Public Works Act 1876 which empowered the Government to supply water for gold fields.

Importantly, the Public Works Act 1876 (and subsequent public works laws) provided the Crown with the power to make dams and water races without any established water limit or renewal – the rights were perpetual.

In contrast, mining legislation contained limitations on licence terms for private gold miners and farm irrigators. In particular, the 1891 Mining Act stated that the Warden could not grant a licence for more than 15 years. It set out the priority of rights system which held that it was determined by the date of application for the water race licence (section 105(12)). The Mining Register was to note the day and time of the application.

The Mining Act 1891 reduced the amount of water that was to remain in the natural water course from 2 sluice heads of water to 1 sluice head (section 105(19)). This legislation continued to recognise that every interest in a water race was deemed to be a chattel interest.

In 1898, the legislation was amended to include a provision that the water supply of any city or town was not to be polluted.

The Mining Act of 1926 extended the quantity of water allowed to 10 heads, which could not be granted for more than 42 years.

Management under the Water and Soil Conservation Act 1967

Mining privileges effectively remained unaltered until the Water and Soil Conservation Act 1967 (WSCA). This Act, which introduced a new national system for the regulation of water, was administered by the National Water and Soil Conservation Authority and regional water boards. Section 2 of the Act was amended in 1969 to provide for existing water uses. This required that every person taking water on 9 September 1966 (where this had been happening at any time for a period of 3 years up to 9 September 1966) was to give notice to the regional water board before 1 April 1970. If notice was given, then the water use was deemed to be a lawfully existing water use.

The Water and Soil Conservation Act was again amended in 1971 to explicitly provide for current mining privileges granted under the mining legislation. This provided for existing mining privileges to

[18] Peter Farley, *Irrigation Scheming, A History of Government Irrigation in New Zealand*, Peter Farley, 2013, p 23.

be authorised under section 2 of the Act. The amendment also transferred the administration of the mining privileges from the Court Wardens to the water boards. Key aspects of this transfer involved:

- retention of the priority right system (section 11)
- regional Water Board to issue certificates of priority (section 12)
- regional Water Board may direct a specified quantity of water not exceeding one cubic foot per second be allowed for public use before the point of intake (section 15)
- all records were transferred to Regional Water Board from the Warden (section 17)
- upon the expiry of a current mining privilege, the Board may grant, on application, the right to continue the use and maintenance of any water race that was authorised under the expired privilege (section 24).

The Water and Soil Conservation Act continued the exemption from expiry terms for mining privileges held by the Crown.

Overview of irrigation in the Manuherekia

Alluvial gold mining started in the Manuherekia in 1863 and the Manuherekia Gold Field was proclaimed in August 1864. While mining was initially started by individuals with 'picks and shovels', the need for sluicing and the diversion of large qualities of water influenced the establishment of mining corporations and collectives and their decision to build water races and sluicing operations.[19] The Government also stepped in and subsidised the construction of large water races.

One of the longest water races was the Mt Ida Water race which was built between 1873 and 1877 to supply water to the Naseby township. The water race is 108 km long and takes water from the upper Manuherekia in the Hawkdun Range.[20] It was designed and supervised by the Otago Provincial Engineer and authorised by the Government Proclamation on 17 October 1873.

The conversion of water races for farm watering and irrigation purposes started in the late 19th century. The Government also had a keen interest in using the mining privileges to establish farm irrigation schemes. The first surveys of irrigation in the Manuherekia, Ida and Maniototo were undertaken in 1906 and by 1913-1914. The Crown had obtained grants of water amounting to 140 heads in the Manuherekia and had started the construction of large irrigation water races.[21] One of the projects was the reconstruction of the Mt Ida water race during the mid-1920s. This race had been abandoned and a storm in 1918 had washed away many stream crossings.

The Ministry of Public Works actively opposed the granting of new individual water rights in the Manuherekia in order to build the irrigation schemes. An example was an application by Mr Davies who applied for a change in water intake out of the Manuherekia in September 1921. At this time, Davies had the rights for 12 heads of water granted in 1908 for irrigation purposes. The water race, however, had never been built. The District Engineer commented to the Engineer in Chief at the Public Works Department:

> To allow the applicant to revive this old right of twelve heads unconditionally would rob the Government scheme of that quantity of water and consequently make a considerable portion of the expenditure on the Government scheme a dead loss.
>
> Altogether, it would not be in the interests of the eventual future progress of irrigation to

[19] Olssen, Erik. *A History of Otago.* Dunedin, N.Z.: J. McIndoe, 1984, p 65.

[20] D J Hamilton, Early Water Races in Central Otago, 3rd Australian Engineering Heritage Conference*,* 2009.

[21] Omakau Irrigation Scheme, AATE W3397 Box 24, Archives New Zealand.

permit the applicants to hold a grant of water unconditionally.[22]

By 1930, large irrigation schemes were underway in the Manuherekia catchment. One of the largest was the Omakau Area Irrigation Scheme which was comprised of one main race and five creek schemes. This involved the construction of the Falls Dam to deliver water to about 3,600 hectares of farm land via a 93km network of water races. To achieve this, the Government had acquired most of the water rights in the upper Manuherekia. The Omakau scheme provided 1 head of water to be allocated per 150 acres over a 150 day period.[23] At the time, the estimated cost of obtaining the remaining water rights held by the late John Wilson (14 heads of Lauder Creek water) was £17,000 (including compensation).[24]

The decision to progress an expanded Manuherekia Irrigation Scheme and the construction of Falls Dam as an unemployment relief project was made on 23 October 1931.

Other mining privileges in the area, which remained in private hands, were made submissive to the main irrigation schemes. As an example, the Thompson's Block water race mining privilege (No. 4363, Thurlow and Others) had a condition which made its water priority subservient to the 75 heads required for the Manuherekia Scheme. Further, the privilege was conditional on the owner entering an agreement to 'sell the right to the Crown on demand at fair valuation for the actual construction of their proposed main race in so far as it would be useful for inclusion in the Government Scheme, no claim being made for the value of water'.[25] Later in the 1940s, as irrigation works continued, the Crown obtained the Thompson's Block water race for £1,520 including the cost of building new race structures.[26] Further licences were obtained over Thompsons Creek (No. 253 and 564) in 1945 for £300. It was commented at the time that 'they are in fact the only remaining private rights of any value and should be acquired by the Crown'.[27]

The irrigation construction phase in 1910-1940s resulted in six main schemes being constructed in the Manuherekia-Taieri catchments:

- Hawkdun Ida Burn Irrigation Scheme (1929-1931), incorporating the reconstruction of the historic Mt Ida water race, which takes water from tributaries in the Hawkdun Range and delivers water to the upper catchment of the Ida Burn and Ewe Burn catchments
- Ida Valley Irrigation Scheme (1917), which is sourced from two large dams, the Poolburn and Manorburn reservoirs
- Blackstone Irrigation Scheme (1920), which takes water from the main stem of the Manuherekia River and discharges water into the lower Ida Burn
- Omakau Irrigation Scheme (1936), which takes water from the main stem of the Mauherekia River and also takes from Dunstan Creek, Lauder Creek, Chatto Creek and Thomsons Creek
- Manuherekia Irrigation Cooperative (1922), which takes water from the Manuherekia main-stem at the Ophir Gorge and some smaller takes from Chatto Creek
- Galloway Irrigation Scheme (1920), which takes water from the Manuherekia main-stem, lower Manor Dam and Dip Creek.

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22 *District Engineer to Engineer in Chief,* Public Works Department, 21 September 1921, Omakau Irrigation Scheme, AATE W3397 Box 24, Archives New Zealand.

23 Ministry of Works, Irrigation in Central Otago, 1954, p 33.

24 Irrigation Omakau Scheme, 1930-1933. W1 W2550 8 64/69, Archives New Zealand.

25 Ibid.

26 Omakau Irrigation Scheme, Matokanui Water Rights, AATE W3397 Box 26, Archives New Zealand.

27 *Resident Engineer to District Engineer*, PWD, 23 May 1945, Omakau Irrigation Scheme, Matokanui Water Rights, AATE W3397 Box 26, Archives New Zealand.

The bulk of these schemes were constructed by the Ministry of Works, and their water takes (except for the Hawkdun/Ida Burn) were largely dependent on the mining privileges held by the Crown.

Since the 1940s, there have been various calls to increase irrigation and water storage in the Manuherekia. An example of this was a meeting between Manuherekia farmers and the Minister of Works in 1956.[28] It was commented at the time that the valley was desperately short of water and that the Falls Dam had not been completed to its originally intended height (as it was considered to be 42 feet short). The dam would also require strengthening. It was commented that the capital cost was very high and funding to upgrade the dam was not supported by the Minister of Works at the time.

Increasing costs to maintain the water storage and races continued to be a major hurdle in Central Otago from the 1950s onwards. A variety of studies carried out by the Ministry of Works (later Minister of Works and Development) noted the challenges around the cost of maintenance, reliance on run-of-the-river intakes, difficultly in management of small schemes and inadequacy of flow to meet summer water demands.[29] A 1954 report also highlighted that the government irrigation schemes in the Manuherekia were entirely dependent on the mining privileges authorised under mining legislation. [30]

Irrigation restructuring in the 1980s

Government restructuring in the late 1980s radically changed the irrigation landscape in Central Otago and elsewhere around New Zealand. Faced with mounting costs to maintain the historic irrigation schemes, the Government made a decision to end the construction and maintenance of farm irrigation and embarked on a plan to sell the schemes to farmer cooperatives or corporations. This coincided with the disestablishment of the Ministry of Works and Development in 1987.

Negotiations for the sale of the Crown irrigation schemes started in the late 1980s. Groups of irrigators established incorporated societies, such as the Galloway Irrigation Society Incorporated which was created in 1986. It was the Crown's policy to transfer all the mining privileges to irrigation companies or adjacent landowners by 31 May 2000.[31]

A primary concern of the irrigators was the fate of mining privileges. As indicated above, the Crown irrigation schemes were built on the basis of the Crown holding perpetual rights to the water under the mining privileges. These perpetual rights were to be extinguished during the sale of the irrigation schemes.

As an example, the Omakau Scheme included a number of primary expired mining privileges for the taking of water as outlined in the table below. The primary deemed permits included No. 5785 (the 5th Priority) which provided a take of 70 heads from the Manuherekia and the Falls Dam share of 80 heads (No.5768N). These water takes had been continued by the Crown under the Public Works Act exemption. In addition to these takes, there were a number of bywash or discharge privileges. The most significant of these discharges was the No. 1 to the Manuherekia River (providing a maximum discharge of 200 cusecs).

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[28] 12 March 1956, Notes of interview between Hon Minister Goosman, Minister of Works and a deputation representing people served by the Falls Dam area (Roxburgh), Omakau Irrigation Scheme, Matokanui Water Rights, AATE W3397 Box 26, Archives New Zealand.

[29] MWD, Working Party Report, Central Otago Irrigation, 1981.

[30] Ministry of Works, Irrigation in Central Otago, 1954.

[31] Peter Farley, *Irrigation Scheming, A History of Government Irrigation in New Zealand*, Peter Farley, 2013, p 26.

Summary of Omakau Scheme Water Takes (estimates only at 1987)

Mining privilege no.	Water take	Original expiry date	Maximum usage (cusecs)	
			Summer	Winter
5768N	Falls Dam in Manuherekia River	2.5.1980		
WR4363	Manuherekia River		12	2
WR5785N	Manuherekia River (5th priority)	3.10.1959	80	-
	Two Public Works Act takings, Becks Creek (unknown)		6	-
	Two Public Works Act takings, Thompsons Creek (unknown)		4	
WR1464B, 3033, 289, 295	Thompsons Creek	Expiry dates from 1941-1966	15	3
WR5784N	Dunstan Creek (2nd priority)	3.10.1959	18	-
WR513B	Lauder Creek (2nd Priority)	30.8.1948	15	-
WR219B	Muddy Creek	24.7.1944	1	
	Two Public works Act taking, Blackbush Creek (unknown)		4	1
WR518	Middle Creek	28.5.1945	3	1
WR516	Coal Creek		1	-
WR515	Scotts Creek	30.8.1948	2	1
WR301	Devonshire Creek		1	-
WR306, 1240	Thompsons Creek		10	3

Source, Archives New Zealand[32]

In addition to the water takes listed in the table above, the Omakau scheme involved many other expired and unused mining privileges relating to Thompsons Creek, Blackbush Creek, Devonshire Creek and other streams.[33]

For most of the negotiations based on mining privileges in Central Otago, the irrigator societies requested a 30 year security of water supply. The 30 year period was chosen on the basis that the new private owners would need to invest funds to upgrade the historic water races and the 30 year period

32 ALLR W5427 873 Box 719 Irrigation Schemes South Island Omakau, Archives New Zealand.

33 ALLR W5427 873 Box 719 Irrigation Schemes South Island Omakau, Archives New Zealand.

would give time to recover the capital expenditure incurred.[34] As explained by Peter Farley:

> The approach taken was to sell the government-owned schemes, including all "Headworks," on an "as is, where is" basis with the purchaser being given a period of statutory access rights to enable them to complete at their own cost, matters such as the definition and registration of access rights which would otherwise have to have been done by the government. The sale process did not involve altering the nature of the water rights held by schemes except to limit the term of any water right to its current term or to 30 years, whichever was less. Access rights were also preserved.[35]

It was intended that the period of transition would influence the sale price of the irrigation scheme:

> As the schemes were sold as going concerns, the water rights were included as one of the scheme assets. There was no attempt to use the sale process to extend or modify water rights except to set a limit of 30 years on the Mining Rights. In some cases, major schemes faced applying for new water rights within two years of the sale. This issue was addressed by allowing for the expected costs of applying for renewal of the rights when negotiating the sale price.[36]

The Crown agreed to the 30 year period during the individual irrigation negotiations and a clause was inserted in the purchase agreements for those irrigation schemes based on mining privileges. This clause promised that the Crown would introduce legislation to secure the 30 year water right term. As an example, the Agreement for Sale and Purchase of Omakau Irrigation Scheme of 23 August 1989 stated:

> 5.2 The Crown shall pass legislation providing for the Mining Privileges, Water Rights and Dam Licence (called 'the Rights') to be transferred to the Purchaser with the same conditions, priorities, privileges and terms upon which they are held by the Crown PROVIDED THAT the terms of the Rights shall expire on the earlier of the date of termination of those Rights upon the terms as now held by the Crown or 30 years from the settlement date.[37]

All the major Central Otago irrigation schemes were sold to local farmer cooperatives and corporations during 1989, including the Manuherekia, Omakau, Hawkdun, Blackstone and Galloway schemes. The Ida Valley scheme was not sold until 1996. The schemes were sold for either nothing or $1 and involved substantial grants by the Crown to upgrade the historic water race infrastructure.[38]

The Omakau, Manuherekia and Blackstone irrigation groups ended up with shares in the Fall Dam (managed by the Falls Dam Company Ltd) and the bulk of the water managed by the irrigation schemes (except for Hawkdun) was held under mining privileges.

The irrigation sales were followed by the Irrigation Schemes Act 1990 which delivered the promised legislation to transfer the mining privileges. For mining privileges acquired by the Crown for the construction of the irrigation schemes, the Irrigation Schemes Act confirmed the 30 year transition period whereby any water rights acquired would continue to exist for a 30 year period after acquisition of the scheme.

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34 ALLR W5427 873 Box 719 Irrigation Schemes South Island Omakau, Archives New Zealand.

35 Peter J Farley, *Privatization of Irrigation Schemes in New Zealand*, International Irrigation Management Institute, 1994, p 7.

36 ibid, p 8.

37 ALLR W5427 873 Box 719 Irrigation Schemes South Island Omakau, Archives New Zealand.

38 The Manuherekia Irrigation Scheme was purchased for $125,000 but the sale price included two houses and a depot as part of the irrigation assets. Reference, Peter Farley, *Irrigation Scheming, A History of Government Irrigation in New Zealand*, Peter Farley, 2013, p 224.

Under section 6(1) of the Irrigation Schemes Act 1990, the transfer of mining privileges was provided for:

> Where an irrigation scheme is sold or otherwise disposed of by the Crown pursuant to this Part, any mining privilege held by the Crown in relation to the scheme shall be deemed to be transferred to the person to whom the scheme is sold or otherwise disposed of.

Section 6(2) of the Act also provided that 'any such mining privilege deemed to be transferred…shall continue in force for a period of 30 years commencing on the date of transfer and shall then expire.' Later, the Resource Management Act 1991, amended this provision to state:

> Except as otherwise provided in section 413(3) of the Resource Management Act 1991, any such mining privilege deemed to be transferred pursuant to subsection (1) shall continue in force for a period of 30 years commencing on the date of transfer and shall then expire.

Mining Privileges under the RMA

At the same time as the Government was in the process of privatising the irrigation schemes, the Resource Management Law Reform (RMLR) process was overhauling environmental laws. A key concern of the reform was a review of water management and the need to ensure sufficient instream flows, especially for the habitat of trout and salmon. Another key concern was a shift away from 'water rights and private ownership' to 'water management' especially in view of the principles of the Treaty of Waitangi.

In terms of the mining privileges in Central Otago, the Resource Management Law Reform (RMLR) papers indicate that the Crown considered that the mining privileges needed to be phased out due to the impact of over allocation (leading to insufficient instream flows), loss of environmental water quality, and lack of transferability as the privileges are 'tied to a piece of land'.[39]

Initially, the Ministry for the Environment proposed that the Resource Management Bill establish a 10 year expiry date for the mining privileges. This period was strongly opposed by the Treasury and the Ministry of Agriculture and Fisheries (MAF) on the basis of the Crown irrigation sales and the negotiated 30 year period for the mining privileges. At the time, Treasury estimated that a 10 year term would reduce the value of irrigation schemes and sales and revenue to the Crown by around $7 million.[40] It was stated that the 30 year transition period was to provide for the 'reasonable expectations of the current generation to realise their investment in their present irrigation arrangements.'

To enhance minimum water flows, it was proposed to promote voluntary acquisition of the deemed permits by the regional council. It was also envisaged that compulsory taking of the mining privileges would be considered with the provision of compensation to the owners.

Consequently, when the Resource Management Bill was being considered by Cabinet in April 1990 (POL (90) M 11/6), a 30 year transition period had been decided and it was agreed:

> That Government's concern is for the establishment of flows that are sufficient to meet minimum standards and that protect the national interest in instream values in Central Otago rivers and streams.

Cabinet also noted that the 'detailing of this national interest for instream flows will require the collection of basic data on flows, uses and instream needs over the next two years'.

Despite the recent sale of the mining privileges as part of the disposal of the Crown irrigation schemes,

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[39] RMLR: Funding and Accountability Mechanisms for Conversion of Mining Privileges, POL(90) 81, 10 April 1990.

[40] Peter Farley, *Irrigation Scheming, A History of Government Irrigation in New Zealand*, Peter Farley, 2013, p 101.

the Government was interested in buying-back the privileges to protect the rivers of Central Otago. Cabinet noted that 'water and soil block subsidy is able to be allocated to fund the national interest in the investigation and measures of purchase and compensation for the Otago mining privileges conversation programme and that the Minister for the Environment determines the priorities.' If the water and soil block subsidy programme was to be discontinued (which it was), or funds were insufficient, then officials were to report back on 'how to fund the achievement of these national interest outcomes in the Otago mining privilege conversion programme.'[41]

With the enactment of the RMA in 1991, all the mining privileges became deemed permits. In 2014, it was estimated that in the Manuherekia catchment, 'the six irrigation schemes (Blackstone, Galloway, Hawkdun Idaburn, Ida Valley, Manuherekia and Omakau) have entitlement to 68.7% (on a volume basis) of the available water allocation in the catchment.'[42] The water takes and discharges for all the irrigation schemes, with the exception of the Hawkdun Idaburn, are authorised by deemed permits. With reference to the Omakau Irrigation Scheme as an example, 15 deemed permits provide for the use of 3,850 L/s of water.[43] All of the deemed permits are set to expire on 1 October 2021.

[41] RMLR: Funding and Accountability Mechanisms for Conversion[?] of Mining Privileges, POL(90) 81, 10 April 1990.

[42] Golder Associates, Manuherikia Feasibility Study – Consent Review – Current Resource Consents, 2 April 2014.

[43] Ibid.

Extract from Rules and Regulations of the Otago Goldfields 1862

http://nzetc.victoria.ac.nz/tm/scholarly/tei-Stout63-t13-body-d1.html

IV.—WATER RIGHTS AND RACES.

1.—Head Races.

Any person intending to divert and use water for mining purposes by means of any Head Race, shall give notice thereof, in writing to the Warden, and to the holder or holders (if any) of a prior right or rights to divert and use water from the same source; and such notice shall be in the form hereinafter set forth; and copies of such notice shall be posted and maintained for 14 clear days at the source whence it is proposed to obtain water, and at the proposed termination of such race; and the intended course thereof shall be indicated by pegs not less than 2 inches square, or by large stones marked ↑, and placed not more than two hundred yards apart. And if no valid objection be entered against such races within 14 clear days from the posting of such notices, a Certificate of Registration may be granted by the Warden to the applicant.

FORM OF NOTICE.

(District and date.)

To the Warden at

I hereby give notice that I intend to construct a Head Water Race for Mining Purpose, commencing at a point (*) and terminating (*) The length of each Race is ______ or thereabouts, and its intended course is (*).

[Signature and address in full of applicant]—

* Here describe precise localities. * Do. * Do.

2.—Races already constructed.

Races constructed prior to the Proclamation of any Gold Field, or of these Rules and Regulations, must be registered with the Warden, as provided by Section 1.

8.—Superiority of Right.

Superiority of right to a supply of water shall be determined by priority of occupation, the earlier occupant having the superior right. In all cases when the occupier claims under a certificate or other authority in writing granted by a Warden or Commissioner, occupation shall be taken to have commenced at the date of such certificate or authority.

4.—Races to be commenced within one month.

The cutting and formation of races must be commenced within one calendar month from the date of registration, and the occupiers shall continue cutting and forming the same until the work is completed, otherwise any superiority of right to which they may be entitled by virtue of such registration shall be deemed to be forfeited.

5.—Superiority of Right Forfeited by Disuse.

If any race shall be entirely unused for a full period of thirty days at a time when water is available for it, occupation of the right shall be deemed to have recommenced at the last re-occupation thereof.

6.—Abandonment of Races.

All rights to any race shall become forfeited if abandoned for the space of one calendar month, unless in cases of sickness or unavoidable absence, or in consequence of failure of water; but it shall be lawful for the Warden in his discretion, upon sufficient cause being shown, to suspend the operation of this Regulation for a further period of one month, and a certificate of such suspension shall be given in writing to the occupiers.

7.—Heads of Races.

All races that may hereafter be cut, shall have a point specified at which they shall be taken from the creek or river. In races already cut, this point shall be taken to be the spot from which the race now heads. No person shall shift or alter the head of any race without the written sanction of the Warden, nor to the prejudice of any existing right.

8.—Alteration of Races.

The alteration or extension of a race at any time shall not in any way affect any right or privilege attached to such race; and the holders thereof shall, during such alteration or extension, be deemed to be in occupation of all the rights and privileges attached to such race: provided that such alteration or extension shall first be approved by the Warden.

9.—Insufficient Supply of Water.

If the water flowing in any creek or river is insufficient to supply all the races connected therewith, the owner of any right shall—on receipt of a written notice from the owner of a superior right, stating that the supply of such superior right is less than he is entitled to—immediately cease to use the water, or such portion thereof as may be necessary to make up the supply of the superior right.

10.—Water Gauge.

If any dispute shall arise between holders of water-rights deriving their supply from the same creek or water-course, relative to the quantity of water to which each of them, the said holders, is or may be entitled, the following shall be taken to be a head of water, and such holders shall be limited thereto:—

A stream of water gauged by a box, 12 feet long, 10 inches deep, and 20 inches wide, all measured in the clear. The box shall be covered throughout. The upper or entrance end of such box may be left entirely open; but the lower end, or end of exit, shall be fitted with a bar 2 inches high, affixed to the floor of the box, and with a pressure or headboard, 6 inches deep, affixed to the top of the box, leaving an aperture of 2 inches in depth, and of the full width of the box.

(a.) If more than one sluice head of water requires to be gauged, the gauge-box should be enlarged horizontally to ensure accurate measurement. But when this cannot be done owing to natural obstacles, or other sufficient reasons, the gauge-box may be enlarged perpendicularly, in which case the depth of the pressure or headboard shall be reduced at the rate of 1 inch for every additional head of water that is perpendicularly measured.

(b.) The gauge-box shall at all times be placed on a level. When water is taken from one source only, the supply shall be gauged at the head of the race, or the source of supply. But if the race is fed, or supplied in part, by any side stream, or streams, the gauge-box shall be placed immediately below such side stream, or the last of such side streams.

(c.) The velocity of the water above the gauge-box shall, if required, be lessened by the construction of a dam bank, or by levelling the race for a distance of 30 feet; and such velocity shall not exceed an average of 1 foot per second in the said 30 feet, to be gauged by a float.

11.—Supply of Water may be Reduced.

When the supply of water from any creek or stream shall be insufficient for the use of all the holders of water rights thereon, it shall be lawful for the Warden, upon adequate cause being shown, to reduce the quantity, in due and equal proportion, which the said holders shall be entitled to draw therefrom, and to regulate the time and mode in which such water may be used.

Provided that nothing herein contained shall be deemed or taken to affect the rights of the holder or holders of a first water-right hereafter granted on any stream; but such holder or holders shall at all times be entitled to the lull supply of water for which he or they shall be registered.

12.—Number of Sluice Heads allowed.

The number of sluice heads allowed for any such race, as aforesaid, shall be as follows:—One or two miners, one sluice head, or 40 inches of water; four or more miners, two sluice-heads; and so on at the rate of one sluice-head to every additional two miners.

13.—Water not to be wasted.

Holders of rights shall not allow any water to run to waste; but such water shall be appropriated to the use of the next holder of a right, according to the date of their respective registrations.

14.—Transfer or assignment.

The transfer or assignment of any race, or of any interest therein, shall not affect any right or privilege attached to such race; provided that, any such transfer or assignment shall have been duly registered at the office of the Warden, and a memorandum thereof made upon the back of the original certificate.

15.—Keeping Races in Repair, Bridging, &c.

The holder or occupier of any race shall keep the same in repair, and shall make an efficient bridge where any road in ordinary use crosses the race, upon being required to do so by the Warden.

16.—Working Ground occupied for Races.

Any person desirous of working the ground on which any race or portion of a race is situated, may do so by first providing an equally good race for the use of the occupier; provided that the consent of the Warden thereto be first obtained.

17.—Reservations.

No water-right shall be granted for the use or diversion of any water which is, or may be, required for public purposes, or for the use of the miners generally.

18.—Water for General Use.

Two sluice-heads of water shall, if required, be at all times allowed to flow in the natural course of a creek or river for general use.

19.—Causing Claims to be flooded.

No person shall back the water of any creek, river, race, or water-course, upon any claim, or otherwise cause any claim to be flooded, either wilfully or by neglect.

20.—Obstructions to Water Courses.

No person shall deposit any earth, stones, tailings, or other substance in the bed of any water-course, to as to obstruct the flow of water therein.

21.—Side streams.

Where a race crosses any water-course, the use of which is required by holders of Miners' Rights, it shall be carried either over or under the same, so as not to interfere with the natural flow of water therein.

22.—Construction of Tail-races.

Before any person shall construct a tail-race, he shall first proceed by notice in the same manner as is directed in Section 1, for headraces. But such notice shall only require to be posted for seven (7) clear days; at the expiration whereof the applicant shall return to the Warden a copy of the notice, which shall be signed by the holders of the four (4) nearest claims, as expressing their assent to or dissent

PAGE 10cient size to carry off the sludge or water), shall be constructed and kept in repair by the owner of the machine whence such sludge or water proceeds.

8.—Forfeiture of Dams or Machines.

The site of any dam or machine not commenced within seven days from the date of the grant thereof, or not completed within a reasonable time, or any dam or machine unoccupied for one calendar month during a period when sufficient water has been available, shall be deemed to be forfeited, and may be granted by the Warden to any person who may apply for the same.

9.—Injury to Property by Dams.

If any claim shall be flooded, or property injured by the bursting of any dam-bank, the owner of such dam shall be liable for any loss or damage occasioned thereby; provided that it is proved to the satisfaction of the Warden that such breaking away resulted from the faulty construction of such dam.

10.—Sites proving Auriferous.

If it shall be proved that the ground occupied by any dam or machine contains auriferous earth or quartz, the owner of such dam or machine may be compelled to leave or remove the same: Provided that adequate compensation for such leaving or removal shall first have been estimated by assessors and paid by the person desirous of working the ground.

VI.—CREEK CLAIMS.

1.—Notice of Diversion to be given.

Any person desirous of diverting the course of a permanent stream for the purpose of working the bed thereof as a creek claim, shall first give notice of his intention to the Warden, and to all parties wording in, or occupying claims adjoining the proposed line of diversion. Such Notices shall be in the form hereinafter prescribed, and copies thereof shall be posted and maintained, for a period of Ten clear days, at the points proposed for the commencement and termination of such diversion, as aforesaid, and if no valid objection be entered there against within the aforesaid period, the Warden may issue a Certificate of Registration to the applicant.

FORM OF NOTICE.

(District and data)

No.

I hereby give notice that I intend to divert the course of (name of stream) and to form a new channel therefor, commencing at a point situate (*), and terminating at a point (*)

(Signature, &c.)____

____

*Here insert, with sufficient accuracy, the localities.

2.—Wall to be Allowed.

Holders of creek claims shall be allowed a sufficient wall between the channel of diversion and the bed of the stream; and the width of such wall shall be defined by the Warden.

Appendix 6

Summary of the state of the freshwater environment for the Manuherekia, Arrow, Cardrona, and Taieri catchments

Authored by Isaac Bain, Ministry for the Environment

Introduction

This report aims to provide a brief summary of the state of the freshwater environment for the Manuherekia, Arrow, Cardrona, and Taieri catchments. It focusses on drivers, pressures, state (including trends) and impact. We are limited to only reviewing existing state of the environment information and no new field data were collected.

Manuherekia catchment

Overview

The Manuherekia is a large catchment (3035 km^2) located near Alexandra, central Otago.[44] It has a long history of water abstractions, and a convoluted network of structures has been developed to abstract, store, and transport water around the catchment. There is widespread concern over water quantity and to a lesser degree water quality in the catchment.

Key drivers and pressures

Land cover in the Manuherekia catchment, as of 2012, was dominated by grassland (90% of total land area)[45] and much of this was exotic grassland (62%). Tussock grassland extent was around half of exotic grassland (27%). There was a significant increase in the extent of cropland between 1996 and 2012, increasing by 306ha or 24%. This appears to be mostly conversions from grassland or shrubland into cropland.

Land use of the grassland systems is dominated by sheep and beef grazing, with the lower catchment able to support more intensive uses due to irrigation.[46] There has also been recent expansion of dairy.

State and trends of wetlands

No assessment of wetlands in the Manuherekia catchment is provided by ORC in state of the environment reports found on their website.[47] This lack of reporting is concerning as wetlands are an

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[44] https://www.lawa.org.nz/explore-data/otago-region/river-quality/manuherikia-river/

[45] https://www.lawa.org.nz/explore-data/land-cover/

[46] https://www.orc.govt.nz/media/6188/water-quality-and-ecosystem-health-in-the-manuherikia-soe-web.pdf

[47] https://www.orc.govt.nz/media/6129/2018-wq-report-card-lower-manuherikia-pdf.pdf
https://www.orc.govt.nz/media/6143/2018-wq-report-card-upper-manuherikia-pdf.pdf
https://www.orc.govt.nz/media/6188/water-quality-and-ecosystem-health-in-the-manuherikia-soe-web.pdf
https://www.orc.govt.nz/media/6957/final_orc_soe_report_2006_to_2017.pdf
https://www.orc.govt.nz/media/6296/2017-2018-soe-report-card.pdf

important type of freshwater ecosystem and are sensitive to changes in hydrology and land use change.

A search of the Freshwater Ecosystems of New Zealand[48] (FENZ)'s wetland layer revealed current wetland extent to total 1,598ha. Historic wetland extent totalled 8,508ha, which means 81% of wetlands have been lost throughout the catchment.

Field data is not available for us to comment on the condition of remaining wetlands. However the FENZ index of condition (overall index of integrity from completely degraded: 0 to pristine: 1) had a mean value for all wetlands in the catchment of 0.645 (range: 0.203 – 0.967) which indicates a moderate level of impact.

ORC does publish a wetland inventory which contains some information about the location, values and size of various wetlands (especially regionally significant wetlands). However, this is lacking in information about the condition of remaining wetlands.

State and trends of lakes

ORC states that there are 63 lakes in Otago that are greater or equal to 10ha in size. It monitors nine of these lakes as part of its state of the environment programme,[49] none of which are located in the Manuherekia catchment. The Council mentions that these nine lakes provide a good representation of lake types and lake-catchment land-uses across the region.

A search of the FENZ lake layer revealed 42 lakes greater than 1ha (including dams and reservoirs) in the Manuherekia catchment. If dams are excluded, this number drops to nine lakes; the largest of which is a 10.5ha glacial-type lake at the head of the west branch of the Manuherekia River (upstream land cover: 100% natural). Also of note is the man-made 8ha Blue Lake (upstream land cover: 12.8% natural, 64.9% pasture).

None of the nine SOE monitored lakes in Otago are similar to the lakes found in the Manuherekia catchment. Of the two reservoir-lakes monitored, these are both large (> 1000ha) and have predominately natural catchments (> 90%). The smallest monitored lake (26ha) has a predominately natural catchment (97.6%). Thus, the reservoirs in the Manuherekia catchment are poorly represented in monitoring because they are much smaller and of dissimilar catchment land cover. The small lakes of the Manuherekia catchment are also poorly represented because ORC does not monitor small lakes that are likely to be affected by pasture catchments. The smallest lake that ORC monitors that has predominately pasture catchment (80%) is 130ha in size, many times larger than the lakes of the Manuherekia.

Sufficient data are not available for us to comment on the condition of lakes in the Manuherekia catchment. In addition, ORC does not monitor lakes representative of the ones found in the catchment.

State and trends of streams/rivers

Water quality

Numerical limits for water quality are set in Schedule 15 of the ORC Regional Plan: Water. The relevant statistics are five-year 80th percentiles, when flows are at or below median flow.

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https://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/

https://www.orc.govt.nz/media/6957/final_orc_soe_report_2006_to_2017.pdf

48 https://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/

49 https://www.orc.govt.nz/media/6957/final_orc_soe_report_2006_to_2017.pdf

Results as of June 2018 show that phosphorus, *E. coli* and turbidity have the most exceedances.[50] Exceedances of these parameters are associated with poor land management.[51] Nitrogen appears to be of less concern in this catchment given current concentrations.

Parameter	Number of sites that exceed limit
Nitrogen (NNN)	1 (20%)
Ammonium (NH_4-N)	0 (0%)
Dissolved phosphorus (DRP)	3 (60%)
E. coli	2 (40%)
Turbidity	2 (40%)

Data from Environment Aotearoa 2019[52] for ten-year trends indicate that, at one site, *E. coli* trends were indeterminate, and likely worsening at the other site. For total nitrogen and nitrate nitrogen, trends were either indeterminate or improving. For ammoniacal nitrogen, trends were either indeterminate or very likely worsening. Note that indeterminate trends do not mean trends were remaining stable, simply that sufficient data were not available to provide statistical significance of direction. Information received from ORC highlights similar trends, with the addition of worsening trends for DRP and turbidity.

Water quantity

Our assessment of the state of water quantity has been restricted by the lack of good hydrological information in the Manuherekia catchment. Two critical pieces of information are unable to be reliably estimated; (1) naturalised flows in the river, (2) actual water usage. With better investment in hydrological modelling these barriers could be overcome.

Notwithstanding the lack of reliable hydrological information, it is clear that the water quantity of the Manuherekia catchment is severely impacted – the point of contention surrounds the exact degree of impact. This impact is due to landscape characteristics (arid climate, high evapotranspiration, low precipitation) mediated by a high degree of hydrological modification (abstractions and transport).

Consented primary surface water takes are estimated to total approximately 32 cumecs, which is eight times the naturalised Mean Annual Low Flow (MALF) (3.9 m^3/s), or twice the naturalised mean flow (18.5 m^3/s). Actual water use is estimated to be lower than consented use, at 16 m^3/s when flows are favourable or 7-9 m^3/s during peak summer conditions.

Aquatic life

Macroinvertebrates

Macroinvertebrates were measured during the summer of 2017/18 as a snapshot at two sites in the Manuherekia.[53] Manuherekia at Ophir scored a 111 for MCI (good) and 5.4 for SQMCI (good). Dunstan Creek scored a 119 for MCI (good) and 7.6 for SQMCI (excellent). Care must be taken in interpreting a

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50 https://www.orc.govt.nz/media/6129/2018-wq-report-card-lower-manuherikia-pdf.pdfhttps:/;/www.orc.govt.nz/media/6143/2018-wq-report-card-upper-manuherikia-pdf.pdf

51 https://www.orc.govt.nz/media/6188/water-quality-and-ecosystem-health-in-the-manuherikia-soe-web.pdf

52 https://www.mfe.govt.nz/environment-aotearoa-2019

53 https://www.orc.govt.nz/media/6296/2017-2018-soe-report-card.pdf

single snapshot of macroinvertebrates as it may not reflect a true overview of the long-term state of macrioinvertebrates in the Manuherekia catchment.

Periphyton

Relatively low abundances of algae were reported in 2017/18. However, two sites had both Didymo and *Phormidium*.

Fish

Electric fish monitoring was conducted at Thompsons Creek in 2017/18 which found 4 different species, mostly upland bully and brown trout with longfin and shortfin eels also present. These results show low diversity and abundance of fish species relative to what would naturally be expected under reference conditions.

It is known that Central Otago, including the Manuherekia catchment, is a hotspot of diversity for endemic galaxiids, with 13 described and undescribed taxa recognised in the region. Non-migratory galaxias are threatened by water abstraction, land-use change, and salmonids. Their remaining populations are highly fragmented, typically occurring in smaller tributary streams and wetlands.

Habitat

Information on habitat is not available from routine state of the environment reporting by ORC. An investigation of water quality and ecosystem health was conducted between late 2009 and early 2011.[54] This report found that the majority of the Manuherekia catchment had minimal fine sediment build-up on the stream bed, with the exceptions of Pool Burn upper and Lauder Creek, which were covered in fine sediment.

Fish passage is an issue, due to water infrastructure, both in the Manuherekia catchment and downstream in the Clutha main-stem. This has led to connectivity of habitat being reduced for fish.

Ecological processes

Ecological processes are the interactions among biota and their physical and chemical environment, including biogeochemical processes. Indicators of ecological processes in rivers provide a measure of how well a stream is functioning, as opposed to how the ecosystem is structured.[55]

No information is available to assess ecological processes in the Manuherekia catchment. This probably reflects a lack of monitoring, though simple indicators of ecological processes are now available and are used by other regional councils (such as cotton strip assay).

State and trends of groundwater

ORC recognises various aquifers in the Manuherekia catchment. These are the Alluvium Aquifer, Manuherekia Groundwater Management Zone, Ida Valley Groundwater Management Zone, and the Manuherekia Clay Bound Aquifer. Their water quality allocation limit has been set at 50% of MAR.

Information could not be found to assess the state of groundwater quality in the Manuherekia catchment.

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54 https://www.orc.govt.nz/media/6188/water-quality-and-ecosystem-health-in-the-manuherikia-soe-web.pdf

55 https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/freshwater-ecosystem-health-framework.pdf

Conclusions

- Wetlands remain in the Manuherekia catchment, but their condition is not well understood.
- The lakes of the Manuherekia catchment are not SOE monitored, nor does representative monitoring take place in the region. These lakes are likely to be in poor condition given surrounding land use.
- Water quality in rivers is poor and declining for phosphorus, *E. coli* and turbidity.
- Water quantity is poorly understood, but likely to be severely over-allocated in terms of abstractions and flow.
- The Manuherekia contains many rare, endemic, fish species that may be in serious trouble. Other common species are also poorly represented.

Arrow catchment

Overview

The Arrow is a small catchment of 240km^2 that feeds into the Kawarau River just east of Arrowtown. If the Arrow/Wakatipu Basin is considered part of the area, then this includes Lake Hayes, though this is not part of the catchment of the Arrow River.

The Arrow catchment has steep headwaters draining the Harris mountain range.

Key drivers and pressures

Land cover in the Arrow catchment is dominated by low producing grassland (80%) which includes tussocklands, with large areas of high producing grassland in the lower catchment (7.3%). The settlement of Arrowtown covers approximately 1.2% of the catchment – but urban areas can have a disproportionate impact on freshwaters relative to their areal extent.

State and trends of wetlands

A search of the Freshwater Ecosystems of New Zealand[56] (FENZ)'s wetland layer revealed current wetland extent to total 3.66ha. Historic wetland extent totalled 22.9ha, which means 84% of wetlands have been lost throughout the catchment.

Field data is not available for us to comment on the condition of remaining wetlands. However the FENZ index of condition (overall index of integrity from completely degraded: 0 to pristine: 1) had a mean value for all wetlands in the catchment of 0.818 (range: 0.296 – 0.905) which indicates low levels of impact.

State and trends of lakes

There are no lakes greater than 1ha in the Arrow catchment. Lake Hayes is however in the wider Arrow Basin area, which had the following exceedances:

Parameter	Number of sites that exceed limit
Nitrogen (TN)	0 (0%)
Ammonium (NH_4-N)	0 (0%)
Phosphorus (TP)	1 (100%)
E. coli	0 (0%)
Turbidity	0 (0%)

Note the above *E. coli* statistic is reported as part of SOE monitoring which uses long-term measures to assess average state. However, surveillance monitoring for swimming indicates a number of breaches for *E. coli* over the last three years, which has resulted in a medium risk rating.[57]

Lake Hayes had a Trophic Level Index of 3.6 as of 2017 (*cf.* 4.69 as of 2009). This indicates average water quality and mesotrophic lake conditions (moderate levels of nutrients and algae).

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[56] https://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/

[57] https://www.lawa.org.nz/explore-data/otago-region/swimming/lake-hayes-at-mill-creek-shallows/swimsite

State and trends of streams/rivers

Water quality

SOE monitoring sites have only recently been established in the Arrow catchment (July 2018) so it will be a number of years before exceedance statistics can be calculated. There is one river site in the Arrow Basin, Mill Creek at Fish Trap, which had the following exceedances:

Parameter	Number of sites that exceed limit
Nitrogen (NNN)	1 (100%)
Ammonium (NH_4-N)	0 (0%)
Dissolved phosphorus (DRP)	0 (0%)
E. coli	1 (100%)
Turbidity	0 (0%)

Given the low intensity land use upstream of Arrowtown, water quality is expected to be good above the residential areas. There is potential for urban and agricultural contaminants to impact water quality in the lower reaches.

Water quantity

Observed 7d MALF is 1.03 m^3/s compared with a naturalised 7d MALF of 1.4 m^3/s.[58] This indicates relatively low levels of actual water usage from the 22 surface water takes. The average ratio of actual: consented water takes varied throughout the year, with very low (~2%) ratios in winter months to moderate during summer months (~30%).

Aquatic life

Macroinvertebrates

Macroinvertebrate results are not available yet as the new biomonitoring programme for the Arrow catchment was only established in January 2019. MCI and SQMCI results for Mill Creek both indicate "probable moderate pollution"[59] (85 and 4.1 respectively). The SQMCI results of 4.1 is close to the boundary of < 4 which indicates "probable severe pollution".

Periphyton

Periphyton data is not available, but may be an issue during prolonged low flow periods especially below Arrowtown.

Fish

Koaro is the only native fish recorded in the catchment. Brown and rainbow trout are also present, but do not penetrate far upstream of Arrowtown. Eels are likely to be significantly impeded by fish barriers at hydro-electric dams on the Clutha River / Mata-Au.

58 https://www.orc.govt.nz/media/4204/arrow-river-science-update-dec-2017_web.pdf

59 https://www.mfe.govt.nz/sites/default/files/mci-user-guide-may07.pdf

Habitat

Data is not available to comment on for the state of habitat in the Arrow catchment. It is noted however that gravel and sand beds may be important spawning grounds for the resident trout.

Ecological processes

Data is not available to comment on for the state of ecological processes.

State and trends of groundwater

Aquifers in the Arrow/Wakatipu are not particularly well monitored in terms of quantity and especially quality. A 2017 ORC report on the Arrow-Bush Ribbon aquifer recommended a complete aquifer study is required to have better understanding of extent, capacity, recharge zones, and the effects of abstraction.[60]

A 2004 investigation into Wakatipu Basin aquifers[61] stated that water quality was generally very good. Nitrate-nitrogen and potassium concentrations were slightly elevated, probably because of animal grazing and fertiliser application. It is possible that water quality has declined since this time but to what extent is unknown.

Conclusion

- Small areas of wetland exist throughout the catchment, but their condition are unknown.
- The condition of Lake Hayes is concerning, and may be close to a tipping point. Eutrophication and pathogens are an issue, with swimming warnings becoming more frequent.
- Actual usage of water is low compared to paper allocation.
- Macroinvertebrate scores for the inflows to Lake Hayes indicate water quality issues.
- Fish diversity is very low, with only one native species having been recorded.

[60] https://www.orc.govt.nz/media/4197/arrow-bush-ribbon-aquifer-report.pdf

[61] https://www.orc.govt.nz/media/4198/wakatipu-aquifers-groundwater-investigation-report-web.pdf

Cardrona catchment

Overview

The Cardrona River drains a moderately sized catchment of 350km^2 before entering the Clutha River at Albert Town.

Key drivers and pressures

The dominant land cover in the Cardrona catchment is low producing grassland (82.8%), with the next largest land cover being high producing grassland (8.5%). Much of the high producing grassland has intensified from low producing grassland between 1990 and 2008.

Irrigation is widespread throughout the flat areas of the lower catchment, with a total irrigated area of 2,850ha.[62] Known irrigation methods include center-pivot, flood, and spray.

State and trends of wetlands

A search of the Freshwater Ecosystems of New Zealand[63] (FENZ)'s wetland layer revealed current wetland extent to total 3.28ha. Historic wetland extent totalled 19.40ha, which means 83% of wetlands have been lost throughout the catchment.

Field data are not available for us to comment on the condition of remaining wetlands. However the FENZ index of condition (overall index of integrity from completely degraded: 0 to pristine: 1) had a mean value for all wetlands in the catchment of 0.902 (range: 0.895 – 0.905) which indicates low levels of impact.

State and trends of lakes

There are no lakes greater than 1ha in the Cardrona catchment.

State and trends of streams/rivers

Water quality

In June 2018, the Cardrona catchment at the Mt Baker SOE site exceeded nitrogen (NNN) and ammonium (NH_4-N) limits, and is very close to exceeding *E. coli* limits (ORC advise there is a worsening trend of *E. coli* at this site).

Luggate Creek is a small, adjacent catchment that exceeds for dissolved phosphorus (DRP) and *E. coli*.

Water quantity

The Cardrona River has a natural drying reach below Mt Barker where surface flow is lost to groundwater. The loss of surface flow here often exceeds the 7d MALF of the river, so surface flow is lost most summers. When the river is dry, this prevents upstream spawning migrations for salmonids.

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62 https://www.orc.govt.nz/media/4379/water-quality-study-cardrona-river-catchment.pdf

63 https://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/

Site	Observed 7-day MALF	Naturalised 7-day MALF
Cardrona River at Mt Barker	0.8 m^3/s	1.1 m^3/s
Cardrona River at Clutha confluence	0.3 m^3/s	NA

Aquatic life

Macroinvertebrates

In June 2018, the Cardrona catchment at the Mt Baker SOE site had a MCI result of 101 which indicates "doubtful quality or possible mild pollution". SQMCI result at this site was 2.8 which indicates "probable severe pollution". The percentage of EPT taxa was 50%, which indicates many sensitive taxa were missing.

Periphyton

Didymosphenia and *Synedra are* the dominant algae present at the Cardrona river site, and these are both in moderate abundance. Low flows may enable the proliferation of long filamentous algae.[64]

Fish

Electric fishing during the summer of 2017/18 at Cardrona at Mt Barker SOE site found 5 fish species (an unidentified eel, koaro, upland bully, brown and rainbow trout). A search of the Freshwater Fish Database also found Longfin eel, Brook Char, unidentified galaxiid, Clutha flathead galaxiid (nationally critical), freshwater mussels, and Koura.

This indicates a reasonable number and diversity of species, but is probably still low compared to what would naturally be expected. Clutha flathead galaxis are restricted to headwaters of the Cardrona, likely due to the presence of trout and koaro. Koaro are able to inhabit the Cardrona catchment due to the establishment of Lake Dunstan.

Habitat

Riparian vegetation was dominated (assessed during 2014) by willows, exotic pasture grasses, and lupins.[65] There was low levels of fencing and stock generally had direct access to the stream bed.

Riffles and runs in the upper catchment were dominated by coarse gravels, while the lower catchment was dominated by fine gravels.[66]

There is a risk that water abstractions are having an additional impact on the connectivity and extent of habitat in the Cardrona river.[67] A single habitat model exists, but it is old (2001) and possibly unsuitable due to lack of calibration data.

64 https://www.orc.govt.nz/media/4496/cardrona-catchment-science-update-2011_2017.pdf

65 https://www.orc.govt.nz/media/4379/water-quality-study-cardrona-river-catchment.pdf

66 https://www.orc.govt.nz/media/4379/water-quality-study-cardrona-river-catchment.pdf

67 https://www.orc.govt.nz/media/4496/cardrona-catchment-science-update-2011_2017.pdf

Ecological processes

Data are not available to comment on the state of ecological processes.

State and trends of groundwater

Only information related to groundwater quantity could be found, whilst data related to groundwater quality was lacking. Due to high levels of nitrogen and *E. coli* in surface water, it is likely that the Cardrona River is negatively contributing to aquifer quality.

Conclusion

- Nitrogen and *E. coli* appear to be the main water quality issue.
- There is a natural drying reach in the Cardrona River which makes it sensitive to further water abstractions during low flow periods.
- MCI scores highlighted probable impact on water quality and/or habitat conditions.
- Rare fish species are still present in the catchment.
- Riparian vegetation is dominated by exotic species, and stock have easy access to the river.

Taieri catchment

Overview

The Taieri catchment is a large (5,700km^2) catchment which joins the Lake Waihola and Lake Waipori complex before entering the sea south of Dunedin.

Key drivers and pressures

Land cover in the Taieri catchment is dominated by grassland, both low producing (56.2%) and high producing (30.4%). Other major land covers include natural forest (2.4%) and planted forest (4.9%).

State and trends of wetlands

A search of the Freshwater Ecosystems of New Zealand[68] (FENZ)'s wetland layer revealed current wetland extent to total 9,802ha. Historic wetland extent totalled 34,126ha, which means 71% of wetlands have been lost throughout the catchment.

The FENZ index of condition (overall index of integrity from completely degraded: 0 to pristine: 1) has a mean value for all wetlands in the catchment of 0.715 (range: 0.203 – 0.969) which indicates moderate levels of impact.

ORC recognises the Waipori/Waihola wetland complex as regionally significant,[69] and has a number of recorded values that indicate good condition (high degree of wetland naturalness, high diversity of indigenous wetland flora and fauna, high diversity of wetland habitat types, etc.).

State and trends of lakes

A search of the FENZ lake layer revealed 105 lakes (including dams and reservoirs) greater than 1ha in size in the Taieri catchment. If dams are excluded this number drops to 28 lakes.

ORC has one SOE lake monitoring site in the catchment at Lake Waihola. This lake is a large (650ha), shallow, tidal freshwater lake. It is located on the Taieri plains 20km from the coast, and is part of the Waihola-Waipori wetland complex. This wetland complex is internationally significant and regarded as one of the largest and most significant remaining freshwater wetlands in New Zealand.

Parameter	Lake Waihola site
Total nitrogen (TN)	Exceeds limit
Ammonium (NH_4-N)	Not exceed limit
Total phosphorus (TP)	Exceeds limit
E. coli	Not exceed limit
Turbidity	Exceeds limit

Lake Waihola generally has a Trophic Level Index (TLI) score in the range of 4-5 which indicates eutrophic lake conditions and poor water quality.[70]

68 https://www.doc.govt.nz/our-work/freshwater-ecosystems-of-new-zealand/

69 https://www.orc.govt.nz/managing-our-environment/water/regionally-significant-wetlands/clutha-district/waiporiwaihola-wetland-complex

70 https://www.lawa.org.nz/explore-data/otago-region/lakes/lake-waihola/

State and trends of streams/rivers

Water quality

Water quality is variable across the Taieri catchment.[71] Most parameters exceed limits at multiple sites, except for ammonium which only exceeds at one site. Phosphorus and *E. coli* are of particular concern in this catchment.

Parameter	Number of sites that exceed limit
Nitrogen (NNN)	2 (13%)
Ammonium (NH_4-N)	1 (7%)
Dissolved phosphorus (DRP)	6 (40%)
E. coli	8 (53%)
Turbidity	2 (13%)

Trends over the period 2008 – 2017 indicate worsening *E. coli* at most sites.[72] Turbidity trends are worsening at about half of the sites.[73] Nitrate-nitrogen[74] and total phosphorus[75] are improving at most sites.

Water quantity

SOE information related to water quantity could not be found. There are 74 deemed permits located in the Taieri catchment. Minimum flow limits are set at multiple places throughout the catchment, and the river sometimes reaches these minimum flows.[76]

Aquatic life

Macroinvertebrates

MCI scores in five out the six monitored sites are between 100 and 115, indicting 'good' condition.[77] The sixth site at Silver Stream has a score of approximately 90, which indicates 'poor' condition.

Fish

A number of fish species have been found in the Taieri catchment, including: Perch, Brook char, Koaro, Brown trout, Koura, Rainbow trout, Inanga, Giant kokopu, Longfin eel, Yelloweye mullet, Shortfin eel, black flounder, common bully, dusky galaxis, lamprey, eldons galaxis, flathead galaxis, roundhead galaxis, upland bully, banded kokopu, freshwater mussels, and others.

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[71] https://www.orc.govt.nz/media/6957/final_orc_soe_report_2006_to_2017.pdf

[72] https://statisticsnz.shinyapps.io/river_water_quality_ecoli/

[73] https://statisticsnz.shinyapps.io/river_water_quality_clarity/

[74] https://statisticsnz.shinyapps.io/river_water_quality_nitrogen/

[75] https://statisticsnz.shinyapps.io/river_water_quality_phosphorus/

[76] https://www.orc.govt.nz/news-and-events/news-and-media-releases/2015/january/orc-extends-water-restrictions-to-safeguard-the-taieri

[77] https://www.orc.govt.nz/media/6957/final_orc_soe_report_2006_to_2017.pdf

Fish densities were high in upper and lower Lug Creek, and Lower Pig Burn. Trout condition was 'fair' across most sites.

Habitat

A 2004 report on the upper Taieri[78] investigated habitat in tributaries and found the majority of sites had minimal fine sediment cover, but three sites had a high percentage of fine sediment cover.

A relatively low number of fish passage barriers probably enables good connectivity throughout the catchment from mountains-to-sea.

Ecological processes

Data is not available to comment on for the state of ecological processes.

State and trends of groundwater

The Lower Taieri Basin has a low level of water quality impact from human impact.[79] Nitrate concentrations are generally low, with highest concentrations in the north of the basin near Mosgiel – though these concentrations are still less than the drinking water standard.

Some areas of the basin have elevated iron and manganese levels, with concentrations regularly exceeding drinking water standards for "appearance, taste, and odour".

Salinity is an issue in some small areas of the basin, and could worsen given sea level rise and further abstractions.

Conclusion

- The Taieri catchment has a large wetland-lake complex in its lower catchment that holds international significance.
- Lake Waihola is particularly sensitive (due to its shallow nature) and has some signs of poor water quality and eutrophic status.
- *E. coli* and phosphorus are the main water quality parameters of concern in rivers.
- The Taieri catchment supports a surprising diversity of fish life, including many rare species.

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78 https://www.orc.govt.nz/media/6189/water-quality-and-ecosystem-health-in-the-upper-taieri.pdf

79 https://www.orc.govt.nz/media/3809/l-t-g-allocation-study-web.pdf

Appendix 7 Regional Plan: Water

The Council notified the Water Plan on 28 February 1998 and made it operative, after submissions, hearings and appeals, on 1 January 2004. It has made 15 plan changes since then.

Changes	Date Notified	Decision Released	Date Operative
Waitaki Catchment Water Allocation Regional Plan	19 Feb '05	30 Sep '05	3 Jul '06
Plan Change 1A (Minor amendments)	17 Aug '05	1 Apr '06	1 Aug '06
Plan Change 1B (Minimum Flows for Waianakarua River, Trotters Creek, Luggate Creek)	20 Dec '08	31 Oct '09	1 Mar '10
Plan Change 1C (Water Allocation and Use)	20 Dec '08	10 Apr '10	1 Mar '12
Plan Change 3A (Minimum Flow for Taieri River at Tiroiti)	26 Jun '10	11 Dec '10	1 May '11
Plan Change 4A (Groundwater and North Otago Volcanic Aquifer)	18 Sep '10	24 Sep '11	1 Mar '12
Amendment 1 (NPS Freshwater Management)	24 Jun '11	24 Jun 11	1 Jul 2011
Plan Change 2 (Regionally Significant Wetlands)	2 Jul '11	12 May '12	1 Oct '13
Plan Change 6A (Water Quality) Plan Change 6A Archive	31 Mar '12	20 Apr '13	1 May '14
Plan Change 4B (Groundwater allocation)	17 May '14	13 Dec '14	1 Sep '15
Plan Change 4C (Groundwater management: Cromwell Terrace)	16 Aug '14	13 Dec '14	1 Sep '15
Plan Change 3B (Pomahaka Catchment minimum flow)	16 Aug '14	14 Feb '15	1 Jun '15
Plan Change 3C (Waiwera Catchment minimum flow)	13 Dec '14	8 Aug '15	1 Mar '16
Amendment 2 (NES Plantation Forestry)	30 Jun '18	30 Jun '18	1 Jul '18
Proposed Plan Change 5A (Lindis: Integrated water management)	8 Aug '15	13 Aug '16	Under appeal

Appendix 2: Letter from the Minister for the Environment (2019)

Office of Hon David Parker BCom, LLB

Attorney-General
Minister for the Environment
Minister for Trade and Export Growth
Associate Minister of Finance

Chair and Councillors of Otago Regional Council

CC: Sarah Gardner, CEO, Otago Regional Council

Dear Hon Marian Hobbs and Councillors

Section 24A Report: Investigation of Freshwater Management and Allocation Functions at Otago Regional Council under section 24A of the Resource Management Act 1991

I am pleased to enclose the Report of Professor Peter Skelton resulting from his investigation under section 24A of the Resource Management Act 1991 (RMA). This was on whether Otago Regional Council (ORC) is adequately carrying out its functions under the RMA in relation to freshwater management and allocation of resources (the Report).

I would like to thank ORC for their willing contribution to the investigation process. I again record that the current predicament has been many years in the making, and that this letter should not be seen as a criticism of the current council or staff.

The main message from the Report is that the Otago region does not have a fit for purpose planning framework in place to appropriately manage applications for new water permits before 1 October 2021, when all deemed permits and a number of other water permits expire. This will also be the case for some other water permits that expire before the end of 2025.

Three important matters from the Report, accompanied by my specific recommendations on each, are set out below.

Inadequacy of the planning framework generally

The Report highlights the importance of ORC prioritising and accelerating work towards a new Regional Policy Statement (RPS) to be operative by 1 April 2022, and a new Land and Water Regional Plan (LWRP) to be operative by 31 December 2025.

Professor Skelton identified that these new planning documents are critical for the ability of ORC to give effect to the national directions.

Views expressed by a wide range of the people Professor Skelton spoke with – including Council staff; stakeholders; and Aukaha, representing Kāi Tahu – supported the need to overhaul the entire planning framework for the Otago region.

Similar views on the planning framework have recently been expressed by Judge Jon Jackson. In two recent Environment Court judgements[1], he described the RPS as *prima facie* not giving effect to the RMA, and the Regional Water Plan as one which:

> *can barely be said to make any effort to manage water volumes in many Otago catchments (including the Lindis River) because in most cases the primary allocation of water for irrigation is simply set as the sum of all existing water takes granted in the catchment.*[2]

With this context in mind, I have given careful thought to the recommendations made by Professor Skelton and how I can best support ORC going forward.

Recommendations

In line with Professor Skelton's recommendations, I formally recommend, under section 24A of the RMA, that ORC:

1. take all necessary steps to develop a fit for purpose freshwater management planning regime that gives effect to the relevant national instruments and sets a coherent framework for assessing all water consent applications, including those that are to replace any deemed permits
2. develop and adopt a programme of work to achieve the following:
    - by November 2020, a complete review of the current RPS that is publicly notified, with the intention that it be made operative before the review of its LWRP is notified
    - by 31 December 2023, a new LWRP for Otago that includes region-wide objectives, strategic policies, region-wide activity policies, and provisions for each of the Freshwater Management Units, covering all the catchments within the region.

Rollover of deemed permits

Professor Skelton's report also recommended that I begin a process to initiate the necessary legislative process to change the date for expiry of the deemed permits in section 413(3) of the RMA, from 1 October 2021 to 31 December 2025 (being the date by which ORC's new LWRP is expected to be operative).

Recommendations

I am not in favour of changing the RMA to extend the date for expiry of the deemed permits. A 30-year transition period was already provided to manage this issue. I prefer that ORC takes steps to resolve the matter rather than taking up the time of Parliament.

Urgent need for interim planning framework

While the comprehensive overhaul of the ORC planning framework is underway, there is an urgent need to ensure that an interim framework is in place between now and 31 December 2025.

[1] *Alliance Group Limited v Otago Regional Council* [2019] NZEnvC 042.

[2] *Lindis Catchment Group Incorporated v Otago Regional Council* [2019] NZEnvC 166 – (RE PC5A to the Otago Regional Water Plan).

This is necessary to manage approximately 400 to 600 future consent applications in over allocated catchments.

The possibility of up to 600 consents being granted under the current planning and consenting framework is problematic.

I understand that around 70 per cent of ORC's currently issued water permits are for durations of 25-35 years, with various expiry dates. This includes over 50 permits that expire in 2050 or later, eight of which are 35 year permits issued this year. I am advised that there is a strong expectation from deemed and RMA water permit holders that their new consents will be for similarly long terms, and that the Council is likely to come under strong pressure to meet these expectations.

In my view, long terms for these new consents would be unwise, as they would lock in unsustainable water use, inhibiting the council from effectively implementing the outcomes of its intended new RPS and LWRP.

Recommendations

Professor Skelton highlights the importance of having robust interim measures in place to provide for short-term consents until the new RPS and LWRP are completed. In line with his recommendations, I formally recommend, under section 24A of the RMA, that ORC:

3. prepare a plan change by 31 March 2020 that will provide an adequate interim planning and consenting framework to manage freshwater up until the time that new discharge and allocation limits are set, in line with the requirements in the National Policy Statement for Freshwater Management.

It is important that these interim measures manage the processing of resource consents (including those to replace the deemed permits). I would encourage you to consider a narrow plan change that provides for the relatively low cost, and fast issuing of new consents on a short-term basis, as an interim measure until sustainable allocation rules are in place. Those consents could, for example, be for a maximum term of five years, or until the new LWRP becomes operative, whichever comes first. It may be beneficial to include these provisions in a stand-alone plan change.

I will need you to keep me informed regularly of progress on the above planning processes.

Next steps

In line with Professor Skelton's recommendations, I formally require, under section 27 of the RMA that ORC provide me with six-monthly reports in relation to the following matters:

- progress made in developing science, planning, consenting, monitoring and enforcement, and land management organisational capability and capacity
- progress in achieving the above recommendations 1, 2 and 3
- a summary of freshwater resource consenting activity for the reporting period.

I require the first report to be provided to me by 30 April 2020 and the reporting to continue on the six-monthly basis until the end of 2025.

I recognise that ORC is already working towards the recommended plan changes. I would like to meet with you to discuss how I can best assist you to lead your council forward to achieve the plan changes within the recommended timeframes.

I also request your formal response to my recommendations above, including an outline of how you intend to achieve the planning framework changes, by **24 December 2019.**

Yours sincerely

Hon David Parker
Minister for the Environment

Appendix 3: Phase 1 and 2 consultation summary report

RPS Review 2020

Community Consultation Summary Report

February – March 2020

Otago Regional Council

Table of Contents

1. Acknowledgements

Otago Regional Council wishes to acknowledge all those who have contributed to the RPS consultation process as survey respondents and / or workshop attendees.

The ideas gathered, and discussion generated through both Phase One (survey) and Phase Two (workshops) of the consultation process have been valuable and insightful for the ORC policy team. The information is an important part of the overall picture that will inform the direction and shape of the new Regional Policy Statement. The Council sees the number of respondents who participated, particularly to the Phase One Survey, as an encouraging example of the region coming together to provide input for the betterment of Otago.

Thank you to the community members and stakeholders who have participated and engaged so far, your involvement is greatly valued.

2. Executive Summary

- The Otago Regional Council (ORC) adopted the Minister for the Environment's recommendation to review the current Regional Policy Statement (RPS) within a clear timeframe.
- Community consultation was undertaken to inform the early stages of the RPS Review and policy development.
- Consultation was carried out in two phases to engage both the wider Otago community and stakeholders on regional resource values, concerns and significant resource management Issues.
- Phase One involved a public survey advertised to the entire Otago region. 312 responses were received.
- A set of values, concerns and issue statements were developed from the data analysed from Phase One responses.
- Phase Two involved four community and stakeholder workshops held around the Otago region. Participants reflected on the findings from Phase One and workshopped outcomes and policy directions.
- The outcome and policy direction ideas for each issue statement have been summarised from the workshop findings.
- The information gathered from both Phase One and Two will inform the direction ORC takes in developing the new RPS.

3. Summary of Key Findings

The summary of consultation reflects the original RPS proposal presented to Council in January 2020. Phase one of the community consultation programme involved an online survey which had a total of 312 respondents, including eight respondents from outside Otago. Phase two of the community consultation programme involved consultation roadshows planned around the region. The programme of the roadshows was interrupted due to the Covid-19 restrictions, so some roadshows were not undertaken. Phase one and Phase two both proved to be important exercises for the RPS review and provided quality community feedback.

The most significant findings of the community consultation were the following:

The online community consultation programme confirmed the relevance of the key issue topics, based on the areas of concern identified at the workshop with Council in January 2020. These issues topics were:

- Natural Hazards and Resilience
- Climate Change
- Coastal Pressures
- Pests and Weeds
- Urban Growth
- Water Demand
- Big Lakes Growth and Infrastructure Pressure
- Impacts from Economic Activities

The community consultation programme has resulted in the identification of two new standalone issue topics that will be included in the revised RPS. Whilst both areas were included in other issues statements, the consultation has highlighted they should be identified as issues in their own right. These issue topics are:

- Water quality
- Biodiversity loss

Additional key findings were:

- Precautionary approaches to policy that enable environmentally sustainable outcomes for both Urban and Rural activities with the support of both public and private sectors.
- Upgrading Infrastructure, particularly waste, wastewater, and stormwater management infrastructure. This was a strong theme across issues related to Urban Growth, Natural Hazards and Resilience, Economic Impacts, and Coast.
- Tighter regulations on Urban Development, ceasing developments on productive land, ceasing developments in known flood risk areas, and reducing urban sprawl in favour of high-density urbanised areas

- Increasing water storage capabilities for the region was a strong outcome for Water Demand issues.
- The Otago Regional Council to be more active in biodiversity loss issues and pest control management though regulation and incentives for landowners and community groups.
- Investing in alternative public transport options to reduce car-based emissions and incentivise alternative heating sources for residential developments to reduce wood or coal burning. These were to improve air quality and help mitigate climate change effects.
- Increased collaborative research and education outcomes across all the issue topics made available to the community. This outcome was particularly relevant for issues relating to Coastal Pressures, Climate Change and Biodiversity Loss.

4. Background

ORC committed in November 2019 to a work programme determined by the Minister for the Environment, to address its Resource Management Act (RMA) planning framework. The work programme requires a complete review of the RPS, and notification of a new RPS, to be operative ahead of the development and notification of a Land and Water Regional Plan. ORC must also implement new National Planning Standards which were introduced into legislation in April 2019, and require all RPS's to be in the prescribed format by 2022.

ORC is aiming to notify a new Regional Policy Statement (RPS) by November 2020, to be operative by 1 April 2022 in time to guide the Water and Land Plan review.

The following principles guide the RPS Review:

- Clear direction on outcomes sought
- Vertically and horizontally integrated
- Consistent approach
- Regime that addresses increasingly complex issues and is flexible to changes in the statutory environment
- Focusses on key issues
- Plain language and ease of use for all
- Policies direct resource management outcomes
- All the answers are to be in the RPS.

ORC's work programme included the phase 1 and 2 consultation, in addition to the mandatory consultation required under the First Schedule to the RMA. The intention was to engage a wider representation than those parties that are involved in the First Schedule consultation.

To guide that consultation process, ORC developed a set of consultation objectives.

- To provide iwi, key stakeholders and the community with the opportunity to have input on the scope and content of the new RPS, through face-to-face meetings and feedback online prior to the formal engagement required by the Resource Management Act.
- To engage effectively and early in the process, to reduce the number of submissions made at notification stage, and therefore streamline the process.
- To deliver a new RPS that is in line with new national direction, National Planning Standards and proposed national policy statements for Highly Productive Land, Urban Development, Freshwater Management and Indigenous Biodiversity.

5. Consultation Approach and Methodology

5.1 Phase One

Phase one of the community consultation process involved distributing an online survey using 'YourSay'. The survey was distributed via a boosted Facebook campaign, regional newspapers and embedded in the February edition of the On-Stream newsletter. Additional advertising of the survey was via regional newspapers and an ORC media release.

Communities throughout Otago were encouraged to identify values, concerns and general comments relating to nine issue statements which had been drafted following a workshop with Councillors in January 2020. The nine issue statements were: Natural Hazards and Resilience, Climate Change, Pests and Weeds, Urban Growth, Water Demand, Coastal Pressures, Big Lakes Growth and Infrastructure Pressures, and Impacts from Economic Activities, and Resilience.

Respondents were also asked to indicate how significant they felt the issue statement was and to comment on why. The data gathered from the Survey was then coded and thematically analysed.

5.2 Phase Two

Phase two of the consultation process involved five facilitated workshops held in March 2020. Four of these were public, and one was for invited stakeholders. Workshops were held in Oamaru, Dunedin (two meetings – one of which was for stakeholders), Tapanui and Balclutha.

Two further events were also planned for Queenstown and Alexandra. However due to the Covid-19 epidemic, these workshops were unable to proceed.

The workshops included two main activities.

Task One: Identifying Outcomes

Attendees mapped the future resource management outcomes that they wished to see achieved in relation to the issues from Phase one of the consultation process.

Method:

Attendees wrote their ideas on sticky notes and placed these on a map of Otago in the relevant location. Region-wide ideas were placed to the side.

Task Two: Identifying Policy Approaches

Attendees discussed and plotted potential policy approaches to achieve the outcomes identified in task one, using some example scenarios. The aim of this activity was to provide guidance in two respects:

- The first was how permissive or prescriptive the policy approach should be in relation to an outcome.
- The second was the degree of environmental improvement sought. The range provided was from meeting national environmental bottom lines (minimum standards) through to achieving (or maintaining) a high level of environmental quality (a more natural state).

Method:

Attendees wrote each policy idea for an outcome on a sticky note, and plotted it as follows:

Along the X axis as relevant between ‘permissive’ and ‘directive,’ and

Along the Y axis as relevant between meeting environmental minimums and a high level of environmental quality (a more natural state). The data, as plotted to these axes are included in Appendix 1.

Two additional issues identified

At the Oamaru workshop, two more themes were identified in addition to the nine themes developed during the phase one consultation. These were Improving Water Quality and Protecting Biodiversity. These were added to the subsequent workshops and feedback sought in the same manner as for the other issues.

6. Summary of consultation findings: Phase one Consultation

Data Analysis Method:

The data collected from the survey was analysed by a process of coding and thematic analysis. The process of coding involved identifying key words used to identify the value or concern topics in each response. These codes are built up over the course of reviewing all comments, and the overall code list becomes more concise as more comments are coded. After all the community comments were coded, we identified the themes that multiple codes would broadly apply to and grouped them into these themes.

This process provided insight on which natural or physical resources were 'valued' or 'of concern' and the percentage of respondents who identified them. This process was also used to thematically summarise the responses to the 9 issues and indicate the general themes associated with each issue.

6.1 Locational Data

A total of 312 responses were received to the community consultation survey. This number was made up of respondents from all over the Otago region. Figure 1 below shows, in percentage terms, where in the region the survey respondents came from. The largest number were from Dunedin (DCC) at 41% followed by Central Otago (CODC) at 27%, Queenstown Lakes Area (QLDC) at 15%, North Otago (WDC) at 8%, South Otago (CDC) at 5 %, and 'Outside Otago' at 3%. All the respondents were from within New Zealand.

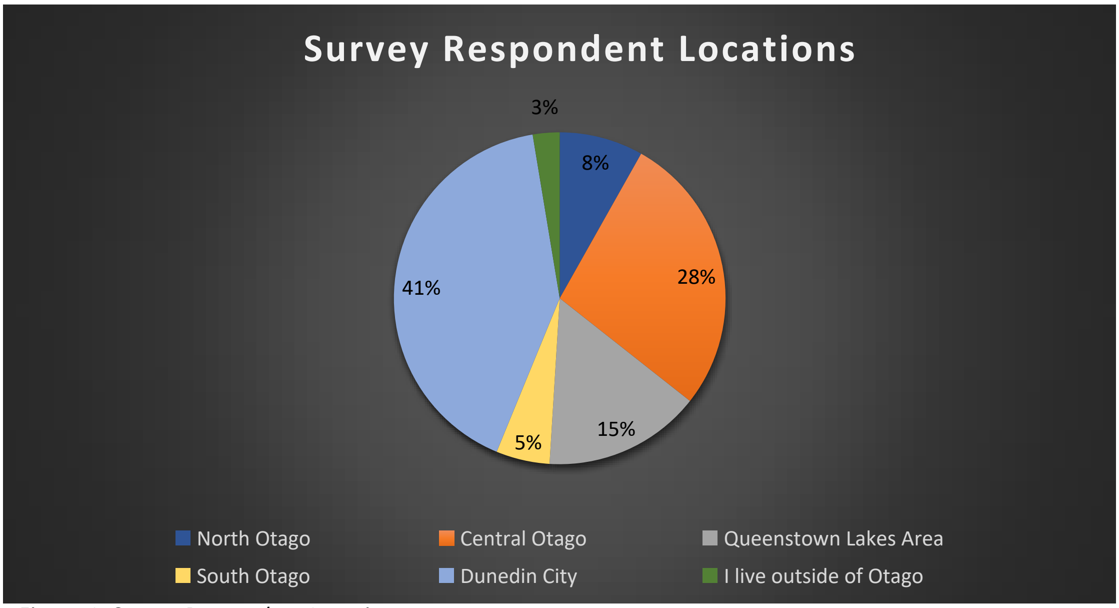

Figure 1: Survey Respondent Locations

6.2 Values

For the values section of the survey, respondents were asked to identify what natural or physical resources they valued most in the Otago region. Respondents had the opportunity to write freely in this section of the survey. To give a sense of the relative importance of the values, the data collected has been represented in two ways:

First, in Figure 2 below, it has been visually represented as a 'wordle' or 'word cloud'. The size of the word represents the words' importance as indicated by the number of times it was mentioned in the coded responses.

Figure 2: Values Wordle

Second, Table 1 shows the raw data for the values obtained from the coding process, presented as a table. The coded survey responses were used to build the themes presented in the above table. The count shows the number of responses that related to each respective theme. Each survey response had the potential to address values or concerns across a range of different themes, therefore the total percentage of responses does not equate to 100%.

Value	**Count**	**% of points**	**% of respondents**
Healthy lakes & rivers	212	28.5	68.6
Landscapes	130	17.5	42.1
Access to the natural environment	60	8.1	19.4
Biodiversity	56	7.5	18.1
Native bush	56	7.5	18.1
Coastal Areas	53	7.1	17.2
Clean air	37	5.0	12.0
Productive land	29	3.9	9.4
Water use	14	1.9	4.5
Wetlands	13	1.7	4.2
Minerals	12	1.6	3.9
Built Heritage	9	1.2	2.9

Healthy marine environment	8	1.1	2.6
Transport infrastructure	8	1.1	2.6
Renewable energy infrastructure	8	1.1	2.6
Climate	6	0.8	1.9
Soils	6	0.8	1.9
Urban areas	6	0.8	1.9
Estuaries	5	0.7	1.6
Groundwater	3	0.4	1.0
Lifeline infrastructure	3	0.4	1.0
Rural Landscapes	3	0.4	1.0
Surf breaks	3	0.4	1.0
Takata Whenua values	3	0.4	1.0
Residential infrastructure	2	0.3	0.6
Total	744		

Table 1

Value Summaries:

The following are brief summaries of the common values described by the community.

Healthy lakes and rivers:

Healthy lakes and rivers were valued by 68% of respondents, making it the most valued natural resource associated with this survey. This included the quality and quantity of water accessible to the Otago communities, the accessibility of these resources for recreation, and the health of native flora and fauna associated with Otago's rivers and lakes.

Landscapes:

The second most valued resource were Otago's distinct and diverse natural landscapes. Respondents value natural open and rugged landscapes, particularly around the lakes district. Value was placed on the unique accessibility Otago communities have and the ability to enjoy vast mountainscapes, open grasslands, and idyllic coastlines.

Access to the natural environment:

A key theme that connected most of the values was accessibility. Respondents indicated they valued being able to freely access the natural environment. This was indicated in valuing access to healthy lakes and rivers, as well as access to Otago's unique landscapes. Increased and sustained accessibility to Otago's natural resources was highly valued for recreation and economic benefit.

Biodiversity:

Healthy and thriving native flora and fauna were valued by respondents. This was linked to valuing conservation efforts and pest control. Community initiatives with landowners and ORC leadership were desired for control.

Coastal areas:

The coast was valued for its landscapes, recreational uses and associated with habitat for biodiversity. Recreational activities such as boating, fishing, swimming and general beach access were interconnected with coastal value. Conserving coastal biodiversity and marine reserves was associated with coastal values.

6.3 Concerns

Survey respondents were asked to identify any concerns they had regarding natural or physical resources in the Otago region. Respondents had the opportunity to write freely in this section of the survey. To give a sense of the relative significance of the concerns, the data collected has been represented in two ways:

First, in Figure 3 below, it has been visually represented as a 'wordle' or 'word cloud'. The size of the word represents the words importance as indicated by the community responses as shown in Figure 3.

Figure 3: Concerns Wordle

Second, table 2 shows the raw data for the concerns obtained during the coding process, presented as a table.

Concern	Count	% of points	% of respondents
Water Health	219	23.1	70.9
Agricultural Practices	110	11.6	35.6
Pollution and Waste	109	11.5	35.3
Residential Growth	74	7.8	23.9
Native Flora and Fauna	56	5.9	18.1
Water Use	48	5.1	15.5
Coastal Health	41	4.3	13.3
Invasive Flora	35	3.7	11.3
Invasive Fauna	31	3.3	10
Tourism and Freedom Camping	29	3.1	9.4
Recreation and Public Access	26	2.7	8.4
Land Quality and Use	20	2	6.2
Exploitation	18	1.9	5.8
Degradation	18	1.9	5.8
Air Quality	15	1.6	4.9
Economy	14	1.5	4.5
Road Quality and Use	13	1.4	4.2
Climate	12	1.3	3.9
Infrastructure	11	1.2	3.6
Wetlands	10	1.1	3.2
Sustainability	9	0.9	2.9
Flooding	7	0.7	2.3
Noise and Light Pollution	6	0.6	1.9
Heritage Buildings	3	0.3	0.9
Total	948		

Table 2

Concern summaries

The following are brief summaries of the main concerns described by the community.

Water health:

A total of 70% of respondents indicated that water health was of concern. This included the quality of water, lakes, rivers and waterways. Respondents described the degradation of these natural resources as a priority concern. Algae, intensive agricultural practices and waste/ wastewater management infrastructure were identified as being associated with the degradation of Otago's water health.

Agricultural practices

35% of respondents indicated that agricultural practices were of concern. Intensive land use and irrigation practices were indicated as responsible for effluent and other run off into water ways. Respondents associated these practices with the degradation of both water health and water quantity.

Pollution and waste

35% of respondents indicated that general pollution and waste management was of concern. The pollution of waterways and coastal environments by poor waste management infrastructure were described, particularly around urbanised areas with larger populations. Urban run-off into the harbour and into coastal marine areas was also identified as a concern.

Residential growth

23% of respondents indicated residential growth as a concern. Associated concerns highlighted were population growth, urban development, loss of landscapes, loss of productive soil and strain on infrastructure. Respondents were concerned that urban sprawl and growth would negatively impact access to healthy water, beautiful landscapes, the loss of productive soil and lead to increased pressure on waste and water infrastructure.

Invasive Flora and Fauna

The community identified rabbits, wallabies and possums as pest species they are concerned about. The community identified concerning weed species, including gorse, broom, wilding pines and algae responsible for degrading water quality.

6. 4 Key Issue Statements

The following section outlines the nine key issue statements as put forward in the survey. Respondents were asked to indicate how significant they felt the issue statement was and then comment on why. For each of key issue statements, a summary of the overall commentary and any identified solutions provided by the community have also been provided

Issue Statement 1: Natural Hazards and Resilience

Natural hazards pose a risk to many Otago communities. An earthquake on the Alpine Fault would cause potentially catastrophic effects for the entire region. There are particular areas in Otago which are prone to flooding. A major hazard event could isolate Otago, or parts of it, for an extended time. How significant do you think this issue is for Otago?

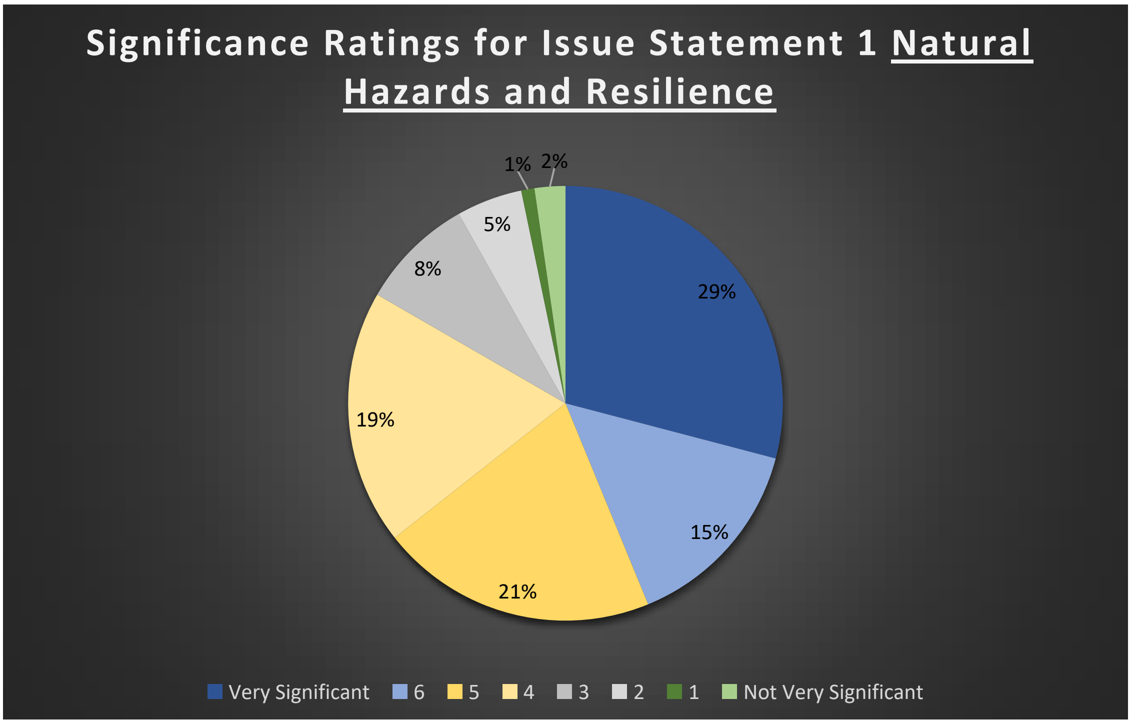

Figure 4

Comments Summary:

Respondents considered flooding to be a more significant issue than earthquakes for the Otago region due to prevalence, ability to predict and inform, as well as potential for control through infrastructure planning. It was suggested that resource allocation for earthquake related hazards should be for response efforts, while resource allocation for flooding should be into upgrading wastewater /stormwater infrastructure. Excess water from floods could be utilised for water demand needs such as irrigation. Isolation of communities from supply routes was also of some concern, particularly for some communities where there are limited options to respond. South Dunedin was considered at risk due to the forecasted rise in sea levels. Suggestions to respond to the risk included an early retreat of South Dunedin and requiring properties to raise their foundations.

Issue Statement 2: Climate Change

Climate change is likely to damage our economy and environment. In Central Otago, we're likely to see more varied rainfall, leading to increased flooding and less water reliability. This will be compounded by stronger winds, increased temperatures and longer dry periods, which may affect the number and types of crops and animals that the land can sustain. On the coast, low lying areas like South Dunedin are at risk of inundation from rising sea levels. This will also exacerbate coastal erosion, which could damage coastal infrastructure (including roads) and expose old waste dumps (e.g. at Middle Beach). Climate change will also affect native animals and plants, compounding the effects of pests and stresses from human use. Some climate change threats are unpredictable. How significant do you think this issue is for Otago?

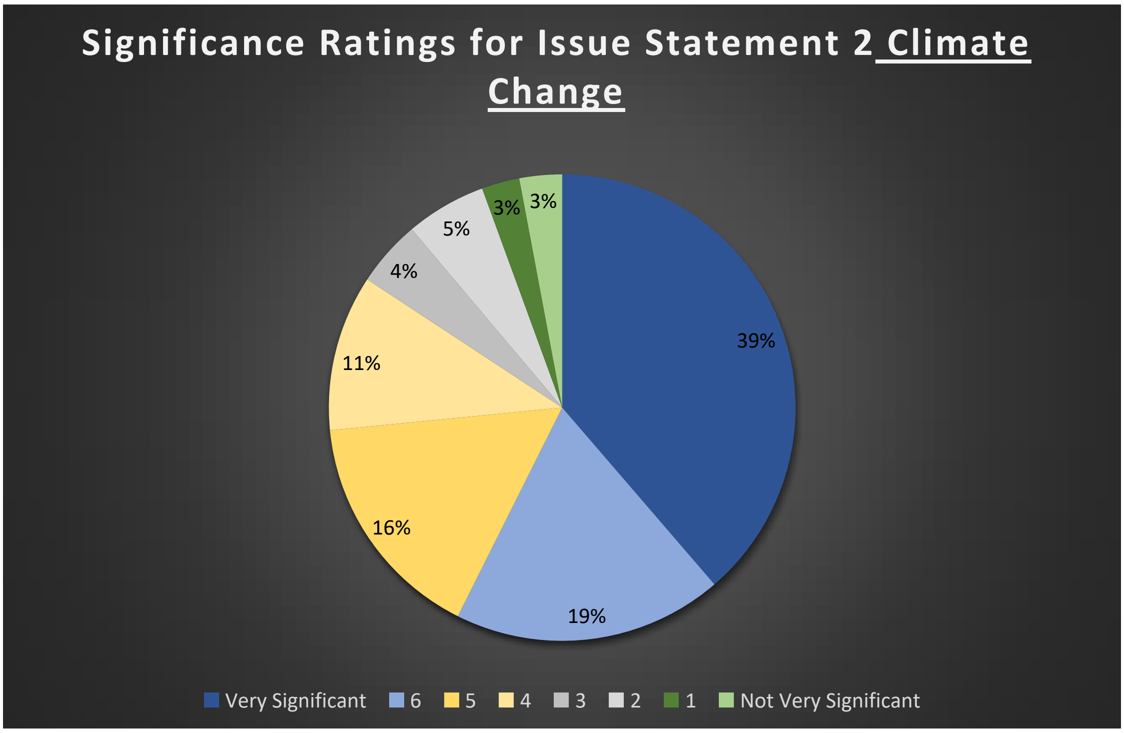

Figure 5

Comments Summary:

Climate change was considered a significant or moderate concern by most of the respondents, however there was significant division around how it should be approached in Otago. There was division between whether people thought the best approach to tackling climate change was adaptation, or mitigation. Division existed around how to best allocate resources to tackle the effects of climate change. Some of these varied solutions suggested by respondents included:

- Increase water storage to continue existing land use practices
- Retreat from certain land and intensive land use practices altogether
- Switch to more resilient crops to utilise a changing climate.

Issue Statement 3: Pests and Weeds

Pest species pose an ongoing threat to indigenous biodiversity, economic activities and landscapes. Pest species can be found throughout Otago, from alpine regions to marine environments. Rabbits are changing Central Otago's landscape, eroding soils and affecting agriculture. Wilding pines threaten high country and tussock grassland, changing the landscape and impacting on our recreational, hydrological and conservation values. Didymo, *Lake snow and Lagarosiphon affect our lakes and rivers. Native aquatic plants are displaced, impacting ecosystem health and recreation activities. How significant do you think this issue is for Otago?*

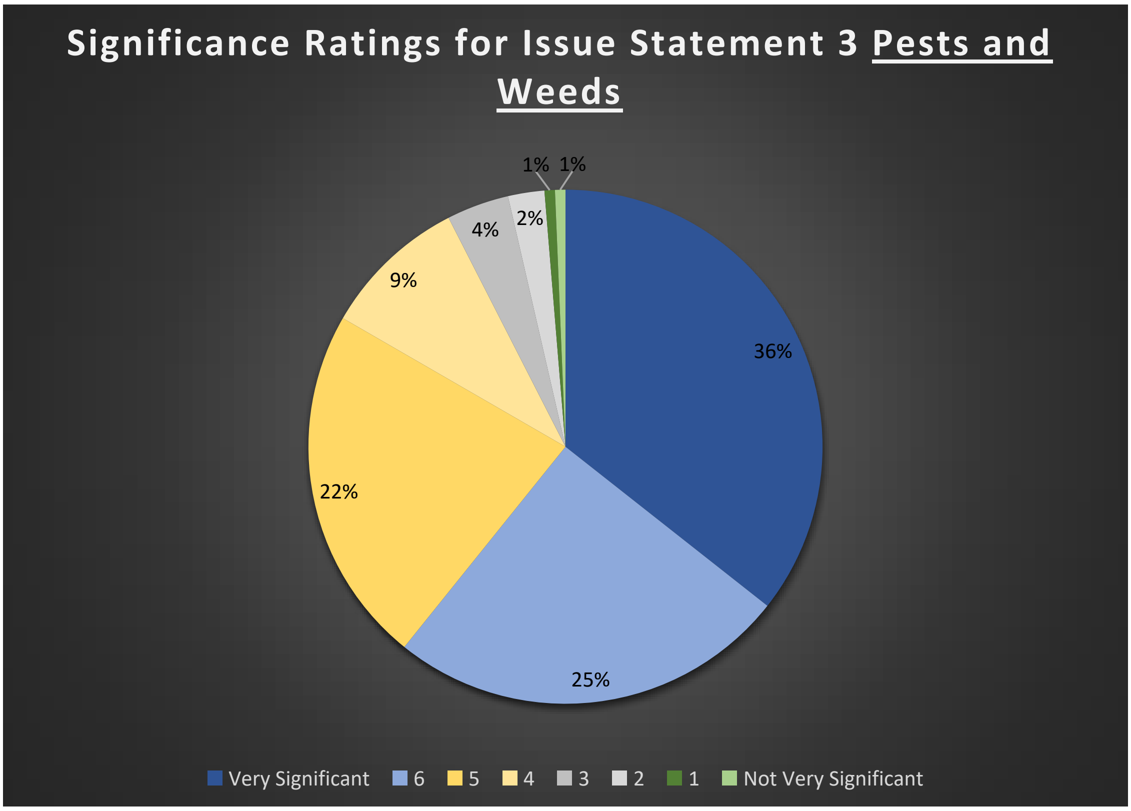

Figure 6

Comments Summary:

Rabbits affecting landscapes, tussock land, and soil quality followed by algal blooms in lakes and rivers were the primary concerns. There were a diverse range of solutions put forward by respondents for pest control, however there was division among respondents about how to consider and approach wilding pines as an invasive species. Effluent runoff was identified as a key issue and was perceived to provide and sustain the conditions for algal blooms in waterways. Suggested solutions by respondents included:

- Community groups and landowner initiatives combined with funding and leadership support from the ORC
- Introducing fines for landowners who were not managing pests on their property
- Reintroducing the rabbit board
- Utilising control viruses
- Placing bounties on pest species
- Reintroducing value on pest species' fur, meat and skin for economic usefulness to the community and self-funding the control initiative.

Issue Statement 4: Urban Growth

Urban growth affects productive land, treasured natural assets, infrastructure and community wellbeing. Natural resources lost to urban growth are gone forever. Frequently, places that are attractive for growth also have landscape and productive values. The growth of Wanaka and Queenstown is changing the natural landscape. Mosgiel's growth is occurring on some of Otago's most highly productive soil, which takes away the option for agriculture. Towns like Arrowtown, Clyde and Milton experience poor air quality in winter, while experiencing pressure to grow. How significant do you think this issue is for Otago?

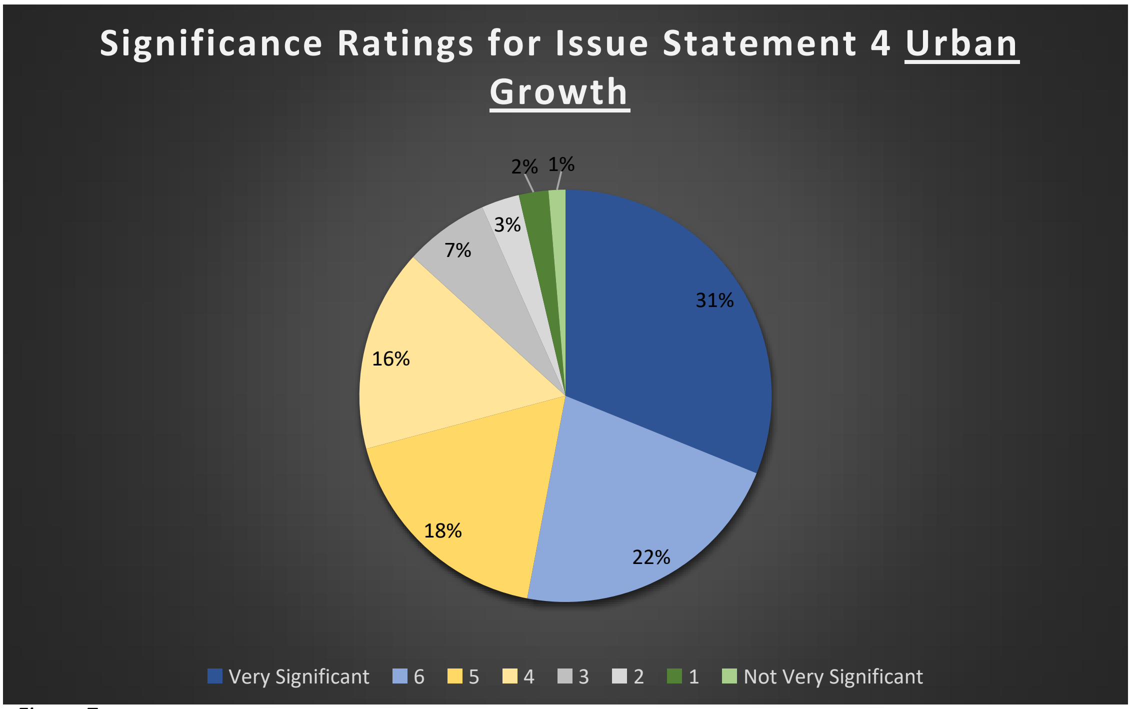

Figure 7

Comments Summary:

Inappropriate urban development was identified as a concern amongst respondents. The effect on productive soil, infrastructure, resource availability, and landscapes were identified. In addition, there was a desire to stop developments that would disrupt the natural character of landscapes, particularly around the Lakes District. Slowing down urban growth and development to better control it was considered an appropriate approach. There was support for long term urban development strategies, along with planning and investment into residential waste and water infrastructure to better manage urban growth. Solutions suggested by respondents included:

- Restricting consents for urban development to ensure development does not commence without first considering the strain on existing infrastructure
- Thorough land evaluations to ensure that strategic and productive land is not residentially developed

- High density housing in urbanised areas
- Developing centralised green spaces with high density residential dwellings to limit urban sprawl
- Local glass recycling plants
- Not consenting developments on flood plains or equally hazardous land
- Allocating mandatory garden blocks per square/km
- Upgrade transport infrastructure
- Ensure new developments are appropriately insulated and incorporate alternative heating sources to reduce wood burning
- Increase localised self-sufficiency of communities to reduce dependency on external supply routes.

Issue Statement 5: Water Demand

Water demand exceeds capacity in some places. In water-short catchments, water availability cannot meet competing demands from agriculture, hydro-electric generation, the community and the environment. Many of these catchments are also experiencing urban growth, increasing the demand on water supply. Some catchments are complex, making it challenging to identify or mitigate these effects. How significant do you think this issue is for Otago?

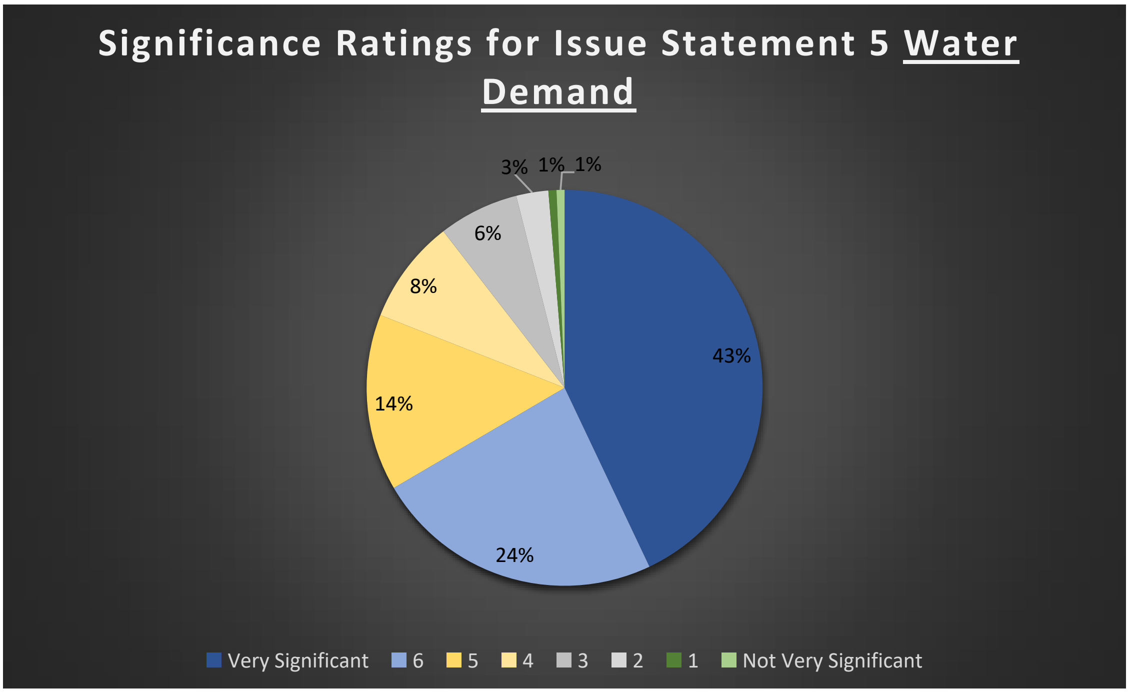

Figure 8

Comments Summary:

The primary concern was that existing water allocations had not appropriately taken community and environmental needs into account. Industries practising intensive land uses

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were perceived to have been allocated too much water, and there was support for an increase in water storage infrastructure to support existing industries and the community. In addition, there was support for ensuring appropriate water supply is available as part of planned urban growth. Suggested solutions by respondents included:

- Increasing water storage
- Appropriately considering existing water infrastructure before consenting new developments
- Improving land infiltration
- Ensuring all new houses have mandatory water tanks in their plans to ease pressure on central water supplies
- Researching the best uses for water based on where the water is, which should influence consents for water usage and land development
- No more water bottling for export overseas
- Reconsider consents for extensive irrigation of inappropriate land uses.

Issue Statement 6: Coastal Pressures

Otago's coast is a rich natural, cultural and economic resource that is under threat from a range of terrestrial and marine activities. Otago's coast provides habitat for rare species (including toroa and hoiho), outstanding landscapes, a rich food source, recreation, industry and potential for further economic use (aquaculture). Threats to it are not understood and not always well managed. From the sedimentation effects of inland development to waste disposal, human activity puts stress on the marine and coastal environment. Some of those activities, like Port Otago and tourism, are vital to our economic wellbeing. How significant do you think this issue is for Otago?

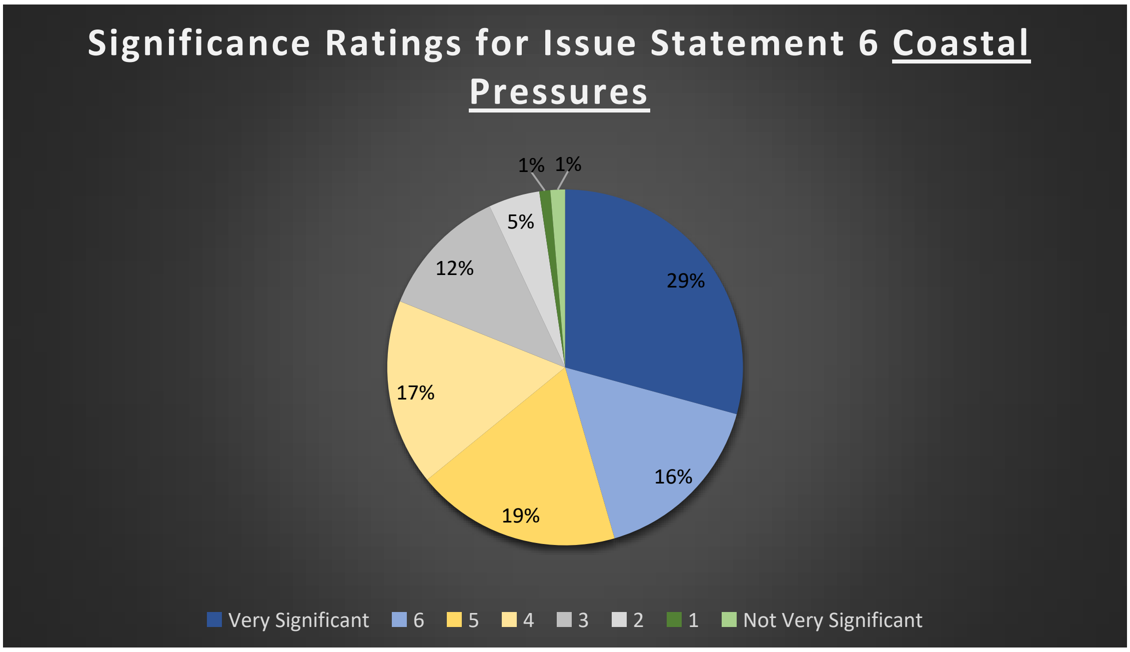


Figure 9

Comments Summary:

Overall coastal pressures were not rated as highly as matters of priorities compared to other issues. This was indicated by the significance being more evenly spread across the scale. However, pre-emptive measures to avoid future degradation were considered important for coastal health. There was a desire for collaboration between the ORC and key agencies to produce science driven, long term management strategies and to better understand the key specific pressures associated with Otago's coastline. It was suggested that ORC could work more closely with the University of Otago Marine Sciences to achieve a better understanding of coastal pressures faced by the region. A precautionary approach to coastal health is desired that prioritises positive environmental outcomes, whilst considering economic impacts. Current aquaculture practices are perceived to be a concern, and there was a desire for more marine reserves along Otago coastlines. Tourism was of some concern relating to coastal pressures, particularly the strain increased tourist numbers are putting on the coastal environment and associated infrastructure.

Issue Statement 7: Big Lakes Growth and Infrastructure Pressures

Lakes Wanaka, Wakatipu, Hawea and Dunstan attract visitors and new residents, putting pressure on their unique environment. The beauty, opportunity and climate of these lakes attract visitors and residents from the around Otago, New Zealand, and the world. This influx brings economic opportunity, but activities and services created to support it can degrade the environment that underpins the area's attractiveness. How significant do you think this issue is for Otago?

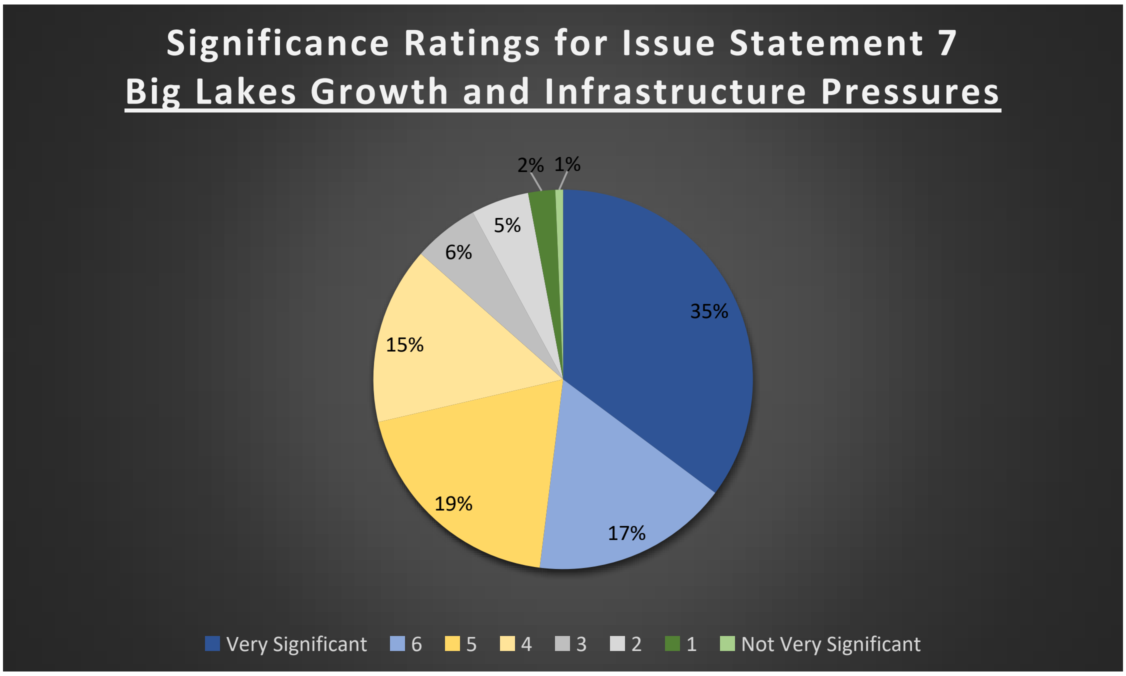


Figure 9

Comments Summary:

The most significant concern identified for this issue was the strain that increased tourism is having on existing waste management infrastructure. In addition, some respondents indicated in the 'Urban Growth' section that they wanted to cease or slow down developments affecting the natural character of landscapes around the lakes. There was a desire for the tourism industry to support the affected local communities in maintaining and upgrading waste management infrastructure. Tighter regulations of freedom camping was identified was sought, as was a consideration of a 'user pays' model. This was seen to help avoid the degradation of local landscapes due to waste dumping. Some suggestions by respondents included:

- Increasing minimum costs for tourists
- Increasing taxes or rates paid by the tourism industry
- Tighter regulations on freedom camping
- Slowing down developments to allow planning and management strategies to catch up
- Ensuring foreign operated tourism companies who profit off regional natural attractions pay accordingly.

Issue Statement 8: Impacts from Economic Activities

Economic and domestic activities use natural resources, but do not always properly account for the environmental stresses and future effects they cause. Sedimentation from development and forestry flows into streams and builds up in the coastal environment, *smothering kelp forests and affecting rich underwater habitats. Water abstraction and waste water and stormwater discharges risk degrading the natural environment, cultural and amenity values, and recreation. Mining and agriculture support employment and economic wellbeing but can also change landscapes and habitats. Otago's port moves freight to and from Otago and Southland, but operates alongside sensitive environments, including the Aramoana saltmarsh. Tourism, which relies on the environment, can also add to degradation. How significant do you think this issue is for Otago?*

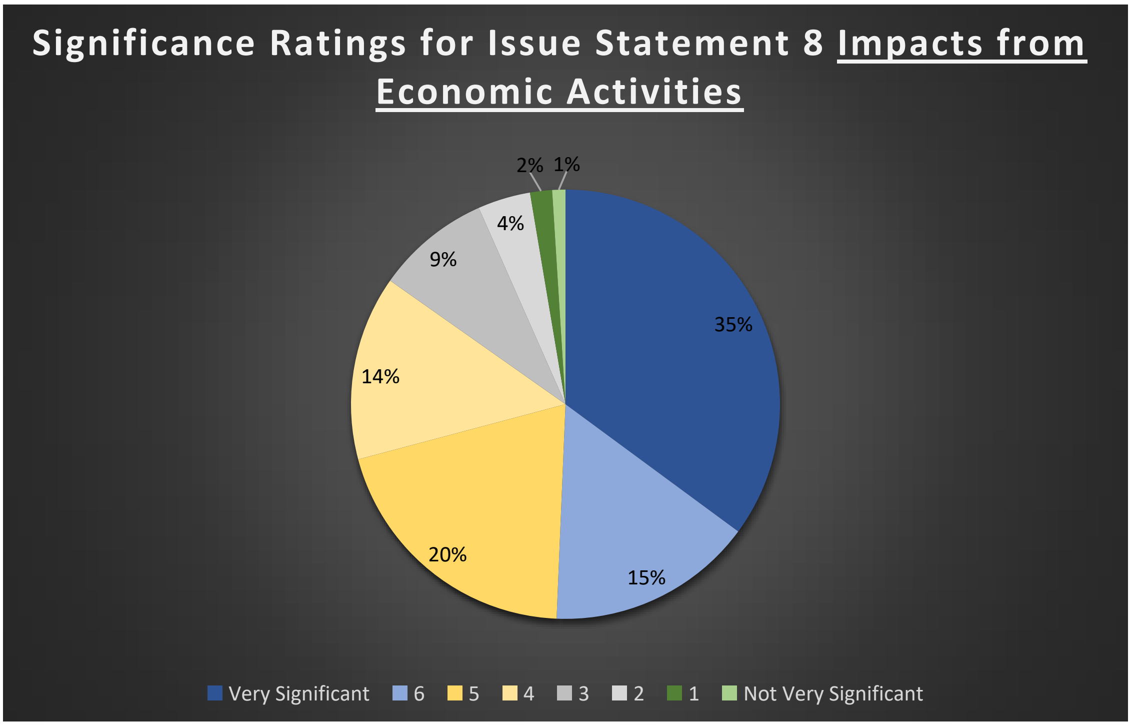


Figure 10

Comments Summary:

A precautionary approach to support positive environmental outcomes was desired by most respondents. More research into the true costs associated with environmental impacts should be driving long term strategies. Changes to more intensive land uses was a concern for many, and should only be supported where environmental impact is low. A strict 'polluter pays' consequence model was put forward by a number of respondents. Suggested solutions included:

- Research into true cost assessment, accurate representations of environmental damage and what issues are caused by which activities
- Education for both community and private sector based on the true cost assessment outcomes and further environmental harms research in order to positively influence community lifestyle and business practices

- Regulation and clear guidelines based on the true cost assessment outcomes and research in order to protect the environment while providing the private sector the means to achieve reasonable economic growth
- Establish consequences for not following regulation which includes a stricter 'polluter pays' approach and is harsh enough that it is only as a last resort for both the private and public sectors.

Issue Statement 9: Resilience

The environmental costs of our activities are stacking up and may soon reach a tipping point. How and where we currently live is likely to change significantly in coming years. To respond to all the issues identified in this RPS, we will need to consider changes to how we travel, the industries our economy relies on, and how we provide for good lives while protecting our natural environment. How significant do you think this issue is for Otago?

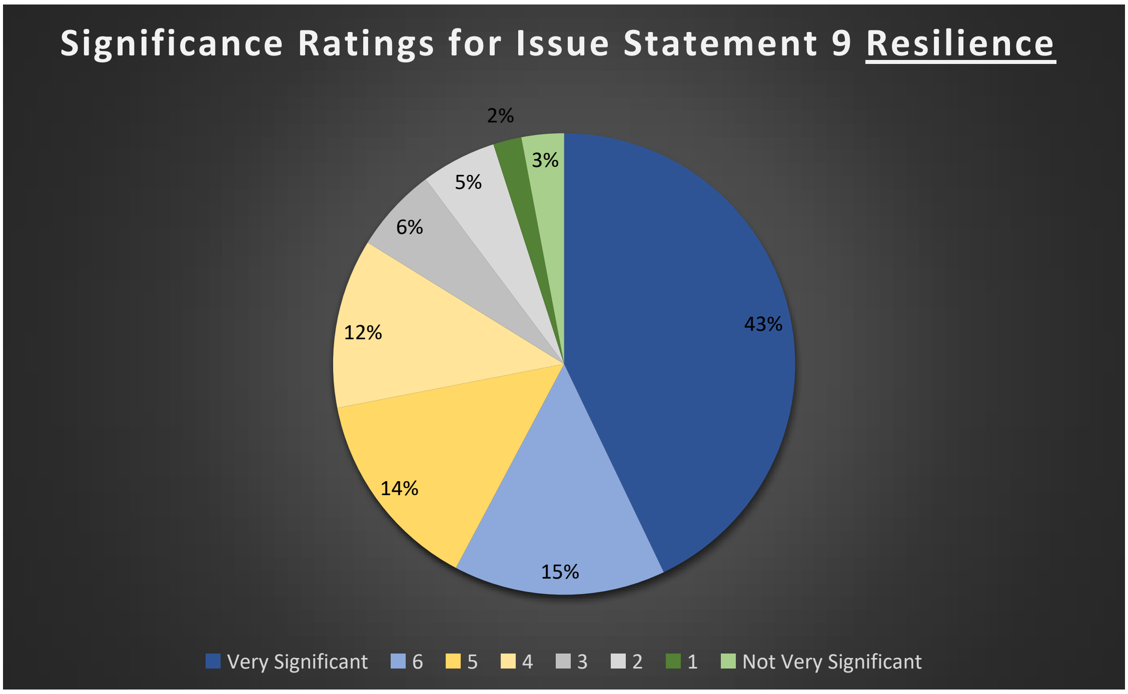


Figure 14

Comments Summary:

There was division between respondents as to where the tipping point lies for the environment in Otago and a call for more research and education to address this. However, consideration of both the environment and economy was important to many. Upgrades and investment into public transport infrastructure was greatly desired as a means to minimise environmental impact. Suggested solutions by respondents included:

- Upgrading and investing in public transport infrastructure such as buses and trains

- Developments making use of solar and/or wind energy should be enabled or subsidised by council
- Investigating trains for transport and supply routes
- Reducing cars in favour of public transport
- Upgrading and investing in existing infrastructure
- Consider renewable power subsidies for both residential and businesses
- Recognition that change and adaptation is necessary for both lifestyle on a small scale and how the private sector is operated on a larger scale

7. Summary of consultation findings: Phase two Consultation

7.1 Task One Summaries

The following section summarises the desired outcomes identified in Task One of the phase 2 consultation process. Where there were overlaps in the outcomes put forward by attendees, these have been condensed into a theme and summarised into a dot point.

Natural Hazards and Resilience:

The desired outcomes from the consultation sessions were:

- Upgrade stormwater and flooding infrastructure in flood prone areas
- Identify and support communities vulnerable to significant power loss or supply route isolation, such as Queenstown and the Catlins
- Maintenance of groundwater tables (inferred context is for protection from flooding)
- Remove sediment from waterways (inferred context is for waterway resilience and protection from flooding)
- Identify Otago based communities most vulnerable to isolation due to ruptures along the alpine fault.

Big Lakes and Infrastructure Pressure:

The desired outcomes from the consultation sessions were:

- Allow for flexibility in residential growth yet limit current rate of seemingly unchecked expansion
- Regulate tourism more restrictively
- Upgrade waste and sewage management infrastructure in Queenstown
- Cease the dumping of sewage into water bodies, including Lake Wakatipu
- Clean up Lake Snow and other algae from water bodies, including Lake Hayes
- Provide for flexibility, adaptation and protection of existing agricultural practices operating in natural landscapes
- Ensure urban areas are held to the same discharge standards as rural areas and businesses, including Dunedin and Queenstown.

Climate Change:

The desired outcomes from the consultation sessions were:

- Increasing water storage capacity to increase resilience *(This was the most sought-after outcome)*
- Increase adaptability of rural communities and mitigation of climate change effects
- Increase public transport options for the region
- Reduce emissions region-wide
- Regulate residential insulation to reduce energy wastage
- Support transition to alternative residential heating sources to reduce coal and wood burning
- Retreat from flood prone areas across the region, including South Dunedin
- Increase research into regional effects of climate change.

Coastal Pressures:

The desired outcomes from the consultation sessions were:

- Upgrade wastewater and sewage infrastructure connected to the coast
- Cease dumping waste into the ocean
- Identify and protect significant biodiversity from fishing and off-shore drilling
- Identify and reduce sedimentation affecting marine and coastal areas
- ORC should support and enable private coastal protection initiatives, such as re-planting in coastal zones
- Cease developments in coastal areas prone to erosion and flooding.

Economic Impacts:

The desired outcomes from the consultation sessions were:

- Establish strict environmental protections from harmful economic practices
- Provide policy pathways for economic activities to follow and demonstrate positive environmental outcomes without precluding economic opportunity
- Enable waste reprocessing to support a circular economy
- Increase investment into infrastructure related to tourism such as waste management and transport
- Identify and address the negative economic and environmental effects of tourism
- Regulate freedom camping
- Consistent rules for rural and urban landowners, private and public bodies around accountability of environmental impacts

- Irrigation and agricultural practices need to be regulated to protect water quality and water consumption

Water Demand:

The desired outcomes from the consultation sessions were:

- Increase water storage capacity
- Ensure urban expansion considers existing water supply infrastructure and does not impact rural water access
- Increase water access and supply for stock drinking
- Support and enable easier mitigations such as constructed wetlands and sediment traps
- Support and enable grey water recycling
- Enable and support the building of dams to capture and store winter water flows.

Pests and Weeds:

The desired outcomes from the consultation sessions were:

- ORC to support landowners and enable them to control weeds and pests
- Utilise stock grazing as a weed control method in areas where spraying is not an option
- Control rabbits, possums, wallabies (Kurow bridge), weasels, stoats, rats, mice, cats and dogs
- Reinstate the Rabbit Control Board
- Place bounties on pests and utilise furs, skins and meats
- Control gorse, broom, *Didymo*, *Lagarosiphon*, ragwort and wilding pines
- Use incentives rather than punishments for pest and weed control.

Urban Growth:

The desired outcomes from the consultation sessions were:

- Stop urban developments on highly productive land
- Intensify existing developments and build high density urbanised areas before developing outward
- Upgrade waste management infrastructure and invest in alternative waste disposal methods
- Upgrade and invest in alternative regional transport options such as rail for both passengers and supply routes
- Upgrade and invest in public transport options for urbanised areas
- Reduce impacts from urban run-off into waterways

- Regulate urban growth appropriately to meet the varying needs of different regional communities.

Biodiversity Loss:

The desired outcomes from the consultation sessions were:

- Set up and fund more parks like Orokanui
- Plan for the effects of unpermitted land use activities on biodiversity and threatened species e.g. illegal bike tracks through endangered snail habitats
- Provide research-based education, clear goals, and assistance on biodiversity practices to the community
- Protect biodiversity through both regulation and incentives
- Reduce the impacts pine forests are having on native bush
- Establish regional parks
- Restore indigenous habitats as a buffer for existing indigenous habitats
- Provide non regulatory support, partnerships, incentives and advice
- Create and urban ecological network in Dunedin by 2030
- Establish increased collaboration with DOC, TAs, Mana Whenua and communities
- Provide for existing use and acknowledge the importance of the primary industries' social, economic and cultural wellbeing
- Enable biodiversity banking as an incentive for landowners
- Identify which indigenous habitats are threatened and which are thriving.

Water Quality:

The desired outcomes from the consultation sessions were:

- One standard of water quality regulation for urban, rural, private and public sectors
- Water quality standards need to reflect both ecological and human needs
- No consenting for water bottling companies
- Remove silt from waterways
- Require 20m minimum riparian areas by all waterways
- Protect riparian areas and allow for grazing to control weeds
- Divert sewage to land instead of waterways
- Allow for innovation and flexibility in the farming sector by reducing restrictions
- Reward landowners who are low nutrient emitters
- All implementation of water quality management should be through partnerships to reduce strain on Council while additionally having greater social and environmental gains
- Provide research-based education on water quality improvement to the community
- Ensure water quality is suitable to drink and swim in throughout the region.

7.2 Task Two Summaries

The following section summarises the preferred policy approach identified in Task Two of the phase 2 consultation process. The consultation axis (see Appendix 1) showed the desired policy directions for each issue statement as indicated by community and stakeholder representation.

Natural Hazards and Resilience

The overall policy direction indicated by community workshop participants for natural hazards and resilience sought a balance between prescriptive and permissive approaches, and between environmental baselines and a return to a more natural state. Participants wanted to see a more prescriptive approach to avoid the consenting of developments on flood plains or in other hazardous areas. This also included the retreat of South Dunedin in preparation for rising sea levels.

Stakeholder workshop participants wanted to ensure flexibility in economic opportunity and innovation, and for the consideration of existing rights with any reconsenting related to land use.

Climate Change

There was an overall leaning towards environmental minimums in respect of climate change. However there was a division among workshop participants between prescriptive and permissive policy direction. Overall, participants sought an increase in climate understanding and research, increased water storage and public transport options, and reduced private car use to cut emissions.

Coastal Pressures

There was preference toward natural state among workshop respondents, with a division between respondents when it came to whether the policy approach should be prescriptive or permissive. Those seeking a prescriptive approach to policy direction sought restrictions on developments along or near coastal areas, the retreat of residential development from at risk coastal areas, and reduced waste disposal to the ocean. Those seeking a more permissive approach suggested responding to the natural effects of coastal erosion when they happen. Stakeholder workshop participants preferred a permissive approach to policy with outcomes more at the environmental minimum end of the spectrum to allow for flexibility in coastal land use, particularly related to coastal development.

Big Lakes Growth and Infrastructure Pressure

Community workshop participants sought outcomes towards a more natural state with prescriptive policy approach to regulating urban sprawl, development, upgrading infrastructure and water bottling around the big lakes. Stakeholder workshop participant indicated a desire for a permissive approach, with outcomes more toward the environmental minimum end of the spectrum and flexibility for innovation in both the agricultural and development sectors.

Pests and Weeds

Workshop participant sought a prescriptive policy approach to pest control and outcomes towards a more natural state. The key points were a desire to eradicate wilding pines and create new eco sanctuaries; holding landowners accountable for pest control; and reintroduction of the Rabbit Board. The highlighted pest and weed species were rabbits, wallabies, possums, gorse and broom.

Urban Growth

There were no clear patterns overall in workshop participants' responses for urban growth. Oamaru respondents showed a preference for a prescriptive policy direction and outcomes towards a more natural state. The Stakeholder workshop participants favoured a more permissive policy direction and outcomes at the environmental minimum end of the spectrum. Dunedin community workshop participants were divided across both axes. The overall themes were:

- Policy direction should consider the location of urban growth, where it is taking place, and reflect accordingly;
- Consents need to consider existing infrastructure before developments take palace;
- Air quality needs to be considered and new developments should be required to have alternative heating options and insulation to avoid wood burning;
- Urbanised areas should move to high density living where applicable to avoid sprawl and increase public transport options to support this.

Water Demand

Overall the emphasis was towards a permissive policy direction for water demand, with a division on the outcomes sought: some wanted outcomes closer to a natural state whilst others sought outcomes closer to environmental minimums in managing water demand. The key themes were supporting access to clean drinking water for everyone, agricultural uses, supporting flexible economic access to water, and increasing water storage for the region.

As mentioned previously the following two issues were added during the consultation sessions.

Water Quality

Overall the emphasis was towards a permissive policy direction for water quality, and a preference that they be closer toward the environmental minimums end of the spectrum. Some water bodies were singled out for being of concern. These were the Pomahaka River, Taieri River, great lakes and South Otago water bodies. It was suggested that locally managed or farmer-led catchment groups should be set up with ORC support. West Otago (Tapanui) and Balclutha workshop participants showed strong engagement with the water quality issue during Task One and Task Two, providing suggestions for outcomes. Some of the desired outcomes related to water quality were:

- Rewarding, not penalising, land users that are low nutrient emitters
- Allowing farmers to be innovative, not consent based
- Regulation should lead to direct environmental benefit
- Implementations should be through a partnership
- Stop grandparenting of nutrients

Biodiversity Loss

Overall, a more prescriptive policy approach with outcomes more at the environmental minimum end of the spectrum. Integrating native flora with urban development was a key theme, as well as general preservation of native flora. Maintain areas of native bush through regulation, implement controlled burning and grazing to reduce wildfires.

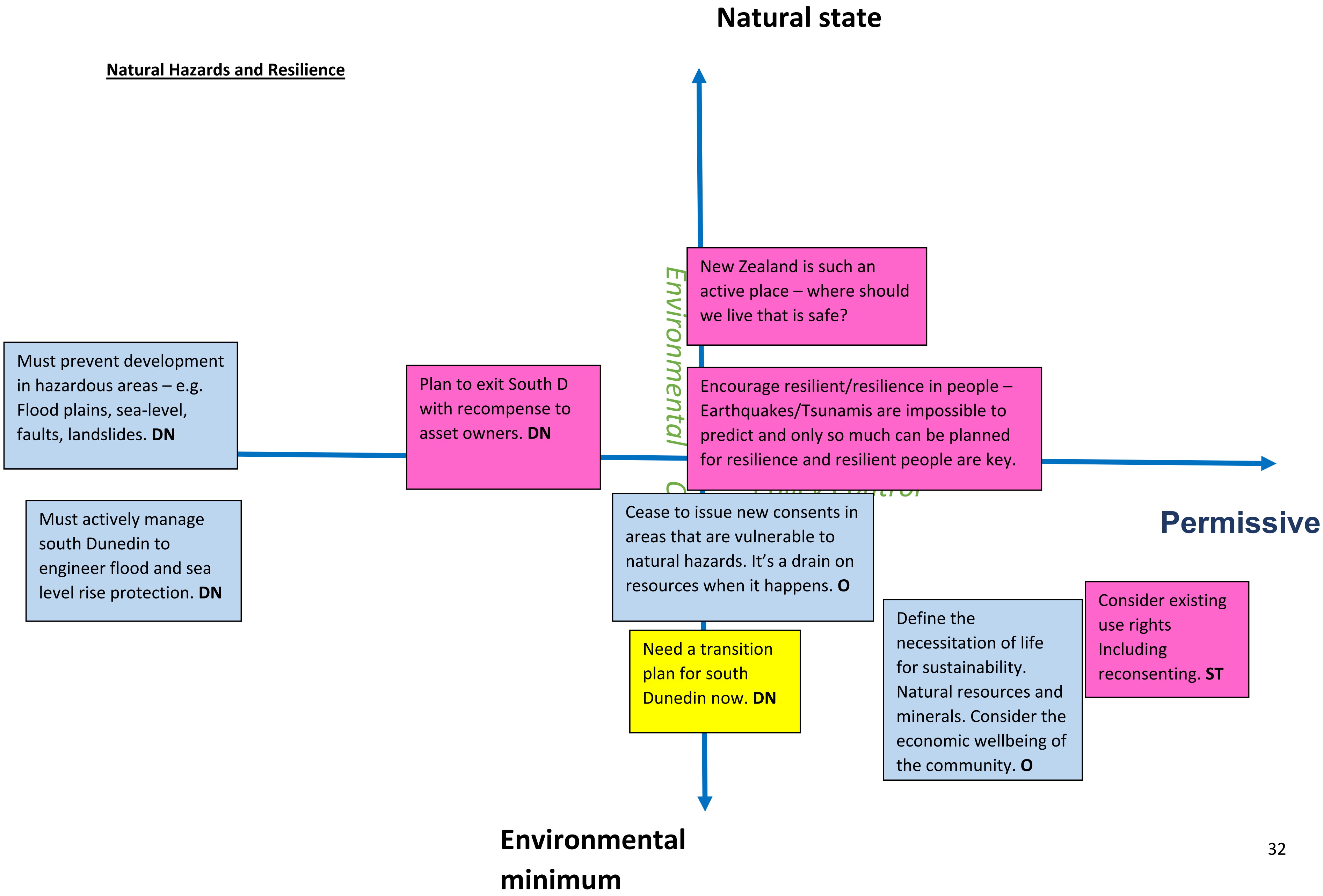
8. Next steps

The information gathered from the consultation process will be used to help define the key resource management issues and the policy direction for the RPS. The information from phase one will help the ORC policy team describe the key values and concerns held by the community, and the relative significance of the various issues. The information from phase two will help the policy team develop proposed outcomes and policy approaches to achieve these, guided by the directions signalled by community and stakeholder respondents.

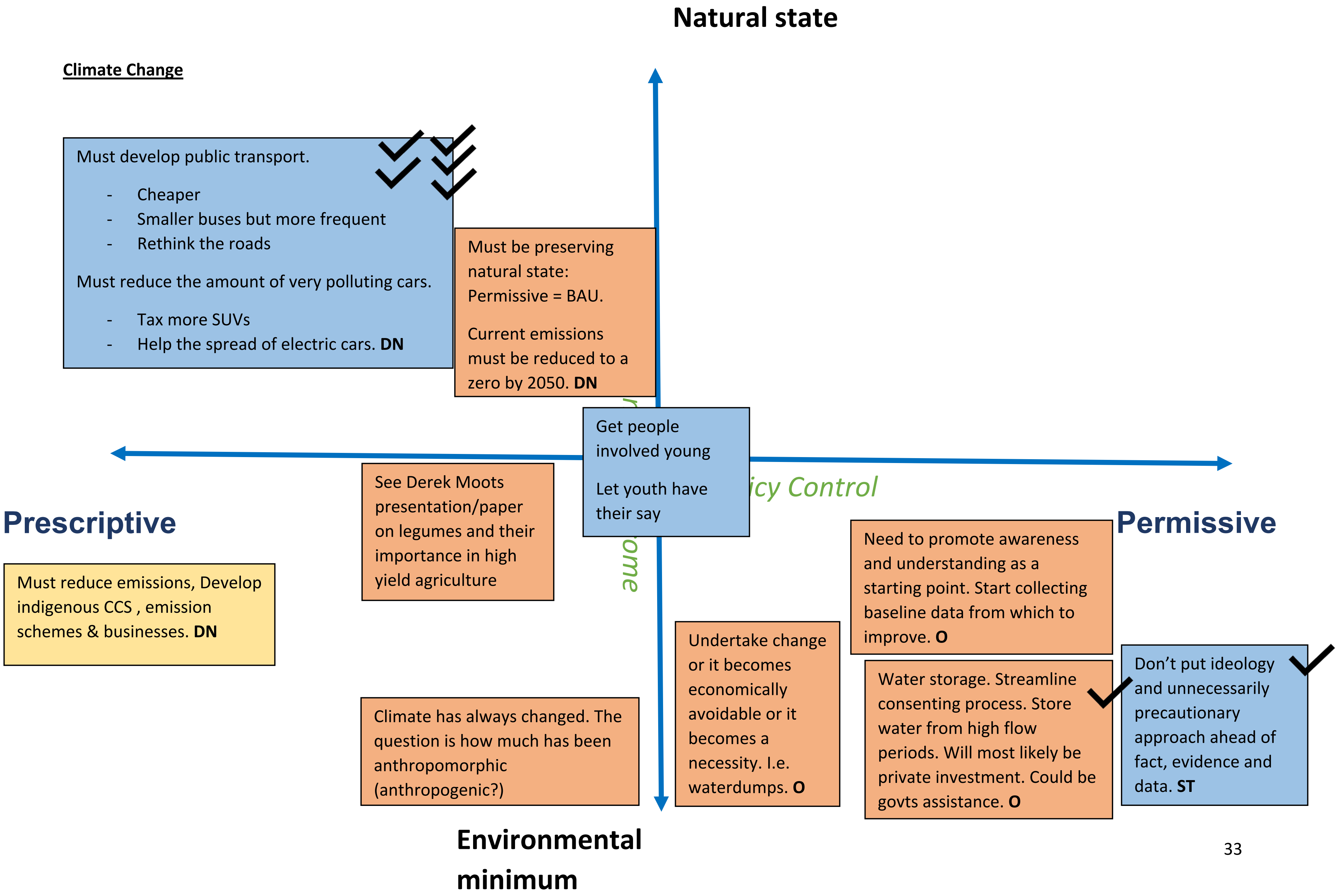
Further, Reference Groups are currently being set up for each of the topic chapters for the RPS. The Reference Groups will provide comments on the policy direction papers being prepared by staff. Phases 1 and 2 consultation have fed into the content of the policy direction papers, and the reference groups will provide the opportunity for input into the drafting stages of the RPS.

Appendix 1: Policy and Outcome Axes

Natural Hazards and Resilience



Climate Change



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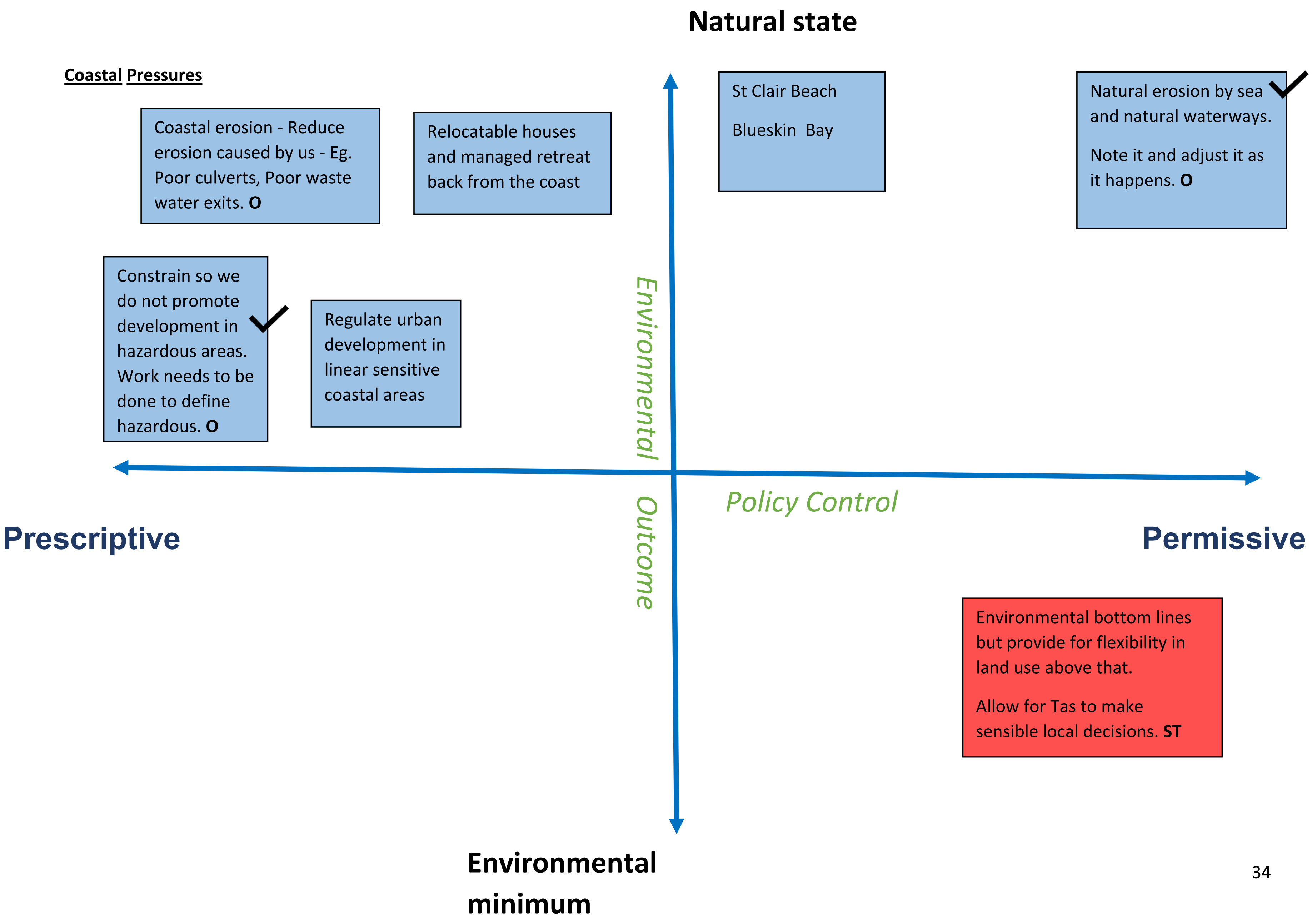
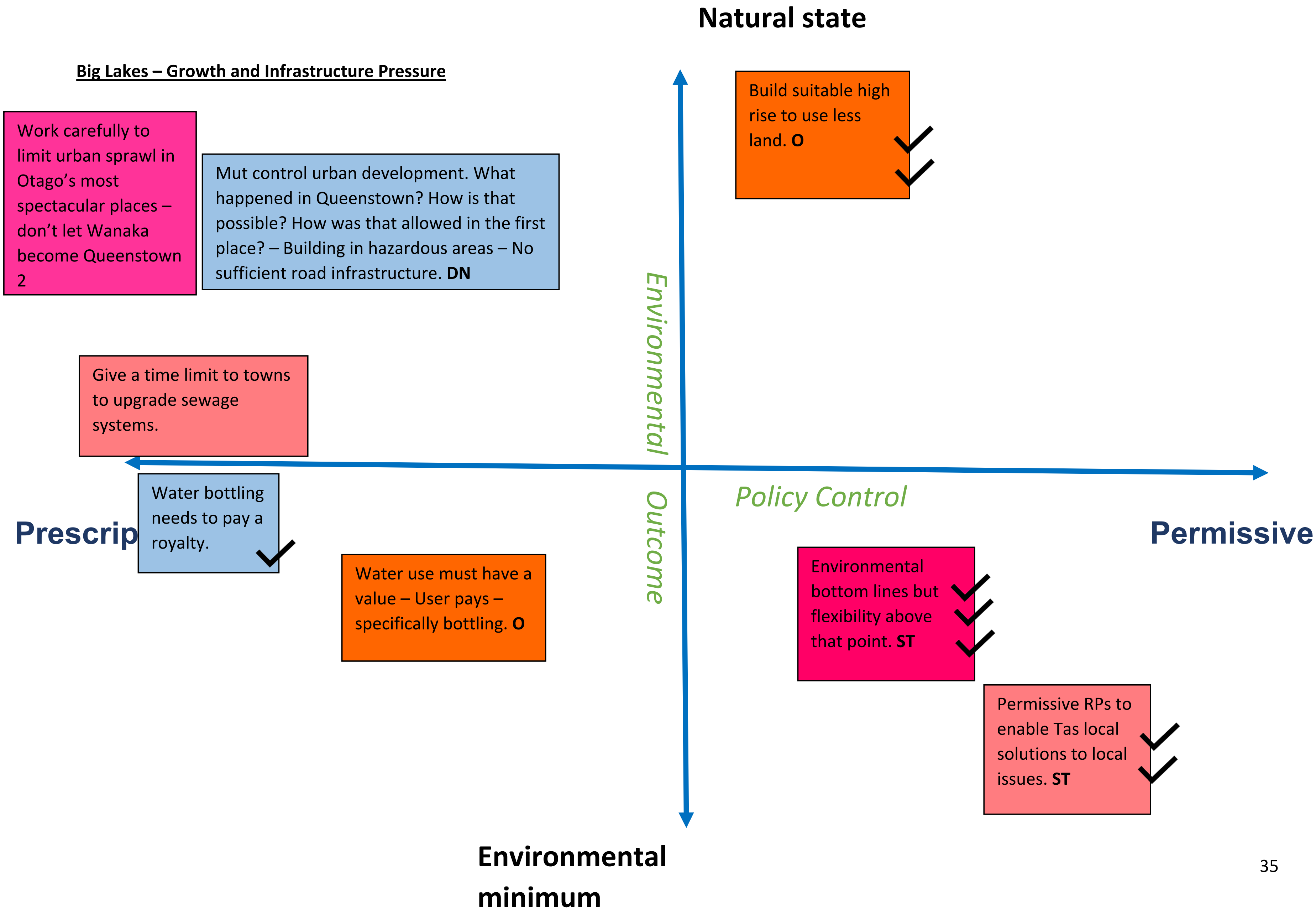
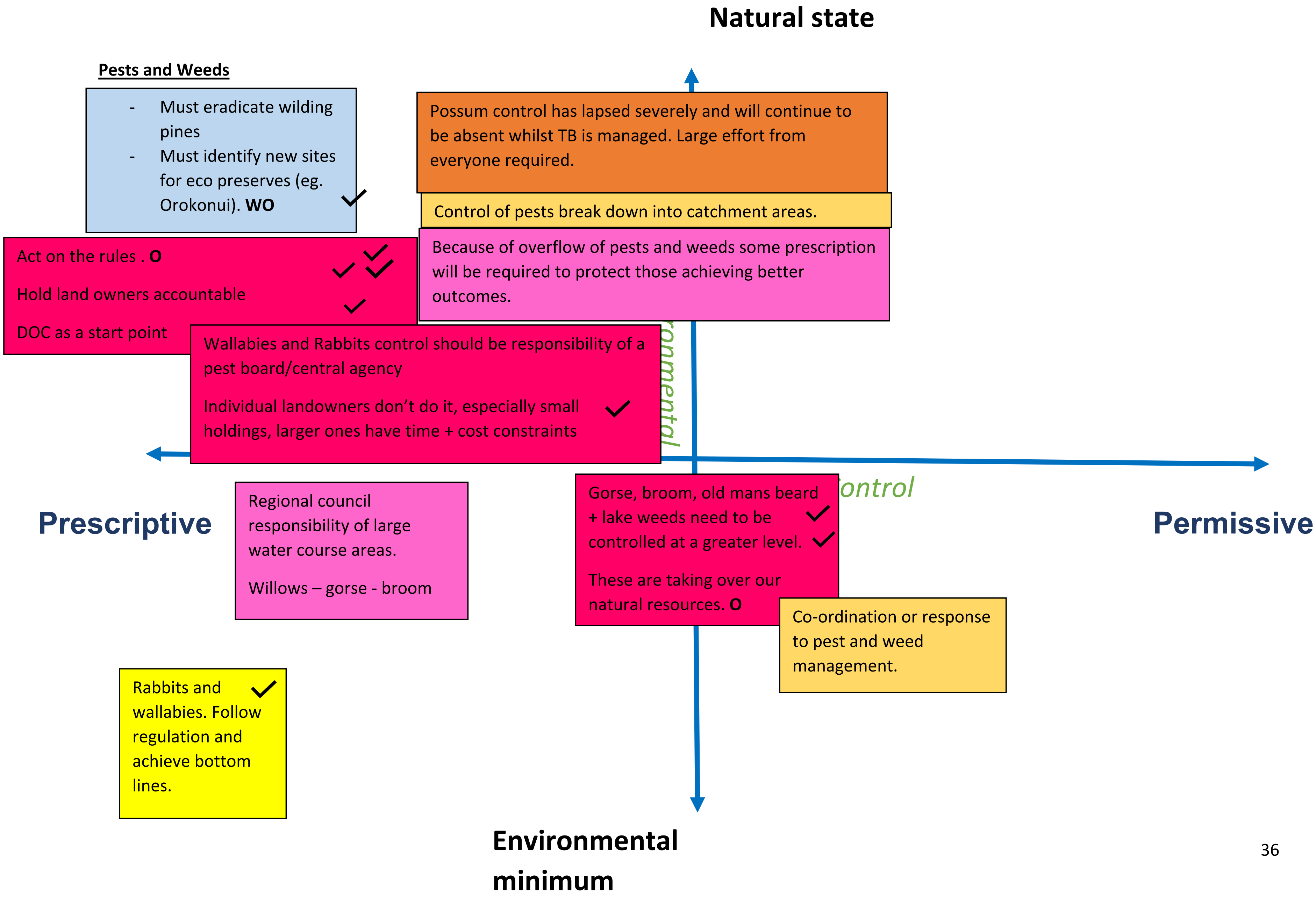

Natural state
Coastal Pressures
Coastal erosion - Reduce erosion caused by us - Eg. Poor culverts, Poor waste water exits. O
Relocatable houses and managed retreat back from the coast
St Clair Beach
Blueskin Bay
Natural erosion by sea and natural waterways.
Note it and adjust it as it happens. O
Constrain so we do not promote development in hazardous areas. Work needs to be done to define hazardous. O
Regulate urban development in linear sensitive coastal areas
Environmental
Outcome
Policy Control
Prescriptive
Permissive
Environmental bottom lines but provide for flexibility in land use above that.
Allow for Tas to make sensible local decisions. ST
Environmental minimum
34


Natural state
Big Lakes – Growth and Infrastructure Pressure
Work carefully to limit urban sprawl in Otago's most spectacular places – don't let Wanaka become Queenstown 2
Mut control urban development. What happened in Queenstown? How is that possible? How was that allowed in the first place? – Building in hazardous areas – No sufficient road infrastructure. DN
Build suitable high rise to use less land. O
Environmental
Give a time limit to towns to upgrade sewage systems.
Prescrip
Water bottling needs to pay a royalty.
Outcome
Policy Control
Permissive
Water use must have a value – User pays – specifically bottling. O
Environmental bottom lines but flexibility above that point. ST
Permissive RPs to enable Tas local solutions to local issues. ST
Environmental minimum
35


Natural state
Pests and Weeds
- Must eradicate wilding pines
- Must identify new sites for eco preserves (eg. Orokonui). WO
Possum control has lapsed severely and will continue to be absent whilst TB is managed. Large effort from everyone required.
Control of pests break down into catchment areas.
Act on the rules . O
Hold land owners accountable
DOC as a start point
Because of overflow of pests and weeds some prescription will be required to protect those achieving better outcomes.
Wallabies and Rabbits control should be responsibility of a pest board/central agency
Individual landowners don't do it, especially small holdings, larger ones have time + cost constraints
Prescriptive
Regional council responsibility of large water course areas.
Willows – gorse - broom
Gorse, broom, old mans beard + lake weeds need to be controlled at a greater level.
These are taking over our natural resources. O
Permissive
Co-ordination or response to pest and weed management.
Rabbits and wallabies. Follow regulation and achieve bottom lines.
Environmental minimum
36

Natural state

Urban Growth

Must reduce expansion in QT. **DN WO**

Halt the subdivision spoiling my delightful coastal view

B. B = This depends on where the growth will be within Otago? If in a township – which is nearing joining up with Oamaru, but infrastructure investment should be provided to support the development. **O**

Urban development should come with housing development. Environmental impact reduced.

Urban development should come with public transport! **DN**

B. Constrain places with bad air quality? Another = stricter requirement for home heating – Including good education on wood, the air quality, the changes required for air quality to be breathable. **O**

A. 1. Continue to provide for traditional form but – denser urban areas such as using existing 2x storied buildings that are vacant can be turned into accommodation
A. Constraining growth = No, would rather the growth at this stage. **O**

Urban development should include improved

Provide for appropriate urban growth and flexibility

Policy Control

Outcome

Prescriptive

Permissive

- Development can only occur where appropriate infrastructure available.
- Compact urban form that preserves productive land.
- Green infrastructure.

Must make land available in Dunedin Urban Expansion. **DN**

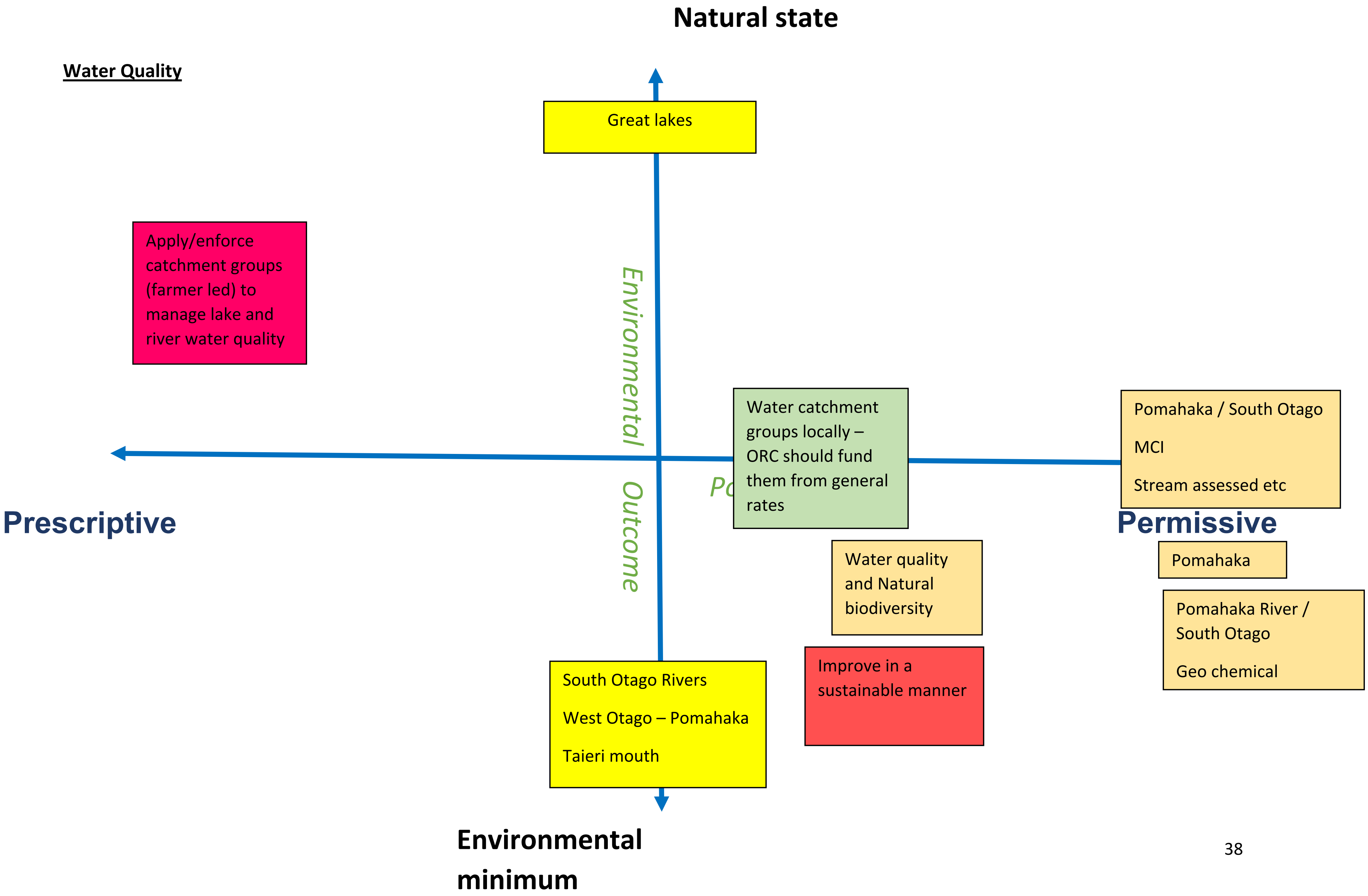
Environmental bottom lines but flexibility provided above that point. **ST**

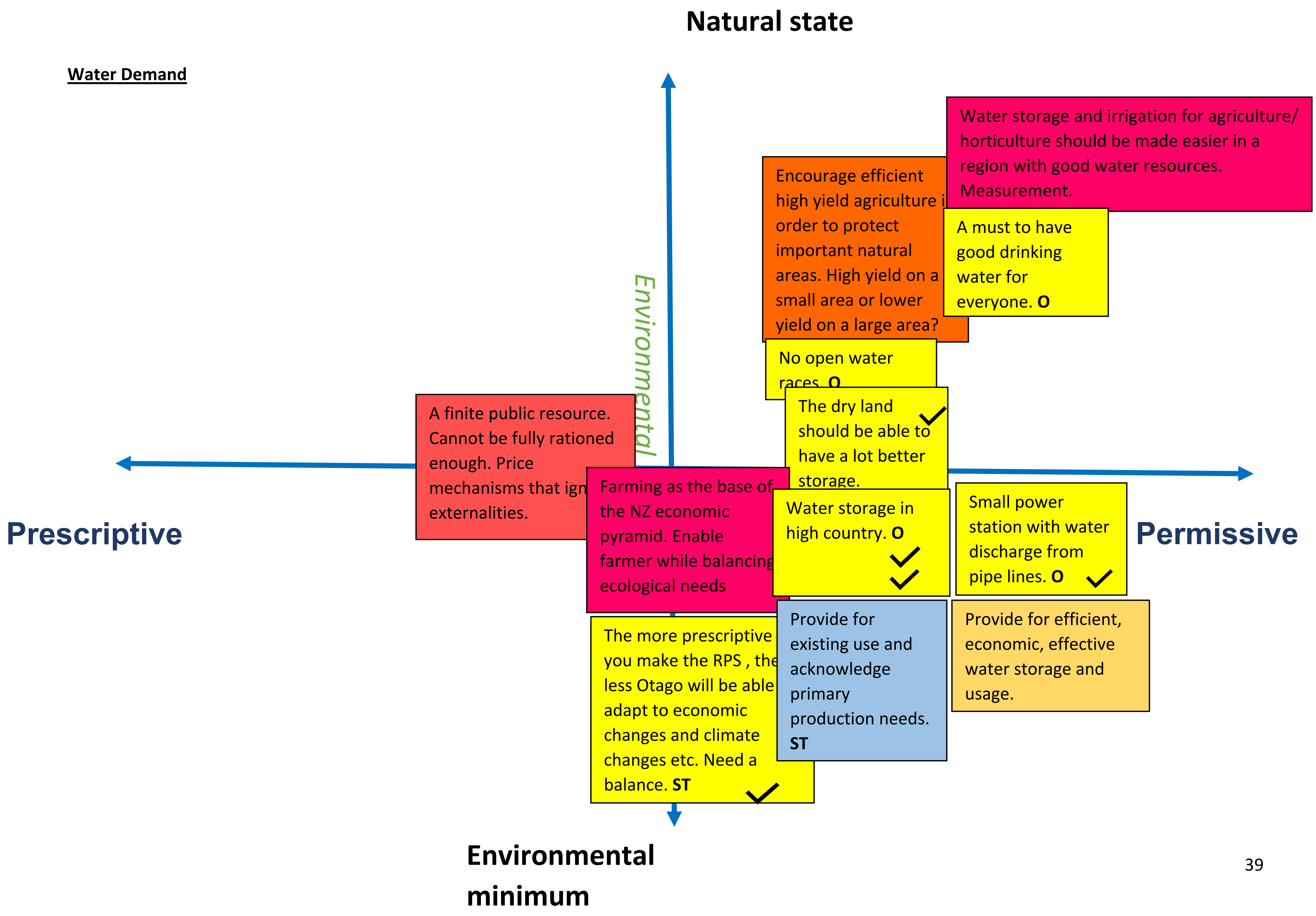
We need more science on how long it's taking for contaminants and nutrients to work through the soil profile.

Environmental minimum

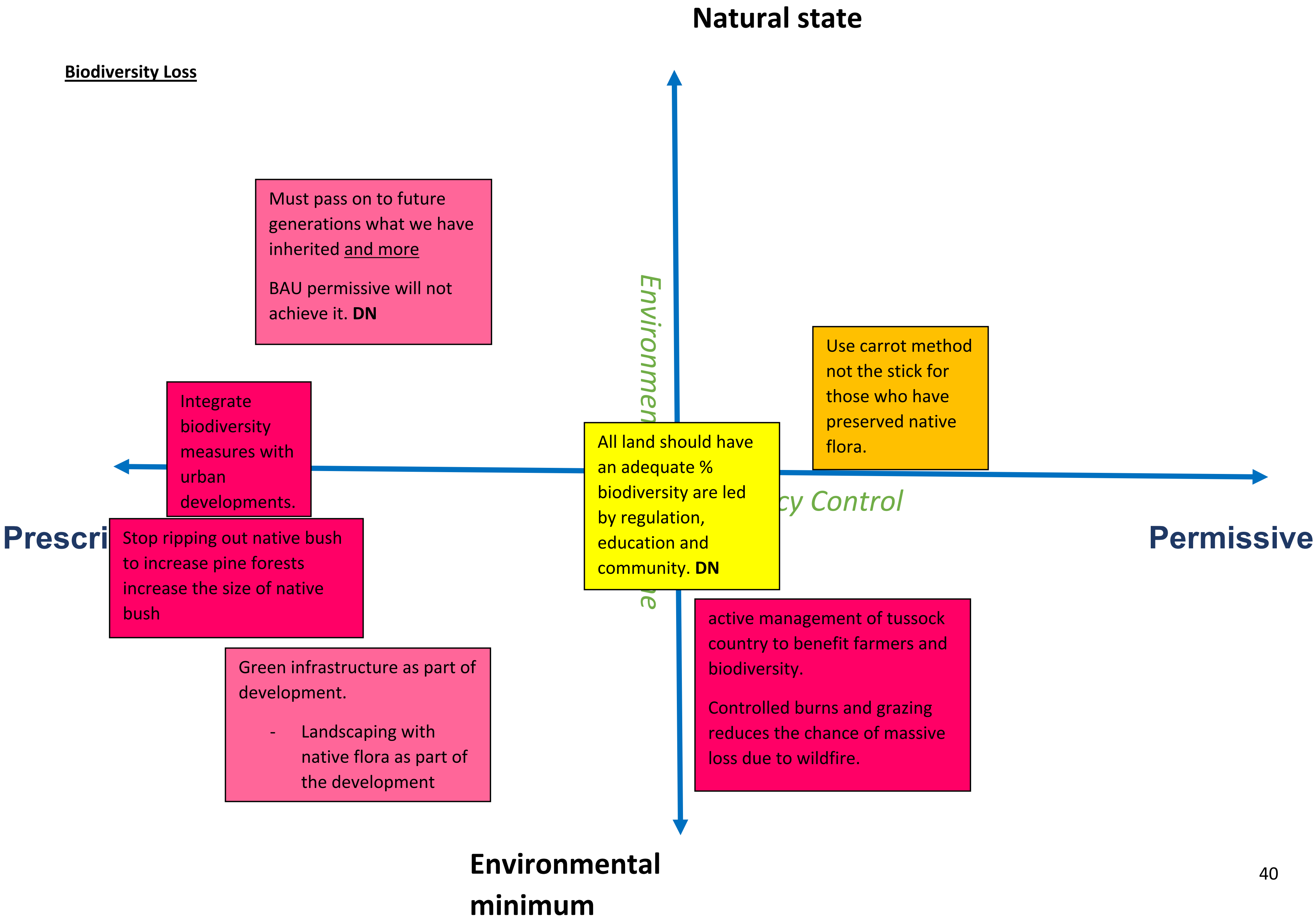
37

Water Quality




Natural state
Water Demand
Water storage and irrigation for agriculture/ horticulture should be made easier in a region with good water resources. Measurement.
Encourage efficient high yield agriculture i order to protect important natural areas. High yield on a small area or lower yield on a large area?
A must to have good drinking water for everyone. O
No open water races. O
Environmental
The dry land should be able to have a lot better storage.
A finite public resource. Cannot be fully rationed enough. Price mechanisms that ign externalities.
Farming as the base of the NZ economic pyramid. Enable farmer while balancing ecological needs
Water storage in high country. O
Small power station with water discharge from pipe lines. O
Prescriptive
Permissive
The more prescriptive you make the RPS , the less Otago will be able adapt to economic changes and climate changes etc. Need a balance. ST
Provide for existing use and acknowledge primary production needs. ST
Provide for efficient, economic, effective water storage and usage.
Environmental minimum
39

<u>Biodiversity Loss</u>



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Appendix 4: Phase 3 consultation summary report

Otago Regional Council

Otago Regional Council Regional Policy Statement Review:

Reference Groups Summary Report

August 21 - 2020

Table of Contents

Acknowledgements

The ORC would like to acknowledge and thank the members of each reference group for the time and effort they dedicated to helping shape the future of Otago. The RPS will be all the richer for the input the reference group members and representation from the Territorial Authorities provided . It is the time, effort and enthusiasm of Otago's community that ultimately creates the place we want to live in, and collectively improve and protect.

1. Introduction

Purpose

The RPS sets out what we want for Otago, what's stopping us achieving this, and how we will solve those issues. In accordance with the Resource Management Act (RMA) 1991, the RPS is required to provide an overview of the resource management issues of the region and set out policies and methods to achieve integrated management of the natural and physical resources of the whole region[1].

The RPS doesn't contain rules; it establishes the framework for Otago's regional and district plans, from which resource management policies, objectives and rules will sit. It includes how resources will be managed, including air, coast, land, freshwater and waste, as well as consideration of ecosystems and biodiversity, energy and infrastructure, hazards and risks, historical and cultural values, heritage, natural character, natural features and landscapes and urban form and development.

ORC is currently reviewing its Regional Policy Statement (RPS), and as part of the process we sought feedback during the drafting stage to inform and fine tune the policy direction. Part of this process involved seeking out suitably interested, qualified and/or experienced persons to participate in a series of reference group meetings, each reflecting a topic of the new RPS.

Partnership with Iwi

Throughout the review of the RPS, the ORC is working in partnership with iwi. The process of the reference group and the outputs which lead to policy directions for the RPS is no different. In drafting the policy direction papers, which form the basis of the Reference Group discussions, review and feedback was sought from iwi. This e the policy direction papers to have appropriate regard to managing resources in a manner consistent with relevant iwi management plans. Iwi were also invited to attend and participate in the reference group discussions, in order to hear the feedback from each group.

Staff are continuing to work with iwi - to finalise the policy direction following the reference groups, and as part of the drafting process for the new RPS.

The Reference Group Process

The members of the reference groups provided advice and guidance to ORC on a total of 11 Regional Policy Statement topics. The topics were broken up into two tranches and held on the following dates:

Tranche One	**Date**
Heritage and Cultural values	22nd June
Air	23rd June
Urban Form and Development	23rd June
Natural Character and Natural Features and Landscapes	25th June
Natural Hazards and Risks	26th June
Tranche Two	**Date**
Energy, Infrastructure and Transport	20th July
Coastal Environment	21st July
Land and Freshwater	23rd July
Ecosystems and Indigenous Biodiversity	24th July
Integrated Management	27th July

[1] RMA, section 59.

Policy Direction Papers were prepared on each topic from undertaking a review of the following:

- Existing provisions within the partially operative regional policy statement (PoRPS) for Otago;
- Central government National Policy Statements (NPS), which the RPS must give effect to, including any proposed NPSs that were available at the time;
- Feedback received during the online survey and community meetings held earlier this year on the significant issues for the region;
- Feedback from iwi. Prior to finalising the policy direction papers, each paper was provided to Aukaha and TAMI for their input and review, to ensure appropriate consideration was given to iwi resource management.

The objectives for the RPS Reference Groups were to:

- Provide input into policy direction, based on the knowledge and experience they each brought to the topic. The reference groups were not asked to reach consensus but rather provide ORC with input, and sometimes disparate, views to consider. However, this being said, where there was the opportunity for consensus on an approach, it was explored during discussion.
- Consider the policy implications of the policy directions paper on the use, development and protection of natural and physical resources.
- Critically review policy direction papers relevant to the topic / chapter of the new RPS.

The time commitment from participants was a minimum of a half day to join in the online reference group discussion, and then time across the two-weeks following to provide written feedback if they wished as well as time prior to the online sessions to review and familiarise themselves with the position papers. The ORC initiated the help of a facilitator from Fairway Consulting to facilitate across the reference group sessions. The facilitators role was to keep the sessions moving forward, keep them structured and facilitate fair, open discussion. Additionally, there was a dedicated scribe to take comprehensive notes throughout the sessions. This ensured a structured review process and useful capture of relevant information.

The Selection Process

A 3-step process was designed:

Step 1 – Expressions of interest due:

Expressions of interest were advertised widely, seeking nominations for all reference groups across two weeks at the end of May 2020. The criteria for candidates were simple: people who had expertise and experience related to a specific tranche topic.

Initial Nomination numbers:

The following sets out a breakdown of the number of applications. There were 188 reference group nominations received across the following 11 RPS topics:

- 54 for land and freshwater
- 22 for urban form and development
- 19 for coastal environment
- 19 for ecosystems and indigenous biodiversity
- 18 for integrated management
- 16 for hazards and risks
- 14 for energy, infrastructure and transport

- 13 for air
- 9 for historical and cultural values
- 4 for natural character, features and landscapes

Step 2 – selection:
An integral part of the selection process was the appointment of a selection panel, comprised of two elected members and two staff, one of whom was at an executive level. On 28 May, the nominations for the first tranche were collated by topic area and provided to each selection panel member by email for their review and shortlisting. In mid-June, the same process occurred for the second tranche of nominations. The panel then reviewed the nominations and identified their own shortlist of up to 10 participants for each reference group based on their assessment against the following criteria:

1. Having an intimate understanding or expertise in the topic area.
2. Having community and/or stakeholder connections across a few associated networks.
3. Having the ability and supporting tools to participate in the online facilitated discussion i.e. Zoom meeting.
4. Having demonstrated ability to fulfil the role.

Reference Group Attendees

The successful candidates came from a wide range of backgrounds, and locations. There were a significant number of participants who were new to regional council processes, and one of the advantages of running the online style was that location was not a constraining factor. A complete list of reference group members for each topic is included in Appendix 1. In addition to the members listed in the appendix, a councillor sponsor, ORC staff, supporting consultants, the facilitator, and the scribe were present at all the reference group sessions. Additionally, a representative from TAMI attended most of the sessions to provide iwi perspective. Aukaha chose to input into the initial policy direction papers and were not present during the reference group sessions.

2. Reference Group Feedback Summaries

Set out below, by topic, is a summary of the feedback received from the Reference Groups. Also included is an overview and context of each topic, and the identified opportunity for this RPS review to address following the review of the PORPS, central government policy directions and feedback from initial community consultation on identification of issues.

Air

Overview and Context:

Air pollution resulting from particulate matter and odour can affect human health and wellbeing and cause nuisance and amenity effects including poor visibility or soiling of surfaces. Fine particles are typically a result of human activities such as the combustion of solid fuel (wood or coal) for home heating, industry and motor vehicles. Air is significant to tangata whenua because of the relationship of air to other resources such as water, flora and fauna, and its life supporting capacity. Offensive discharges to air (such as odour) can affect wāhi tapu and discharge of dust can adversely affect mahika kai sites. The National Environmental Standards for Air Quality (NESAQ) came into effect in 2004 and were updated in 2011. The intent of these standards is to provide a guaranteed minimum level of health protection for all New Zealanders. The Ministry for the Environment is currently working on an updated NESAQ. Consultation on the revisions to the NES concluded at the end of July and any revisions to it are not expected to be gazetted until the first quarter of 2021. The substantial change within the proposed NESAQ that will affect Otago is a change to monitoring $PM_{2.5}$ *(instead of* PM_{10}*)* and a reduction in emissions standards for domestic burners. The change to $PM_{2.5}$ will likely result in Otago recording a higher number of exceedances in Air Zone one and two towns.

Air quality monitoring results show that for most of the year, Otago's air quality is very good. However, during the winter when home-heating increases, many towns in the Otago Region do not comply with the ambient air quality standards set out in the current NESAQ or the Regional Plan: Air. Due to a continued trend of frequent exceedances, and potentially more exceedances as a result of proposed amendments to the NESAQ, combined with the Air Plan being overdue for review, an opportunity presents for the RPS to provide clearer direction to manage air quality. While some parts of the Partially Operative Regional Policy Statement (PORPS) remain relevant and appropriate, some provisions require revision to improve their clarity in their application to air quality management, address issues raised by the community, and ensure the new RPS responds to the requirements of the NESAQ and National Planning Standards.

Opportunities:

A review of the partially operative RPS showed there were a number of opportunities available through the review of the RPS. Notably, there is an opportunity to better align with the NESAQ and to address ambient air quality to protect the health of people in Otago. Additionally, the issue of domestic solid fuel burners is a persistent problem in Otago and contributes to poor air quality. There is an opportunity to address this issue by promoting the use of cleaner fuels and new, clean burning, domestic heating technologies. Finally, the RPS has an opportunity to provide more guidance and direction to local authorities for the management of odour, discharge of particulate matter and to address the tensions between dense urban forms and growth and air quality.

Summary points from Reference Group:

Below is a summary of the key points raised through the Reference Group

Air Quality

- Greater direction for improvements in areas where air quality is poor as well as preventing the decline in air quality, especially where it is currently good.
- There was a preference from Reference Group members for the use of concise, meaningful language that describes a clear outcome.
- Addressing air quality is a bigger problem than that which can be achieved through the RPS and regulation. There was considerable support to including non-regulatory methods which direct the Regional Council and Territorial Authorities to advocate for change in relation to elements such as improving buildings standards, prohibiting the sale of non-compliant burners and resilience in energy supply.
- The Reference Group were supportive of strong policy direction associated with the prohibition of non-compliant burners and of clear timeframes for compliance.
- There was support for improvements to air quality being presented as a long-term outcome, with a 30-year transition period, with milestones along the way.
- There was no clear preference on whether the term "offensive and objectionable" should continue to be used, however, if it is to be used going forward, there was support for defining the terms or providing criteria, so it is clearly understood for RPS users.

Outdoor Burning

- Outdoor burning was considered an issue that would benefit from management and direction at the RPS level, and consideration should be given to the availability of data to support including an appropriate management approach.

General Discussion

- The integrated management of transport and urban growth will assist in achieving good air quality in the Region.
- The relationship between air quality and climate change was another matter raised by members of the Reference Group that could be considered by the RPS.

Heritage and Culture

Overview and Context:

Historic heritage is defined in the Resource Management Act 1991 (RMA) as natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, and includes archaeological, architectural, cultural, historic, scientific and technological qualities. It includes historic sites, structures, places, and areas; archaeological sites; sites of significance to Māori (including wāhi tapu) and surroundings associated with the natural and physical resources. Otago is a region rich in historic heritage, with cultural and historic heritage places and areas that are recognised as nationally, regionally and locally important. Sites and resources used by Kāi Tahu ki Otago[2] are spread throughout Otago, and form part of wider cultural landscapes (wāhi tupuna). Wāhi tupuna embody both the customary and contemporary relationships of Kāi Tahu and their culture and traditions. Kāi Tahu has a special relationship with their ancestral lands, water, sites, wāhi tapu, and other taonga. Broadly, this Maori relationship is recognised as a matter of national importance.

The National Planning Standards separates out the significant resource management issues for the region identified by Council, and the significant resource management issues for iwi. Kāi Tahu ki Otago have identified key resource management issues for iwi, which includes Wāhi tupuna. Previously, Kāi Tahu have identified that the mauri and wairua of some places, sites, resources and the values of cultural, spiritual or historic significance to Kāi Tahu have often been destroyed or degraded.

A review of the district plans that give effect to the PORPS was undertaken by Heritage New Zealand Pouhere Taonga[3], where they note that the Dunedin City and Queenstown Lakes District plans both generally align with the PORPS, but greater alignment could be achieved if both plans had stronger provisions to protect sites of significance to Maori. Further, through the development of the second-generation district plans for QLDC and DCC, ORC is aware of issues with the terminology used in the PORPS around identifying and then protecting regionally and nationally significant historic heritage.

Opportunities:

There are opportunities in the new RPS to clarify the terms regionally and nationally significant heritage, to provide direction and guidance on identifying sites and areas of significance and to build methods that will enable a closer relationship between iwi and regional and local authorities to

[2] The collective term Käi Tahu Ki Otago is used to describe the four Papatipu Rünanga and associated whänau and röpü of the Otago region.
[3] National Assessment RMA Policies and Plans – Heritage Provisions, December 2018.

achieve this outcome in relation to wāhi tapuna. More broadly, there are opportunities to provide more clarity in the provisions and recognise Ngai Tahu values when it comes to wāhi tupuna.

Summary points from Reference Group:

Below is a summary of the key points raised through the Reference Group.

Language

- Participants preferred clear and firm directives for managing historic heritage to ensure a consistent approach across the region.
- Members of the Reference Group are supportive of the objectives providing for a more holistic approach to heritage by looking both forwards and to the past.
- Support for the inclusion of clear criteria to identify significant heritage values.

Regional Themes

- Preference for the policies to list the heritage themes that are significant and relevant to Otago, as a way of setting out the values that need to be considered when identifying significant heritage sites, areas and buildings.
- No clear preference was provided by the Reference Group for requiring both nationally and regionally significant places or areas to be identified through the RPS, nor was there particular support for a "three tiered" approach[4]. There was agreement however that clarification from the approach in the PORPS was required.
- Participants supported the use of an existing set of criteria for identifying historic heritage values, such as that used by Heritage New Zealand Pouhere Taonga (HNZPT) to assess heritage items for inclusion on the HNZPT List/Rārangi Kōrero.

Cultural Values

- There was some uncertainty from the Reference Group members if "cultural values", in the context of the historic and cultural values chapter, are specifically Kāi Tahu values or whether they apply to all cultures in New Zealand.

Natural Hazards

Overview and Context

The Otago region is exposed to a wide variety of natural hazards that impact on people, property, infrastructure and the wider environment. The effects of natural hazards vary in terms of both their likelihood and consequence. The adverse effects of natural hazards are generally best managed by avoiding development in areas which are known to be subject to natural hazards. Avoidance of adverse effects is the right principled position; however, growth pressures can create situations where this is not always an option. Therefore, in some situations, mitigating the effects of natural hazards to tolerable levels will be a feasible option to ensure the health, safety and wellbeing of the community.

Hazardous substances, contaminated land and waste materials can cause adverse effects on both human health and the environment through both short-term and long-term exposure. Historic land use and storage of hazardous substances have left a legacy of soil contamination in New Zealand. This

[4] 'Three Tiered' refers to the addition of a third significance category related to identification and management criteria for historic heritage.

contamination has been largely caused by historic practices in which chemicals were manufactured, used, stored and disposed of in ways that are considered unacceptable by today's standards. While councils do have a general ability under the RMA to manage hazardous substances, in most cases, the Hazardous Substances and New Organisms Act 1996 and the Health and Safety at Work Act 2015 controls are adequate to avoid, remedy or mitigate adverse environmental effects of hazardous substances.

Opportunities:

Whilst the review of the PORPS showed that the provisions relating to Natural Hazards are reasonably robust, there are a number of opportunities for improvement in this chapter. Broadly, there is room for more directive and clearer provisions. The inclusion of a new framework to provide further clarity on assessing significance of risk is an opportunity, and as such three options were provided to the reference group: a qualitative, a quantitative or a semi-quantitative approach. The opportunity to provide further clarity on assessing community tolerance of risk is also a worthy consideration for the new RPS. Finally, there was an opportunity for the new RPS to address existing use rights and the risk levels associated with current use. The Act currently provides for regional councils to extinguish existing use rights under Section 10 of the RMA.

Summary points from Reference Group:

General Discussion

- The Reference Group indicated that the current PORPS objectives were reasonably well balanced. However, they suggested that the objective that seeks to minimise risk is not as strong as it could be, and the concept of 'minimising' risk is open to interpretation.
- It was suggested that the objective should require levels of risk from natural hazards to be reduced to a moderate or tolerable or some other descriptor of a low level.

Significant Risk

- A semi-quantitative framework work for assessing the significance of a natural hazard risk was preferred by the reference group. It was noted that the Bay of Plenty RPS includes a similar framework. A risk matrix may help respond to this approach.
- Community input into the understating of risk was important in defining significance of risk.
- There was support for expanding on the current approach in the PORPS, which steps through the hazard and consequence identification and then response options for when you identify a risk.

Community Tolerance

- A risk matrix could be used to define what the tolerable level of risk is. This would help existing provisions that use the term "community tolerance of risk". Much discussion was had however that the level of community involvement and engagement you need in order to undertake such a process is significant. This also has a direct correlation with timing.

Existing Use Rights

- There was support for existing use rights to be maintained in the RPS but the terminology to be changed to 'managing existing land uses', as there are a variety of options available to manage existing land uses to reduce risk before extinguishing existing use rights. The RPS needs to be specific about what level of risk needs to be reduced if existing use rights are to be managed.

Natural Hazard Mitigation Works

- The RPS needs to include policy that identifies how natural hazard mitigation works should be managed in sensitive areas, ensuring that values can be protected, whilst the risk is managed.

Urban Form and Development

Overview and Context:

Urban growth and development results from, and facilitates communities providing for their economic, social and cultural wellbeing. Well-functioning urban places are dynamic and efficient, enable human social interactions and provide a wide variety of housing, employment and recreational opportunities that meet changing needs and preferences, in a way that maximises the wellbeing of all its present and future inhabitants, and respects its history, its setting and the environment.

Adverse impacts from inefficient or poorly planned urban development impacts on *people* – both on individual and community wellbeing. The concentration of humans and human activities can also generate adverse impacts on the natural environment, including by land consumption, waterway and vegetation modification for housing, industry and play areas, the diversion and use of water, and waste disposal and effluent and discharges to air, land and water, all of which can also impact mana whenua values.

Consultation undertaken in February and March 2020 that sought feedback on the nine draft Issues for the RPS, included a specific Urban Growth issue. Inappropriate urban development was identified as a concern amongst respondents in written comments to many issues. The effect on productive soil, infrastructure, resource availability, and landscapes were identified. There was support for long term urban development strategies, along with planning and investment into residential waste and water infrastructure, improved public transport, walking and cycling, and minimising loss of productive land as possible means to better manage urban growth.

Opportunities:

Broadly, there is an opportunity to provide increased specificity for outcomes, processes and criteria in the new RPS, and bring the provisions in line with the new national level requirements. In particular, the new RPS has an opportunity to address gaps in strategic spatial planning across the region. Due to the varying degree at which developments occur across the region, consistency and coordination in the planning framework is required that also accounts for specific issues that may need management, including environmental outcomes. Additionally, incorporating Kai Tahu values in urban planning framework is a key opportunity for improvement. Finally, urban planning that ensures appropriate infrastructure, including services, is vital for sustainable urban growth. There is an important opportunity to build clear, directive provisions into the new RPS that appropriately address infrastructure and service gaps prior to development.

Summary points from Reference Group:

- The Reference Group indicated a preference for clear, direct and concise language to be used in the provisions for the RPS.
- There was some discussion about incremental improvement to the PORPS and the potential missed opportunity for bold new thinking to address emerging challenges and reset

directions. The former being more supported by TAs given the time and money invested in recent plan development processes.

- There was also a reference for clear and firm directives for managing urban development within clear parameters, that left the space for ground up local responses to be developed.

Natural Character, Natural Features and Landscapes

Overview and Context:

Natural Features and Landscapes

Natural features and landscapes are distinct from natural character. While all involve biophysical and experiential aspects, natural features and landscapes also include associative aspects – how people and societies have associated with a place (such as heritage and cultural aspects). Otago has a wealth of outstanding and highly valued natural features and landscapes, including some that have already been identified through the region's district plans. Otago's natural features and landscapes are highly valued for a range of reasons, including their cultural and social importance. They also support domestic and international tourism in the region.

Natural features and landscapes can be negatively affected or degraded by a range of uses in and nearby them. As a consequence, some land management practices have failed to adequately provide for Kāi Tahu Ki Otago interest in wāhi tūpuna (cultural landscapes). The RPS 1998 required the protection of outstanding natural features and landscapes but did not provide direction on their identification or what 'protection' meant, or any consideration of other features and landscapes that were not considered outstanding. These decisions were left to territorial authorities and as a result, there has been variation in how natural features and landscapes have been identified and managed in district plans. While parts of the PORPS remain relevant and appropriate, some provisions will need to be revised in order to improve their clarity and ensure the new RPS meets the requirements of the RMA and National Planning Standards.

Natural Character

Natural character is the expression of natural elements, patterns and processes in a landscape. The degree or extent of natural character in an area depends on the extent to which natural elements, patterns and processes occur, and the nature and extent of modifications to the ecosystems and landscapes. The RMA requires the preservation of the natural character of the coastal environment, wetlands and lakes and rivers (and their margins) and the protection of them from inappropriate subdivision, use and development. Subdivision, use and development can degrade the values and characteristics of natural character by introducing man-made structures in natural environments largely absent of human activity, modifying or removing vegetation, altering landforms and changing ecosystem processes.

Natural character is fundamental to the Kāi Tahu relationship with whenua, wai taonga, wāhi tapu and wāhi taonga, and is understood in relation to the quality of the environment prior to colonisation. Where these qualities remain, they are taonga - precious remnants of a modified environment to be respected and protected. Wherever possible, Kāi Tahu believe these qualities should be restored to bring back balance and support mauri. Degradation of natural Character can affect the mauri of areas and the relationship of tangata whenua with their ancestral lands and waters, particularly the coast and freshwater bodies. Where there is degradation, it is important to Kāi Tahu that restoration occurs so that natural character can be enhanced.

Opportunities:

Natural Features and Landscapes:

One of the key opportunities for the new RPS is to address the management of natural features and landscapes outside the Coastal Environment. More specifically, there is an opportunity to treat natural features and landscape management in the same way as in the Coastal Environment, which would align more closely with Iwi management plans. There was an opportunity to consider the identification of natural features and landscapes in the RPS at regional level or continue along the lines of the PORPS and enable district level plans to map and identify them. Finally, at a broad level, there is opportunity to clarify and provide more direction in the existing provisions for local authorities in the protection and management of outstanding natural features and landscapes.

Natural Character:

Natural character is a broad topic that sits across a number of other topics, particularly the coastal environment and land and freshwater. There is an opportunity to better align how the RPS intertwines natural character with iwi values, and the interconnectedness across the whole system as opposed to isolated areas with particular aesthetic properties. Additionally, there is an opportunity to adopt national direction, which would enable the identification of natural character in wetlands, lakes, rivers and their margins, and provide direction for district plans on these matters.

Summary points from Reference Group:

Natural Features and Landscapes

- Initially there was discussion about whether these values should be maintained or enhanced. The iwi view is that enhancement, restoration, and improvement is important. Also, there is a distinction between heritage and cultural values. This distinction needed to be reflected in the planning provisions.
- There was discussion of the need to consider protection of tussock areas to ensure the distinctive landscape character of Otago is retained.
- Historic wetlands were mentioned, and the need to repair them to improve water quality.
- People considered integrated management and bringing climate change to the forefront were important considerations in a policy approach.
- There was discussion of the need (mandatory or otherwise) to map areas of outstanding landscapes and the benefit of providing consistency between councils in this aspect. Currently, because of the lack of direction, there are multiple approaches across TAs, and also concern about the resources required to do this.

Natural Character

- RPS needs to be more directive about the preservation of natural character.
- The approach for natural character to be addressed specifically within the relevant topics was preferred amongst the reference group, rather than a generic approach applying within its own chapter.

Energy, Infrastructure and Transport

Overview and Context:

Infrastructure, energy and transportation networks are services that communities rely on. These assets are fundamental to support social and economic wellbeing, so infrastructure must be effective, resilient and respond to the changing needs of people and communities. The Otago region includes nationally and regionally significant renewable energy resources, infrastructure and transport networks. The region contributes significantly to New Zealand's renewable electricity generation through hydro dams on the Clutha and the Waipori rivers and with the Mahinerangi wind farm. The Otago region also has potential for additional renewable energy generation. In relation to mineral exploration and extraction, Otago has significant lignite resources, and is also home to the Macrae's Gold Mine, which is the largest gold mine in New Zealand.

When considering the development and management of infrastructure it is critical for the health, safety and wellbeing of communities. It is necessary to afford these activities protection from reverse sensitivity effects and potential impacts that other activities may have on their effective operation. The scale and type of activities involved in the operation, maintenance, upgrading and development of infrastructure is such that adverse effects on the environment are likely, including, at times, significant adverse effects. Efforts are required to minimise adverse effects, particularly where infrastructure operates to a sub-standard level or where alternatives are available. There are instances however where residual effects cannot be avoided, remedied or mitigated. Infrastructure, energy, transportation and mineral extraction and exploration are all activities of concern to iwi.

There are overlapping responsibilities between regional and district councils for managing the provisions and effects from energy, infrastructure and transport networks under the RMA. Many of the energy, transport and infrastructure matters also traverse the coastal environment, both within the coastal marine area and adjacent to it. This complexity means that it is important the region has a clearly articulated approach to managing these activities and their environmental effects

Opportunities:

The broad direction for energy, infrastructure and transport in the PORPS is appropriate, however some refinement of terminology and management approaches in the provisions would better align with national planning standards. Extractive industries are a land use which was covered by the PORPS, it doesn't have a natural home in the National Planning Standard Chapters, and so was considered by the refence group within this topic. However, its eventual home may be elsewhere in the RPS.

Summary points from reference group:

Energy

- General support for the direction within the PORPS to be carried forward for the RPS review.
- Suggestion that Otago should be a net carbon-absorbing region and the RPS could provide the drive for this.
- The RPS needs to more strongly enable small and community scale renewable electricity generation as this is an opportunity to improve energy reliability and community resilience.

Infrastructure

- Agreement that nationally and regionally significant should be defined separately but have different management approaches.
- Definition of "regionally significant" should follow the same structure/content as "nationally significant".
- TA's requested a review of the definition of "municipal infrastructure" – it is fairly limited at the moment and has some unexplained restrictions.

Transport

- The provisions need to acknowledge mobility needs, especially in an ageing society.

- Provisions need to be more enabling rather than effects-focused, particularly when related to encouraging modal shifts to walking, cycling, public transport or to more carbon neutral forms of transport.
- The RPS should acknowledge that there are limited alternative transport options outside of the urban areas.

Mining

- Should be recast to apply to all extractive industries, not just mining.
- There was feedback from those representing the extractive industries that the wording of draft provisions was too restrictive, and needed to better account for offsetting or compensation, although it was acknowledged that offsetting and compensation was addressed in more detail through the biodiversity chapters.
- There was recognition that some adverse effects (for example, on cultural values) cannot be avoided, offset or compensated for.

Coastal Environment

Overview and Context:

Many activities occur within, or affect, the coastal environment including urban development, recreational activities, transport infrastructure, energy generation and transmission, food production and other farming activities, plantation forestry, rural industry and mineral extraction. Poorly located or managed activities can have adverse effects that compromise the carrying capacity of the receiving environment and impact on the values of the coastal environment such as natural character, biophysical processes, water quality, surf breaks, indigenous biodiversity and natural landscapes.

The coastal waters are a receiving environment for freshwater, gravels, sediment and contaminants from the terrestrial landscape - of particular concern are the significant discharges of land-based sediments via rivers and waterways that have a smothering effect on the benthic systems[5] of the coastal area, including the important kelp beds. The interconnection of the land and sea environments is consistent with the ki uta ki tai ('mountains to the sea') or interconnectedness philosophy of iwi. This interconnection requires careful consideration in managing the effects of land use activities. Other important issues for mana whenua are the impacts of sea level rise, erosion of Māori lands, and the effects of reclamation within the Otago area, including dredging impacts on the health of the ecosystems of the harbour.

Opportunities:

There are a few options for the Coastal Environment chapter in the new RPS, particularly around the identification of significant areas, management of natural character, protecting significant surf breaks, water quality, coastal access and activities in the coastal marine area. There is an opportunity to manage the natural character of coastal environments within the coastal environment chapter for clarity. Additionally, the provisions concerning identification, maintenance and enhancement of water quality in the coastal marine areas have room for improvement, including the management of sediment and waste discharges. Specific criteria for identifying marine biodiversity could also be improved. Finally, there is an opportunity to better manage activities in the coastal environment, including the addition of provisions to address subdivision and developments in the coastal environment.

[5] The lowest level of a marine or freshwater system.

Summary points from reference group:

Extent and Characteristics of the Coastal Environment

- The criteria drafted for the identification of the coastal environment is considered to be reasonable.
- Reference Group members indicated a preference for the landward extent of the Coastal environment to be mapped at RPS level, although acknowledged the time constraints in being able to achieve this. They also identified concerns that mapping would need to be dynamic and reviewed regularly due to ongoing changes to the coastal environment.

Coastal Biodiversity

- The development of specific marine criteria was supported as a preference to adapting terrestrial biodiversity criteria to the marine environment
- The relationship between the Fisheries Act and Resource Management Act also come into play in this area and the RPS needs to be mindful of its jurisdictional limitations.

Natural Character

- There was support for natural character specific to the Coastal environment to be managed within this chapter.
- Sub-surface natural landscapes may need consideration in the RPS.

Surf Breaks

- There was support for regional surf breaks to be identified for Otago, and acknowledgement that the management approach to these needed to be different to nationally significant surf breaks. This was to ensure that hazard work such as breakwaters, seawalls etc have a pathway to be established in areas of regionally significant surf breaks e.
- Feedback from the community would be needed to support this approach, and there was some concern that identification of surf breaks may be met with resistance from some of the surfing community.

Water Quality

- Discharges to the coast should have better guidance under the RPS.
- There was widespread support for a precautionary approach to activities in the coastal marine area.

Activities in the Coastal Marine Area

- There was some concern that aquaculture has been given a separate section where other activities have not, although they may be covered by other legislation such as the Fisheries Act.
- In managing coastal water there was mention in the draft provisions to maintaining and enhancing habitats provided in the coastal marine areas, and trout and salmon were included. Whilst it was acknowledged that this reference is required under the Resource Management Act, it was widely suggested that there could be further wording to give precedence to native habitats.

Land and Freshwater

Overview and Context

The health of land and freshwater is vital for the health of our environment, people and economy. It is at the heart of our culture and identity. Nationally, and in parts of Otago, freshwater is facing significant pressure. Population growth and land-use intensification in urban and rural environments has increased demand for water for drinking water, irrigation and other economic uses. It has also impacted on the quality of our water, increasing contamination such as by nutrients and sediment and harming ecosystems.

For Kāi Tahu, freshwater management is a significant issue. Current water management does not adequately consider the interconnections between water and land and does not address Kāi Tahu values and interests or recognise mātauranga. This hampers Kāi Tahu's effective participation in resource management processes and impacts on the mana of both people and water. Historical and contemporary land uses have degraded waterbodies in Otago, both in terms of their quantity and quality, leading to adverse effects on the mauri of water bodies and the diversity and abundance of mahika kai resources.

All these pressures have been recognised by the Government, with a new suite of national directions on managing freshwater that aim to significantly strengthen the regulatory framework for managing freshwater. This will be a paradigm shift for water management across the country, and in Otago and will have considerable implications for uses of land that affect water quality and quantity.

Opportunities:

There is an opportunity for the new RPS to appropriately and clearly respond to the new national policy regulations set out in both the National Policy Statement for Fresh Water Management (NPSFM) and the National Environmental Standards for Fresh Water (NESFW), and further align with the RMA. In particular, the new RPS can address the effects and status of water quality, allocation of freshwater, introduce the Freshwater Management Unit (FMU) framework and address the lack of integrated management between land use and fresh water. While the NPSFM establishes the minimum standard for the overall policy framework, the ORC has an opportunity to provide direction on how to apply the framework within the Otago context. At the time of conducting the reference groups, the draft NPSFM was used to guide discussion. Since then the NPSFM has been gazetted and will take effect on 3 September. This has some impact on the approaches which were discussed with the reference group. An example of this is the draft NPSFM included the requirement to prepare a region wide freshwater vision for the RPS. There is now a requirement for visions to be set at an FMU level.

Defining Te Mana o Te Wai has remained a requirement and has been progressed with iwi but had not been drafted at the time of the reference groups.

Summary points from reference group:

Te Mana o Te Wai and Freshwater vision

- Three options for regional freshwater visions were presented to the reference groups, with generally greater support for the second option (identified below). Reasons included the clear timeframe it sets out, the focus on protection of healthy ecosystems rather than singling out certain uses, and support for a holistic approach rather than defining the different features that are included in 'waterbodies'.

Otago's fresh water, the foundation and source of life, is revitalised within a generation and safeguarded to uphold te mana o te wai, through a partnership grounded in the principles of te tiriti. Otago's waterbodies will sustain healthy ecosystems by embracing ki uta ki tai, which will support each waterbody's mauri, so each waterbody retains its distinctive character, and behaviour in terms of flow patterns, quality, and connections. In turn, fresh water in Otago will provide for te hauora o te wai, te taiao and te tangata to thrive now and for generations to come.

- Whilst there was clear preference for option two, there were some elements to be considered in any re-drafting, including
  - making sure it is achievable but not being too detailed,
  - consider that the timeframe 'within a generation' may not be reasonable to all elements of the vision, and there was some discussion that form some issues, a generation is too long.
  - use of 'revitalised' could be replaced with 'healthy'
  - consider include resilience to change and a reference to climate change.

<u>Freshwater Management Units</u>

- Support for the RPS remaining at a high level when it comes to detail within an FMU. It is the role of the LWRP to provide specific direction on the management of water within each FMU.
- There was some confusion over the use of criteria for setting FMU boundaries in the RPS, and it was considered that the RPS should set the FMUs instead.
- When discussing Freshwater Management Units (that have already been identified), there was concern that Otago has many unique features/areas and pulling them all together into a small number of large geographical areas could create issues from an implementation perspective. Flexibility to have conversations and set management approaches at a more detailed level need to be maintained for the LWRP.

<u>Water quantity</u>

- Any provisions relating to water quantity should give effect to the priorities of Te Mana o te Wai.
- Provision of water quantity to provide for drinking water needs to also consider the quality of that water and the desire for it not to be treated.
- Detail of how to determine water allocation should be set at the LWRP level not the RPS, but the relationship between what a river needs to achieve Te Mana o te Wai and then what can be taken beyond that could be explored. This will ensure that more than just 'lip' service is provided to Te Mana o Te Wai.
- The role of storage across the region in relation to water quantity should be provided at the RPS level.
- Any reference to 'overallocation' in the RPS will need to be supported by a definition. The NPSFM will provide a definition that will need to be implemented.
- RPS should define what the problem with overallocation is – i.e. effects on ecosystem health, inability to maintain a minimum flow.
- Acknowledge that phasing out of any over-allocation is notoriously difficult – options include 'sinking lid' with short term consents or setting out milestones for reduction within a generation. A timeframe for phase out should be included.
- The RPS could provide direction to how to deal with consents which aren't being used in FMUs.

Water quality

- It was acknowledged that the forthcoming NPS will address several new aspects such as cumulative effects of contaminants in catchments and that this could provide further guidance for the RPS.
- The relationship between water quality and water quantity in Otago should be reflected in the provisions.
- Support for the approach that implements a 'we will not go backwards' approach.
- A need to be clear in the provisions where we apply 'reduce, minimise, remedy, mitigate, avoid' etc. to ensure the outcome being sought is clear. At the same time, there was a preference to see words like 'swimmable' which define an outcome rather than words like minimising, improving etc. In other words, the use of non-technical outcome focused language.
- Need to consider setting a timeframe to achieving the provisions to be consistent with the freshwater vision.
- Methods need to make sure implementation and action at lower order documents is achieved. Consider the role of community and catchment management groups in achieving bottom lines.
- Support the RPS to provide some direction to the balance between on-site wastewater disposal and the provision of reticulated services.
- Support for provisions which clearly set the bottom line - like no further degradation of water quality for a water body.
- Cumulative effects of contaminants need stronger policy direction.

Wetlands

- Acknowledge that the NPSFM will provide considerable direction on management.
- Coastal wetlands must be included, but a different management approach might be required between wetland types.

Outstanding Water Bodies

- There was further concern around the identification of significant water bodies that the methods are too broad and could be applied to any/all water bodies.
- Support for the RPS to provide the overarching guidance, and the management approaches to be applied at the LWRP.

Land Use and Soils

- For land use and soils, it was agreed that the language used needed careful consideration so as not to direct, but rather provide a pathway to innovation.
- It was agreed that a link to climate change mitigation could be made in this area of the RPS.
- Soil health provisions are important but need to be careful to not constrain too much in terms of how soils may be maintained or restored.
- Link between soil health, vegetation clearance and management practices with water quality, support for policy provisions that address this.
- Need to include provision from the PORPS on dry catchments – forestry. In particular, the loss of good productive land to forestry and the change to the hydrology of plantation forestry.

Ecosystems and Indigenous Biodiversity

Overview and Context:

Biological diversity (herein called biodiversity) describes the variety of all living things, including the range of species living in our environments, their genetics, and the ecosystems where they live. New Zealand's high level of indigenous biodiversity makes a unique contribution to the world's biodiversity. However, the health of New Zealand's biodiversity has declined significantly since the arrival of humans, and Otago is no exception. Mahika kai and taoka species, including their abundance, have been degraded by resource use and development in Otago and Kāi Tahu have faced impediments to their ability to exercise their customary rights to mahika kai, including lack of public access and sites no longer being safe to access.

Mahika kai and taoka are two important concepts for Kai Tahu with relation to biodiversity. Mahika kai is the gathering of food and other resources, as well as the places they are gathered, and the practices used, while Kāi Tahu consider all indigenous species as taoka. Mahika kai is an intrinsic part of Kāi Tahu identity and has been the basis for the Kāi Tahu economy for hundreds of years.

In early 2020, the Government proposed a new National Policy Statement for Indigenous Biodiversity (NPSIB). Current indications are that this NPS will come into force in the first half of 2021, and it will bring with it an approach that significantly alters the current approach to maintaining and protecting areas of indigenous biodiversity, particularly in terrestrial environments.

Opportunities:

The main opportunities for the new RPS to explore are the recognition of the unique characteristics of marine environment, providing more detail in the implementation of provisions across organisations, and further clarifying the responsibilities of both the ORC and district councils through methods. There is additionally an opportunity to minimise any future changes to the new RPS by ensuring the core philosophy of the draft NPSIB are captured in the new provisions.

Summary points from reference group:

General

- Provisions need to make measurable outcome statements and provide clear direction to avoid further biodiversity loss.
- There needs to be more focus within the provisions on the role and value of ecosystem services.
- Enhance was deemed to not be an appropriate management approach as a region, we need to restore or rehabilitate to recoup some of the past loss.
- More direction about monitoring and review to include indicators, monitoring requirements, inventory development. There was a suggestion to look at DOC's TIER1 method to assist this.
- More recognition of climate change is needed, and management approach should encourage resilience through techniques like buffer zones and allowing ecosystems 'room to move'.
- Offsetting and compensation: there were agreement to follow the sequence of actions as set out in the NPSIB (i.e. avoid, remedy, mitigate, offset, compensate). Keep the PORPS 2016 direction as far as possible, but with some of the clarity from the NPSIB.
- ORC can't do this alone; the methods need to set out how ORC will support community groups, landowners, etc to manage biodiversity (for example, rates relief for vulnerable/protected areas).
- Pest management
  - RPS should give direction about what the Pest Management Plan should do and how that carries through to operational work programmes.

- RPS should discourage wilding pines, particularly linked through to hydrology effects in dry catchments.

Coastal biodiversity

- Support for marine-specific biodiversity criteria. Work that has recently been done to map biodiversity across Otago, including marine biogeographic regions should be used to support this approach.
- Management regime needs to recognise the connection between freshwater and coastal biodiversity.
- Need to ensure identification of significant areas isn't isolating, for example by including ecological corridors and migration paths.
- Needs to contain a management approach that is specific to estuaries.
- Action needs to be more than 'maintain' as there is a desire to restore what has been lost.

Integrated Management

Overview and Context:

In resource management planning, and from a 'western' viewpoint, there are four identifiable characteristics that differentiate integrated management from other approaches to the management of natural and physical resources. These characteristics are Inclusiveness, interconnectedness, goal oriented and strategic. Integrated management is also integral to the Māori worldview. From an environmental and spiritual perspective, Māori see the world as a unified whole. The concept of holism underpins mātauranga Maori and guides the way in which Māori view and treat the environment. This is reflected in the concepts of respect, reciprocity, spirituality and responsibility, which Maori apply to the environment.

Due to the complexity of integrated management, and the broad coverage it has, there are a few key issues that need to be addressed. Climate change, consideration of kai tahu values, the use and development of natural resources, the economic and domestic values of natural resources and cross boundary issues are all key areas that need integrated management with a holistic lens.

The purpose of an RPS to promote sustainable management of the natural and physical resources for Otago requires an integrated approach, taking an all embracing, holistic view of resource management. It also requires an approach that meets the social, economic and cultural needs of the people and communities of Otago, now and in the future. To create a document that is strategic in its nature and that establishes a regime that results in fully inclusive integrated management of the natural and physical resources of Otago, the review of the RPS needs to reflect and adopt these concepts.

Opportunities:

The provisions in the PORPS as they relate to how to approach integrated management are largely to be retained, with an opportunity to provide further clarity relating to intersecting topics. The integrated management chapter of the RPS provides a home for any intersecting topics or themes, and an opportunity to address complex interconnected issues spanning across multiple chapters.

Summary points from reference group:

- The integrated management chapter is where conflicts and trade-offs are resolved. It is the place to say that if you're dealing with one domain, you need to be aware of the effects on another. The principles in it should apply at every scale and provide a framework for decision making through lower order plans.

- In supporting an integrated management chapter, it needs to be clear, concise, low on prescriptive detail, with a strong purpose.
- There is the opportunity for this chapter to set a vision for Otago that is practical to implement. The chapter needs to set out what needs to be done, and who needs to do it. It needs to be holistic and more aspirational; about restoring vitality and enhancing, not just about maintenance and less degradation.
- Whilst addressed specifically in this chapter, integrated management needs to be woven into every chapter of the RPS.
- There was support for ORC to take a stronger role in the integrated processes, by leading and facilitating the conversation between agencies and with communities.
- Integration detail is often difficult to convey and understand. Experiment with other ways of showing the detail, for example by including diagrams such as the doughnut economics model to demonstrate integration.
- The chapter needs to address making decisions in a shifting baseline due to climate change, integrating decision making across time in a sustainable way and supporting resilience to impacts.
- A greater focus on wellbeing is needed within this chapter.

3. Moving Forward: Draft Policy Directions

The following section provides an overview of the policy directions, taking into consideration the reference groups feedback:

Air: draft policy direction

The draft policy approach within the Air chapter will cover the following:

- An overarching objective requiring ambient air quality in the Otago Region to provide for the health and wellbeing of the people of Otago, amenity and cultural values and the life supporting capacity of ecosystems.
- The draft policies describe the actions that will be undertaken to achieve the objectives and include a requirement to improve air quality where it is currently degraded; and prevent the decline in air quality in areas where air quality is currently good.
- Policy direction covering the prohibition of using domestic solid fuel burning appliances that do not comply with the NESAQ standards, with timeframes that prioritise the prohibition in airsheds where air quality is currently poor.
- Policy direction to manage the adverse effects of offensive and objectionable air discharges, including discharges from outdoor burning.
- The provisions also include policy direction for offsetting to improve ambient air quality, consistent with Regulation 17 of the NESAQ 2004 (amended 2011).

Heritage and Culture: draft policy direction

The draft policy approach within the Heritage and Culture chapter will cover the following:

Cultural Values

- Protect Wāhi Tūpuna from inappropriate land use and subdivisions. The provisions will not change much from the PORPS, with adjustments to better align outcomes with section 6 of the RMA.
- Acknowledgement in the provisions that only Iwi can identify Wāhi Tūpuna sites. Methods will include direction for local authorities to amend their plans to include objectives, policies and methods to protect wāhi tupuna from inappropriate use and development.
- Methods will also direct local authorities to collaborate with Kāi Tahu to identify and protect places, areas or landscapes of cultural, spiritual or traditional significance to them, and to include areas (by way of maps) and the associated values in the regional and district plans.

Historic heritage

- Refinement of the existing approach to heritage identification and protection will be developed through the objectives.
- A new identification system for heritage sites is being drafted based on the approach within the *Heritage New Zealand Pouhere Taonga Significance Assessment Guidelines (Guidelines for Assessing Historic Places and Historic Areas for the New Zealand Heritage List/Rārangi Kōrero (2019)).* This will provide clarity and consistency across the region as to how to identify items of regional and national significance, and who is to undertake the work.
- Policy direction will also include more specific provisions to guide the management of identified heritage sites.

Natural Hazards: draft policy direction

The draft policy approach within the natural hazards chapter will cover the following:

- The majority of the PORPS objectives are appropriate and will be kept in the new RPS, with some minor language changes to set the outcome of achieving tolerable levels of risk.
- New provisions will include a semi quantitative framework that enables the significance of risk to be assessed and to identify tolerable levels of risk.
- The inclusion of community tolerance to risk will continue in the RPS, however it is acknowledged that this will provide the framework for conversations with the community to occur, over time, to supplement future policy direction.
- Clearer direction around both the management of existing land use rights and natural hazard mitigation works in sensitive areas will be provided, along with clarification as to the role of ORC in extinguishing existing use rights.

Urban Form and Development: draft policy direction

The draft policy approach within the urban form and development chapter will cover the following:

- Specifically, the changes to the Urban Form and Development provisions relate to giving effect to the new National Planning Standard for Urban Development (NPSUD).
- Existing policy direction from the PORPS is kept largely the same, although redrafted, with the NPSUD requirements being built on top of existing direction.
- The additional policy direction from the PORPS include:
    - Articulation of the criteria for Future Development Strategies, spatial plans or development must consider how to achieve quality urban environments. Criteria to consider elements such as integrated infrastructure provision, climate change mitigation, hazards, and natural resource features of the area.

- Provision for Papakainga housing, development of marae and nohoaka and aspirations for whenua Maori are specified.
- Provide a policy pathway to enable urban development (intensification, expansion or land use change) that is consistent with a Future Development Strategy or an equivalent endorsed spatial planning document. Equally, when a development is not consistent with such documents, require the assessment against specified criteria to create quality urban environments.
- Facilitating change to urban areas with population stasis and decline (where a lack of growth is the issue but changing demographics and social circumstances result in changed demands).
- Provide a framework for managing rural residential development and rural lifestyle development and non-productive use of rural land.
- Manage the mixing of activities within existing urban areas.
- Ensure all new developments are designed to minimise runoff and emissions including GHG, maximise energy efficiency, and connectivity and are connected to appropriate infrastructure.

Natural Character, Features and Landscapes: draft policy direction

As was supported by the reference groups, natural character will be dealt under each relevant topic section, but for simplicity and consistency with the remainder of this report, the approach to Natural Character across the topics is included here.

The draft policy approach within the natural features and landscapes chapter will cover the following:

- The existing policy direction within the PORPS will largely be carried forward in this new chapter.
- More recognition of climate change impacts will be added to the policy direction.
- Objective 2 will be reworded to focus on enhancement and to remove the unnecessary phase 'at a minimum'.

The draft policy approach relating to natural character across the RPS will cover the following:

- Natural Character provisions will be included in the land and freshwater chapter in order to account for the natural character of freshwater bodies and to give effect to section 6 of the RMA.
- A separate approach that accords with the New Zealand Coastal Policy Statement will be added to the Coastal Environment chapter. Natural Character will therefore not be included as a standalone chapter, and the provisions will be built into Freshwater and Land, and Coastal Environment chapters instead.
- In both chapters there will need to be recognition of the Kai Tahu values associated with Natural Character as expressed through the enhancement of visual amenities, and restoration of areas with degraded natural character.

Energy, Infrastructure and Transport: draft policy direction

The draft policy approach relating to Energy, Infrastructure and Transport chapter across the RPS will cover the following:

- The direction from the PORPS for energy, infrastructure and transport will be maintained but with refinement to ensure the objectives and policies reflect good practice drafting techniques, align with national guidance and address gaps. This may require the updating of terminology and management approaches to ensure consistency with the recent central government policy documents.

- An additional provision to enable small scale and community level renewable electricity generation will be included.
- Clarity will be provided through resolving definition tensions between regionally significant and nationally significant infrastructure.
- Transport provisions will be reviewed to ensure the adequately provide mobility needs and for the limited alternative transport options available outside urbanised areas.
- Mining provision will be broadened to apply to all extractive industries. It is likely these provisions will be included in the Land and Freshwater chapter.

Coastal Environment: draft policy direction

The draft policy approach relating to the Coastal Environment chapter across the RPS will cover the following:

- New provisions for marine biodiversity rather than amending existing terrestrial biodiversity provisions. This is likely to simplify the expected changes that will need to be implemented in the terrestrial biodiversity provisions once the NPSIB comes into effect.
- The natural character of the coastal environment will be managed separately, and the provisions will be amended to provide more clarity for organisations as to their responsibilities and roles in identifying and managing coastal natural character.
- New provisions will seek to address coastal water quality and manage sedimentation and contaminant discharges within the coastal environment, as well as appropriately address activities such as subdivisions and developments in coastal environments.

Freshwater and Land: draft policy direction

The draft policy approach relating to the Freshwater and Land chapter across the RPS will cover the following:

- The chapter will be set up and guided by a set of provisions which reflect what Te Mana o Te Wai means for Otago. Staff are continuing to work with iwi to develop this approach.
- A regional vision will be included in the RPS, and, in accordance with the NPSFM, freshwater visions for each FMU will also be developed and included.
- A framework to addressing water quantity and overallocation should it be identified through the LWRP process is being developed. The details of this policy approach will primarily be addressed through the Land and Water Regional Plan, however the RPS plays a key role in providing direction to that Plan on how management frameworks should be established.
- Policy direction for water quality will apply the requirements of the NPSFM but will also consider the strong relationship between water quality and quantity in Otago.
- Regarding wetlands, there is a clear direction provided by the NPSFW to protect wetlands and as such the RPS framework will include provisions requiring the identification of wetlands and then a management framework depending on their type.
- The RPS will provide guidance and direction for identifying outstanding water bodies and their management, with the detail to be undertaken through the LWRP.
- The direction in the PORPS for soils will largely be carried through to the new RPS, particularly regarding values of soil, significant soils and management.
- Additional provisions will be added to the RPS to address the management of land. This will cover waste, extractive industries, highly productive land, land use in dry catchment and land disturbance and management practices.

Ecosystems and Indigenous Biodiversity: draft policy direction

The draft policy approach relating to Ecosystems and Indigenous Biodiversity across the RPS will cover the following:

- This topic will address three types of biodiversity instead of only two as per the PORPS. The three biodiversity types will be coastal, freshwater and terrestrial. Acknowledging all three will bring the new RPS in line with the national standards found in the proposed NPSIB, NZCPS and NPSFM.
- As mentioned above in the Coastal Environment chapter, the proposed direction is to include marine-specific significance criteria.
- For freshwater biodiversity, the proposed provisions will set a higher standard for ecological health and set criteria for identifying outstanding water bodies which will include ecological values among other significant values.
- For terrestrial biodiversity the existing criteria contained in the PORPS will largely be retained.
- It should be acknowledged that the proposed NPSIB will take effect sometime in 2021 which may require changes to the provisions.

Integrated Management: draft policy direction

The draft policy approach relating to Integrated Management chapter across the RPS will cover the following:

- The Integrated management will be clear, through objectives and policy, a vision for what integrated management in Otago is intended to look like to achieve. This approach acknowledges that the topics in the RPS do not operate independently of one another - issues such as freshwater management, ecosystems, land use and air are all impacted by related activities as a whole system.
- Policy direction will specifically focus on Ki uta ki tai (mountains to the sea); climate change; ecosystem health and sustainable use of resources. It will aim to provide clear outcomes to be achieved and aim to resolve tensions as they exist between resources and or/activities.

5. Appendix One

Air RPS Reference Group ***Councillor Sponsor – Gary Kelliher***	
Jeremy Baker	Cosy Homes Charitable Trust
Brigid Buckley	*Fonterra Limited, Christchurch*[6] Unable to attend the Zoom meeting
Scott Mossman	Fulton Hogan, Dunedin
Ian Longley	NIWA, Auckland
Bernard Farrington	Oculus Architectural Engineering, Arrowtown
Dr Michael Butchard	Public Health South, Southern DHB, Dunedin
Danielle Smith	Public Health South, Southern DHB, Dunedin
Francisco Barraza	University of Otago, Dunedin
Maria Bartlett	TAMI
Anna Johnson	Dunedin City Council
David Campbell	Central Otago District Council
Tara Hurley	Queenstown Lakes District Council

Combined Natural Character and Natural Features and Landscape Reference Group ***Councillor Sponsor – Michael Laws & Hilary Calvert***	
Kim Reilly	Federated Farmers of New Zealand, Dunedin
Casey Cravens	Wild Angler Ltd; Otago Anglers' Association; NZ Southern Rivers
Fergus Sutherland	
Grahame Sydney	
Jillian Sullivan	
Mary Sutherland	
Neville Peat	
Maria Bartlett	TAMI
Craig Barr	Queenstown Lakes District Council
David Campbell	Central Otago District Council
Jane MacLeod	Dunedin City Council

Natural Hazards and Risks RPS Reference Group ***Councillor Sponsor – Carmen Hope***	
Daniel Druce	Contact Energy Limited, Dunedin
Abha Sood	NIWA, Wellington
Bernard Farrington	Oculus Architectural Engineering, Arrowtown
Tom Scott	Southern DHB, Dunedin
Jason Harvey-Wills	rda consulting, Dunedin
Gary Bennetts	Teviot Orchard Company Ltd, Roxburgh
Stephen Knight-Lenihan	University of Auckland, Auckland
Francisco Barraza	University of Otago, Dunedin
Christina Riesselman	University of Otago, Depts. of Geology and Marine Science, Dunedin
Nima Taghipouran	WSP, Dunedin
Maria Bartlett	TAMI
David Campbell	Central Otago District Council
Luke Place	Queenstown Lakes District Council
Emily Grace	Queenstown Lakes District Council
Sarah Hickey	Dunedin City Council

[6] Unable to attend

Historical and Cultural Values RPS Reference Group ***Councillor Sponsor – Michael Deaker***	
Sue Patterson	Arrowtown Promotion and Business Assn Inc, Arrowtown
Graye Shattky	Central Otago Heritage Trust, Alexandra
Ian Butcher	Ian Butcher Architect Ltd, Oamaru
Jackie St John	Oceana Gold (New Zealand) Limited, Dunedin
Robin Miller	Origin Consultants Ltd, Queenstown
David Pirie	Southern DHB, Dunedin
Karen Greig	University of Otago, Dunedin
Gerald Carter	Waitaki Whitestone Geo Park, Halswell
Maria Bartlett	TAMI
Sarah Picard	Queenstown Lakes District Council
Anna Johnson	Dunedin City Council

Urban Form and Development RPS Reference Group ***Councillor Sponsor – Alexa Forbes***	
Scott Willis	Blueskin Energy Ltd, Dunedin
Campbell McNeill	Everyday Studio Ltd, Dunedin
Claire Freeman	Geography Department University of Otago, Dunedin
Sheila Watson	*Heritage New Zealand Pouhere Taonga, Christchurch*[7]
Andrew Shand	Southern DHB, Dunedin
Garth Falconer	Reset Urban Design, Wanaka
Anne Salmond	Salmond Architecture Ltd, Wanaka
Gordon Roy	University of Otago, Dunedin
James Berghan	University of Otago, Dunedin
Margaret Macleod	Queenstown
Charlotte Flaherty	Dunedin
Maria Bartlett	TAMI
Anna Johnson	Dunedin City Council
David Campbell	Central Otago District Council
Amy Bowbyes	Queenstown Lakes District Council
Emily McEwen	Dunedin City Council

Coastal Environment RPS Reference Group ***Councillor Sponsor – Kevin Malcolm***	
Bronwyn Bain	Wanaka
Hendrik Schultz	Department of Conservation, Dunedin
Simon Davies	Federated Farmers of New Zealand, Milton
Chanel Skye Ngatokorua Gardner	Harbour Fish, Dunedin
Mike Beentjes	National Institute of Water and Atmospheric Research Ltd (NIWA), Dunedin
Elisabeth Slooten	Otago University, Dunedin
Rebecca McGrouther	Port Otago Limited, Dunedin
Carol Scott	Southern Inshore Fisheries Management Co Ltd, Nelson
Wayne Stephenson	University of Otago, Dunedin

[7] Unable to attend

Trudi Webster	Yellow-eyed Penguin Trust, Dunedin
Marian Weaver	Waitaki District Council
Tom Simons-Smith	Dunedin City Council

Ecosystems and Indigenous Biodiversity RPS Reference Group ***Councillor Sponsor – Bryan Scott***	
Matthew Sole	Alexandra
Neil Cullen	Waihola
Richard Bowman	Lake Hayes
Michael Thorsen	Ahika Consulting Ltd, Dunedin
Janice Lord	Botany Department, University of Otago, Dunedin
Bruce McKinlay	Department of Conservation, Dunedin
Kim Reilly	Federated Farmers of New Zealand, Dunedin
Sue Maturin	Forest and Bird, Dunedin
Don Robertson	Chair Guardians of Lake Wanaka, member Guardians of Lake Hawea, Trustee Upper Clutha Lakes Trust, Lake Hawea, Wanaka
Niall Watson	Otago Fish and Game Council, Dunedin
Nancy Latham	Wanaka
Maria Bartlett	TAMI
Katie James	Dunedin City Council
Richard Ewens	Dunedin City Council
Katie Russell	Queenstown Lakes District Council
David Campbell	Central Otago District Council
Gareth Boyt	Waitaki District Council

Energy, Infrastructure and Transport RPS Reference Group ***Councillor Sponsor – Kate Wilson***	
Scott Willis	Blueskin Energy Ltd, Dunedin
Peter Dowden	Bus Users Support Group Ōtepoti-Dunedin
Daniel Druce	Contact Energy Limited, Dunedin
Brigid Buckley	Fonterra Limited, Christchurch
Scott Mossman	Fulton Hogan, Dunedin
Alison Paul	Oceana Gold Ltd
Rebecca McGrouther	Port Otago Limited, Dunedin
Tom Scott	Southern DHB, Dunedin
Susan Krumdieck	University of Canterbury and Transition HQ, Christchurch
Charlotte Flaherty	*Dunedin*[8]
Maria Bartlett	TAMI
Jane MacLeod	Dunedin City Council
Jacinda Baker	Dunedin City Council
David Campbell	Central Otago District Council

Integrated Management RPS Reference Group ***Councillor Sponsor – Gretchen Robertson***	
Hilary Lennox	Ahika Consulting, Cromwell
Ken Gimblett	Boffa Miskell, Christchurch
Janet Stephenson	Centre for Sustainability, University of Otago, Dunedin
Murray Brass	Department of Conservation, Dunedin
Jenny Grimmett	Down to Earth Planning Ltd, Ida Valley

[8] Unable to attend

David Cooper	Federated Farmers of New Zealand, Dunedin
Kate Scott	Landpro Ltd, Central Otago
Niall Watson	*Otago Fish and Game Council, Dunedin*[9] *Unable to attend Zoom meeting*
Nigel Paragreen	The Otago Fish and Game Council, Dunedin
Kevin Wood	University of Otago, Dunedin
Maria Bartlett	TAMI
David Campbell	Central Otago District Council

Land and Freshwater RPS Reference Group ***Councillor Sponsors – Marian Hobbs & Andrew Noone***	
Ken Gillespie	Chair Hawkdun/Idaburn Irrigation Co.Chair Otago Water Resource Users Group. Member of Manuherikia Reference Group, Ida Valley Omakau
Hanna Stalker	DairyNZ, Hampden
David Cooper	Federated Farmers of New Zealand, Dunedin
Sue Maturin	Forest and Bird, Dunedin
Don Robertson	Chair Guardians of Lake Wanaka, member Guardians of Lake Hawea, Trustee Upper Clutha Lakes Trust, Lake Hawea, Wanaka
Kate Scott	Landpro Ltd, Central Otago
Roddy Henderson	NIWA, Christchurch
Helen Trotter	Otago Fish and Game Council, Dunedin
Lloyd McCall	Pomahaka Water care Group, Otago South River care, Queenstown
Rosemarie Nelson	Southern DHB, Dunedin
Gill Naylor	*Rural Women New Zealand, Alexandra*[10]
Gary Bennetts	Teviot Orchard Company Ltd, Roxburgh
Dr Marc Schallenberg	University of Otago, Dunedin
Geoff Crutchley	Upper Taieri Catchment Group, Puketoi
Dugald MacTavish	Wise Response Society Inc, Palmerston
Maria Bartlett	TAMI
David Campbell	Central Otago District Council
Rachel East	Dunedin City Council
Marian Weaver	Waitaki District Council

[9] Unable to attend
[10] Unable to attend

Appendix 5: Freshwater visions consultation summary report

Consultation report:
RPS Long-Term Visions for Fresh Water, October – November 2020

Prepared by James Adams
Senior Policy Analyst
RPS, Air, and Coast Team
January 2021

DRAFT

Contents

Introduction

1. Over a 5-week span through October and November 2020, ORC staff and councillors presented 23 workshops at 18 centres throughout Otago to discuss visions for fresh water with local communities.[1] These discussions, along with results from an online survey, other feedback, and existing information held by ORC, are being used to develop long-term visions for fresh water in Otago that will be included in the Regional Policy Statement (RPS) as objectives.

2. This consultation report describes why the consultation happened and how the workshops functioned. It then summarises all the information ORC received and explains how it will be used.

3. To avoid confusion, this is a separate process from other community discussions ORC has held, and will hold, about implementing the new National Policy Statement for Freshwater Management 2020 (NPSFM) and the National Environmental Standards for Freshwater 2020 (NES Freshwater). Although there is some overlap in subject matter, the long-term visions for fresh water are part of developing the RPS and, after that, a new land and water regional plan, as opposed to implementation discussions about the immediate practical changes that will occur due to new regulation.

4. Communities will have further opportunities to contribute to land and water regional plan development and participate in implementation discussions.

5. ORC gratefully acknowledges the time and effort taken to contribute to this process by Kāi Tahu representatives, community members, and stakeholders alike.

Why the consultation happened

6. In November 2019, after a s24A investigation report on ORC's freshwater management and allocation functions,[2] the Minister for the Environment made several recommendations to the ORC to address its Resource Management Act (RMA) planning framework. ORC committed to a work programme to address those recommendations, which included the review and notification of a new Regional Policy Statement (RPS) by November 2020, in order to make it operative by 1 April 2022, in time to guide land and water regional plan development.

7. In September 2020, the Ministry for the Environment released a new National Policy Statement for Freshwater Management (NPSFM). The new NPSFM includes a requirement to develop long-term freshwater visions for each Freshwater Management Unit (FMU) in Otago, or parts of those FMUs if appropriate. These visions need to be included as objectives in the RPS.[3] The new NPSFM also now requires community input on FMU boundaries.[4]

8. Prior to the new NPSFM taking effect, creating FMU visions was part of the intended process for developing a new land and water regional plan. The new NPSFM requirement meant that

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[1] See Appendix 1

[2] Peter Skelton *Investigation of Freshwater Management and Allocation Functions at Otago Regional Council: Report to the Minister for the Environment* (Wellington: Ministry for the Environment, 2019)

[3] National Policy Statement for Freshwater Management 2020, cl 3.3.

[4] National Policy Statement for Freshwater Management 2020, cl. 3.7(1)(a)

this part of the process had to be brought forward so that the visions could be included in the RPS. This necessitated extending the RPS work programme to accommodate a consultation programme and vision development. The new notification date, agreed with the Minister, is now June 2021.

What a Freshwater Management Unit (FMU) is

9. FMUs were required under the previous iteration of the NPSFM. ORC had previously established them, within input from iwi, for Otago through agreement in Council (see Appendix 2), though these had not been formalised through an RMA process.

10. FMUs are defined areas for freshwater management in a region. In Otago, the boundaries were established based on several factors, such as similar land uses, similar water quality or quantity issues, hydrological factors and connections between catchments, communities of interest, and existing monitoring and jurisdictional boundaries.

11. The Clutha Mata-au FMU has been subdivided into smaller units, called rohe, to account for the connectedness of the entire Clutha Mata-au catchment while providing for the wide variety of uses, influences, and environments that occur along the river's path.

12. The interconnectedness of freshwater environments means that, while ORC considers the proposed FMU and rohe boundaries are appropriate, it acknowledges there are other reasonable ways these boundaries could be set.

What a vision does

13. The purpose of long-term visions for fresh water is to articulate the high-level community aspirations for fresh water in each FMU to help guide freshwater management. The detail on water management for each FMU – rules, levels, flows, limits and so on - belongs in a land and water regional plan. The vision workshops therefore begin a longer conversation to develop a comprehensive framework for freshwater management in Otago.

14. Though the new requirement delayed RPS notification, it also created opportunity. Placing a community generated vision in the RPS as an objective means regional and district plans must give effect to it, putting community aspirations at the core of freshwater management.[5]

15. The new approach means that community visions will guide the land and water regional plan development process, creating a necessary strong link between the regional plan and the RPS.

The NPSFM sets parameters for visions

16. Visions for the FMUs must reflect and be developed through engagement with communities and tangata whenua, expressing what they desire those areas to be like in the future.[6] Other main requirements are:

- the visions need to take account of local history and environmental pressures;

[5] Resource Management Act 1991 ss67(3)(c) and 75(3)(c).
[6] National Policy Statement for Freshwater Management 2020, cl 3.3.

- the visions must set goals that are ambitious but reasonable, with a timeframe to achieve them;
- the visions are bound by NPSFM requirements, particularly the te mana o te wai hierarchy of priorities, which may be briefly stated as water health first, human health second, other human needs third.[7] In application this concept is more nuanced, with significant input on meaning and practice from tangata whenua.

[7] National Policy Statement for Freshwater Management 2020, cl 1.3.

Consultation methodology

17. Consultation on long-term visions had several strands:
    - a series of community workshops covering all FMUs and Rohe;
    - an online survey;
    - written feedback and face to face meetings with iwi representatives;
    - other submissions or reports received as an adjunct to these processes (such as the Shaping Our Future report, prepared by the Upper Clutha community, which represented a significant amount of research and community consultation).

18. Consultation was also designed to recognise and accommodate connections to the upcoming land and water regional plan development process, and other concerns about ORC's wider work that might arise.

Community workshops

19. Twenty-three community workshops were undertaken over the period 27 October to 26 November 2020 at 18 locations across Otago (see Appendix 1). Workshop attendance totalled 237, excluding Councillors and ORC staff.

20. The Manuherekia Rohe of the Clutha Mata-au FMU was not included in the workshop process, because it was already undergoing its own pre-existing comprehensive process. In addition to broader conversations with the community over the past few years, the Manuherekia Reference Group has been operating for some time alongside a dedicated team from ORC to develop a management regime for that catchment, and the new NPSFM requirements will be wrapped into that process. The work that has previously been done leant itself to the drafting of a freshwater vision for the Rohe which was then subject to consultation online.

21. Three to four staff and 2 or 3 regional councillors attended each meeting. They helped answer questions and facilitate breakout groups.

22. At each venue, maps were available of the FMU or rohe (sometimes multiple rohe were discussed), with some time given over as people arrived for discussion and introductions. A facilitator managed the meeting logistics and timekeeping.

23. Also available were short information sheets prepared by ORC staff, summarising what information ORC currently held about the FMU, including scientific monitoring and trend information. The full version of ORC's most recent State of the Environment Report was also available.[8]

24. Each workshop began with a short presentation to explain why the consultation was occurring, the key concepts and regulations involved, and how the workshop would be run, and was followed by a short question and answer session. This session raised several issues across the meetings that, while beyond the scope of the visions development, will be important for ORC to note and act on.

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[8] Adam Uytendaal; Rachel Ozanne *State of the Environment Surface Water Quality in Otago 2006 to 2017* (Otago Regional Council: Dunedin, 2017

25. The workshop then broke into smaller groups for interactive discussions about aspirations for freshwater in the FMU. Each group was assisted by an ORC facilitator. A worksheet was used (fig. 1) to help facilitate discussion and record ideas. As well as recording community members' long-term aspirations, this also helped with setting out the pathway to reaching long term goals with more specific short- and medium-term goals the community considered important.

26. The worksheet's second column included a series of prompts for discussion, drawing on values identified in the NPSFM. The priorities row was included to facilitate a further prioritising exercise that was proposed, but not used as part of the final workshops.

27. Each group member was then given 5 sticky dots, which they could use to identify the 5 issues or visions their breakout group had discussed that they considered to be the most important. They also had the option of putting multiple dots against a vision or idea if they considered it particularly important.

28. Finally, each breakout group fed back a summary of its worksheet to the workshop as a whole.

		Short term (5years)	**Medium term (5-20years)**	**Long term (20+ years)**
Environment	Water quality Water quantity Habitat Aquatic Life Ecological Processes Threatened Species Natural Character			
Cultural / Social	Human contact Fishing Drinking Water Supply Heritage Passive Recreation / amenity			
Economic	Hydroelectric Power Generation Irrigation, Cultivation & Food and Beverage Production Commercial / Industrial use Research values			
Priorities				

Figure 1: Worksheet used for Long-term freshwater vision workshops

29. The NPSFM requirement to establish timeframes for achieving visions was standardised on the worksheets into short (< 5 years), medium (5 -20 years) and long term (>20 years) time frames. Given the broad concepts being discussed and the ultimate goal of creating RPS objectives, staff considered this approach struck a reasonable balance by addressing a level of detail oriented to the level of discussion while setting up a framework for achieving goals as the NPSFM requires.

30. Through the introductory presentation, staff noted the council's proposed FMU and rohe boundaries, and asked attendees to consider whether any change was required.

31. The workshop period was followed by a short email survey to participants to gauge responses to the process. Feedback received during this process will be used to help inform future engagement processes, particularly as it relates to the development of a land and water regional plan.

Online Survey

32. As a parallel process to the community workshops, ORC ran an online survey using Your Say (see Appendix 3). The survey was constructed using the worksheet as a guide to encourage a consistency in the level of detail as to that collected during the workshops.

33. ORC received 216 individual online survey responses (the feedback period ran from 20 October to 27 November 2020).

34. As mentioned previously, community workshops were not undertaken for the Manuherekia Rohe; instead a draft vision was prepared and feedback was sought via an online survey.

Iwi consultation

35. ORC had ongoing discussion with Kāi Tahu through Aukaha and Te Ao Marama Inc, on behalf of affected runaka in Otago and Murihiku. Iwi elected not to attend the individual workshops, preferring to respond separately in a format that suited the values and concerns they wanted to express.

36. Aukaha provided feedback from their runaka on general principles for all the visions, as well as some specific points on each FMU. Te Ao Marama, on behalf of their respective runaka, provided specific feedback by FMU.

Other responses

37. ORC also received a further 10 written responses separate to the online survey process. Some stakeholders preferred to provide feedback as a traditional paper or letter, providing greater scope to discuss a range of issues.

Feedback Summary

Processing the data

38. Through the various channels of feedback, ORC received a considerable amount of information.

39. The information was processed using a qualitative research software package (Atlas.ti), designed for analysing qualitative data.

40. All information received was tagged and collated into the FMU and rohe consultation summaries provided later in this report. For the purposes of vision development, staff focussed on responses to the 20-year time frame, while taking note of shorter-term goals.

41. The information provided for aspirations in the short and medium term will be more thoroughly analysed and utilised as part of the Land and Water Plan development process. As mentioned earlier, the RPS and a land and water regional plan need to work in sequence to facilitate a cohesive land and water management regime. These visions discussions and the information gathered are contributing to this process.

42. Information received that did not belong in the visions process, but was nonetheless valuable to ORC operations, was summarised and raised with ELT to be addressed through internal council processes.

Methodology

43. ORC processed the information using the following methodology:
    a. Developing a way to categorise the information which helped relate feedback to NPSFM requirements;
    b. Initially inputting and analysing data based on those categories, and then expanding the categories to account for the feedback received, with a focus on long term (>20 year) considerations;
    c. Capturing community views on impacts and actions to inform the future development of the Land and Water Plan;
    d. Identifying key themes across categories and creating a series of consultation summaries for each FMU or Rohe.

44. This approach allowed for consistency across multiple analysts, using both the Atlas.ti software and a unified structure.

What we received

45. The following section summarises the information ORC received through consultation for each FMU or Rohe, based on the methodology described above.

46. The Clutha Mata-au FMU as a whole is not represented, being the summation of the rohe summaries.

47. In each summary, the “Local Context” section describes the way communities see their respective areas and the things that matter to them. It notes some of the key issues raised, and some of the actions people would like to see taken. These elements will inform the visions and are also important to the ongoing development of the Regional Freshwater and Land Plan.

48. The “Long term aspirations to inform freshwater vision development” collates the main goals and visions that came through for each FMU or Rohe. These will have the most influence on the visions’ content. Note that, because the final vision statements will be high level, they may not address all these points directly, or use the same language. They will be informed by the range of feedback received and should reflect the spirit of the range of visions the community has put forward, in the context of NPSFM requirements.

49. Note the section on the Manuherekia Rohe is slightly different in format, as it is undergoing a modified process, as described earlier.

General principles

50. Key themes that appeared across all feedback were
    - fish passage in the Clutha Mata-au FMU;
    - reducing or eliminating stormwater and wastewater discharges to freshwater, and eliminating direct discharges;
    - fit for purpose monitoring;
    - protecting native species and habitat;
    - a need to rethink activities in both urban and rural areas to ensure Otago’s freshwater environments remain healthy;
    - finding ways for communities to retain their integrity and prosper within the envelope of environmental health.

Iwi values

51. FMU specific points are captured in the FMU and Rohe summaries below; however, there were clear general principles in iwi feedback:
    - recognising and honouring te mana o te wai and upholding the mauri of the wai;
    - increasing areas and populations of indigenous biota;
    - connecting biodiversity corridors;
    - restoring flows in waterbodies impacted by abstraction;
    - protecting native fish from the mortal impact of hydroelectricity infrastructure;
    - sustaining the connection of mana whenua with Otago’s water bodies, through recognising rakatirataka and enabling exercise of kaitiakitaka

- providing for practice of mahika kai and other mana whenua aspirations as land and water users;
- enabling mātauraka regarding freshwater and the resources it supports to be retained, kept alive and transferred to future generations.
- no further loss of values;
- ki uta ki tai (mountains to sea) management – treating waterbodies as a whole system;
- restoration achieved within a generation.

Consultation feedback summaries by FMU

Upper Lakes Rohe[9] (part of the Clutha Mata-au FMU)

52. The following collates community views on the long-term freshwater vision for the Upper Lakes Rohe, which ORC received principally through community workshops at Queenstown and Wanaka, online surveys, and the Shaping Our Future report, mentioned earlier. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

53. Communities in the Upper Lakes want clean and functioning waterbodies that contribute to a healthy environment, social opportunities, and economic stability. Being able to fish, swim in, and drink the pristine water are valued recreational opportunities and economic attractions. Many respondents saw preserving both the natural character and outstanding water bodies as a shared responsibility across communities, local government, and economic entities, to ensure the source lakes of the Clutha River are kept pristine for future generations.

54. While the lakes are generally considered pristine with significant natural character, several respondents were concerned that current monitoring was not capturing the full picture, especially for water quality at the lakes' edges, where human use impacts are highest. Some noted a perceived decrease in native birds and fish, such as the common bullys around the Wanaka lake edge and called for improvement in monitoring and water quality.

55. There was also widespread unease among respondents about the impacts both tourism and subsequent urban growth were having on local water and wastewater infrastructure, and the surrounding environment. The community was particularly concerned that urban growth will degrade natural outstanding landscapes and waterways, and the increased pressure on already strained water infrastructure will lead to impacts on water quality.

56. Pest species such as didymo and lake snow are also causing water quality issues which affect the environmental, social and, ultimately, economic functions of the water bodies. Valuing, restoring, and enhancing the natural environment and native ecosystems are considered key drivers for securing social and economic prosperity.

Long-term aspirations to inform freshwater vision development

Environmental	• Freshwater environments reflect their natural state, supporting thriving endemic bush cover and native habitat that is home to a high density of native birds and fish, ensuring no native species are endangered. • Pests are significantly reduced, or eradicated, particularly lake snow and didymo, and endemic native species are the first choice for riparian planting.
Social/Cultural	• Water bodies are swimmable, and drinkable without treatment, safe for fishing and mahika kai.

[9] See glossary

	• Urban growth and land use are managed to fit within environmental capacities for ongoing ecosystem health, allowing rivers the freedom to move and change naturally. • Water management recognises the strong ties and affinity to the area for many people of different backgrounds, and the need to retain the aesthetic values that underpin them. • All water users share responsibilities and opportunities brought by a pristine environment, with environmental care and low-impact living as intergenerational core values. • An engaged, informed, and knowledgeable community.
Economic	• Economic use focuses on best practice, minimising environmental impact and recognising healthy freshwater ecosystems as vital to economic activity.

Dunstan Rohe[10] (part of the Clutha Mata-au FMU)

57. The following collates community views on the long-term freshwater vision for the Dunstan Rohe, which ORC received principally through community workshops at Cromwell, Arrowtown, and Wanaka, and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

58. Respondents consider the Rohe to have good water quality and special natural character and want to maintain this into the future. The Wakatipu Basin community was concerned about the state of Lake Hayes and plans for improving quality in the lake. Good water quality underpins agriculture (in particular horticulture and viticulture) and tourism, which are key economic drivers. People wanted to see native species back in the rohe, particularly tuna.

59. Pests were identified as a key threat to habitat quality and the economy, particularly wilding pines and lake weeds. Community members were also concerned about the impact of trout and salmon on native fish, especially tuna.

60. To preserve local ecology and water quality, land uses need to be appropriate to the climate, soil types, and resources available, and have appropriate infrastructure servicing them. There was general concern about how climate change will exacerbate adverse effects. Farm Environment Plans were identified as a useful tool, provided they are implemented and audited properly.

61. Respondents emphasised the need for good information about water quality, quantity, and hydrology. They considered monitoring and data is not currently good enough to determine an environmental baseline, and therefore can't provide for adequate management. The monitoring network needs to be fit for purpose.

62. There was a sense that urban communities needed to better understand urban effects on water and be responsible for them. Urban waste, stormwater, and silt run off were raised as particular issues. Rural respondents also wanted rural residential development confined to non-productive land.

63. Community resilience could be enhanced through flexible consenting that provides for actual needs for water (particularly for horticulture, which has variable use across years), support for on-farm water storage in feasible places, and small-scale energy production. Some respondents saw water spilt through the dams as a potential source for harvesting and storage.

64. The community saw improved relationships as key to addressing existing issues, supported by a more transparent regulatory process and more collaboration between agencies on common tasks, making it easy for people to do the right thing. Some communities in the Dunstan Rohe have been independently discussing the future for their part of the area, with groups like Shaping our Future developing community visions. They want to see community led decisions supported and implemented by regulatory agencies.

[10] See glossary

Long-term aspirations to inform freshwater vision development

Environmental	• Rivers, lakes, and their margins are restored and maintained to reflect their natural state, providing a safe haven for flourishing native species, free from pests, and providing ecological services from run-off control to climate change resilience. • The rohe remains attractive; clean and green is a reality, not just a tagline. • Waterways are safe for swimming and drinking, and support the range of environmental and human needs, with substantial riparian areas minimising sediment and nutrient run off. • Flows reflect rivers' natural behaviour, providing ample fish habitat and resilience to climate change effects, with water available for harvesting and storage.
Social/Cultural	• Implementing te mana o te wai provides for threatened species, restores mahika kai, and underpins the essential long-term partnership between pakeha and takata whenua. • Trout and native fish are provided for, including a healthy eel population suitable for harvesting. • Sustainable drinkable waterways and lakes. • Otago is a recreation destination for locals and visitors, with all water safe for swimming. • ORC actively facilitates efficient water harvesting for long-term water reliability.
Economic	• The area is recognised as the world's best producer of fresh produce and wine, underpinned by excellent water quality, the right activities in the right places, and well managed infrastructure, sustainably supporting economies and communities. • Otago is recognised as a world tourist destination, with tourism managed to be within infrastructure capacity and provide economic and environmental benefits for local communities.

Manuherekia Rohe (part of the Clutha Mata-au FMU)

65. As mentioned previously in the report, the process for consulting on the Manuherekia vision was different to that which has been undertaken on the remaining FMU and Rohe. This was due to previous consultations on the values and aspirations for the Rohe in 2019. The feedback from the previous consultation enabled a draft vision to be prepared, and feedback sought directly on that vision.

66. Below is the draft vision which was the subject to online consultation across the consultation period:

> "Within the Manuherekia Rohe the health and mauri of freshwater ecosystems is prioritised, whilst achieving and sustaining the social, economic and cultural wellbeing of mana whenua and communities through:
>
> - river and tributary flows and water quality that sustain ecosystem health.
> - healthy habitats of all freshwater and avian species;
> - no species endemic to the Rohe being in the threatened category;
> - all wetlands being highly functioning and protected; and
> - sustaining the naturalness and distinctiveness of the waterbodies, their margins and surrounding landscapes;
> - Connections between the health of freshwater and the wellbeing of mana whenua and the community are recognised and celebrated.
>
> This will be achieved by ensuring:
>
> - By 31 December 2025, an enduring water management regime is in place, which supports restoration of degraded ecosystems and climate change resilience, through efficient water use, best practice land management and enabling adaptive management; all remaining wetlands and the braided river character in the upper catchment are protected.
> - By 2040, water quality and flows sustain a healthy ecosystem, water is suitable and safe for contact recreation, drinking water supply, and access to mahika kai, which supports the visibility of Wāhi Tūpuna and mana whenua connections
> - By 2050 the river and tributary flows and water quality have been restored, land uses have adapted or changed to reflect the new water management regime."

Feedback received

67. The following collates the feedback received on the draft vision.

68. Water in the catchment supports several highly valued and often competing values. Feedback received across the board covered both a desire to see a strengthening of the environmental bottom line and tightening of timeframes to achieve such and a greater focus on enabling the use of water and the economic value it plays in supporting the community. There was also feedback that the river was in good health now and that nothing needed to change.

69. Many in the community felt the economic value and desired outcomes of the community were not appropriately covered in the draft vision. Of particular importance was a secure and reliable supply of water for irrigation; equity between users; more efficient use of available

water; increase to irrigated area and ongoing support for the tourism industry. A stronger representation of the community within the vision was desired by some respondents.

70. Feedback also acknowledged some of the tensions within the draft visions, such as protecting and encouraging native species to thrive, whilst providing for the healthy habitats of avian and freshwater species and sought clarification within the vision to address this concern.

71. There was general support for achieving and sustaining drinkable and swimmable water, and access to mahika kai. Although there was some debate over the appropriateness of the timeframes set, with a number of respondents believing them to be too long, and wanting to see achievement sooner, with a concern being expressed that if we take too long it will be too late for improvements. Additional detail to specify outcomes within the timeframes was supported, as was further clarification on the use of "restore", with the question being posed, what are we restoring to?

72. The integration of land use and the health of the water was supported in the vision, but that this should be at such a level not to constrain future policy direction within the Land and Water Regional Plan to determine what that would look like for this rohe.

Roxburgh Rohe (part of the Clutha Mata-au FMU)

73. The following collates community views on the long-term freshwater vision for the Roxburgh Rohe, which ORC received principally through community workshops at Clyde and Roxburgh, and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

74. Respondents largely perceived water quality and quantity to be good. Some community members suggested that there are untapped water resources that could be more efficiently utilised to support both the communities and economy. There was concern about upstream discharges and the lack of information available about causes of water quality issues.

75. Communities felt that the biodiversity in waterways was currently good and it should be the communities that are responsible for keeping these levels stable. This was also the case for natural character.

76. In some cases, modified areas were valued as much as unmodified areas, for example, the ecology and natural character associated with the dams. Some respondents viewed the notion that the environment be returned to a specific point in history as unreasonable and arbitrary.

77. Large scale hydroelectricity generation was acknowledged as important, however there was opposition to increasing the amount of large-scale damming.

78. Food production is a vital part of the Roxburgh Rohe's local economy. Having flexibility to develop innovative, adaptable, and efficient irrigation schemes is highly valued, and allows the community to continue irrigating within environmental limits. Community level research was encouraged to support a 'ground up' approach to understanding local needs. Combining information and education with regional experts and monitoring data would facilitate greater partnership between the ORC and the community to produce tailored and effective outcomes for water management.

79. There was also a discussion about the boundaries for the Roxburgh Rohe, and there was some confusion about why Roxburgh Township was not included. The current boundaries have Roxburgh township in the Lower Clutha Rohe.

Long-term aspirations to inform freshwater vision development

Environmental	• Communities are connected to, and responsible for, thriving and biodiverse ecosystems in partnership with the ORC and across generations. • Stable natural character integrated with realistic and beneficial enhancements. • Clean potable water available for recreational and economic uses, free of sediment. • Efficient, affordable, and secure water supplies to ensure supportive productivity.
Social/Cultural	• Water is drinkable and free of water-soluble pollutants and other discharges across generations.

	• Healthy numbers of trout and other valued species are present in the waterways for continued recreational fishing. • Water is freely accessible for everyone. • Communal sense of connection to the land and investing into the wellbeing of the environment for economic and social stability. • Everyone has continued access to clean waterways suitable for recreational fishing, swimming, and kayaking. • Resilient, efficient, and secure water stores. • Water treated as taonga, meeting Iwi aspirations for wāhi tapu.
Economic	• Food Production: Food producers in the Roxburgh Rohe are recognised as world leaders in environmentally ethical, profitable, and efficiently sustainable food production. • Large scale hydroelectricity generation remains stable. • Irrigation is adaptable, innovative, efficient, and integrated. • Expert and community level research and monitoring data is integrated with community action and education for best practice water management.

Lower Clutha Rohe[11] (part of the Clutha Mata-au FMU)

80. The following collates community views on the long-term freshwater vision for the Lower Clutha Rohe, which ORC received principally through community workshops at Ettrick, Tapanui, Balclutha, Roxburgh, and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

81. Respondents considered that the water quality was good and well maintained by those who use the water. It was accepted that most waterways were drinkable and swimmable and therefore the visions should reflect the desire to maintain current water quality.

82. The community suggested better monitoring, research, and data transparency is needed to determine the natural baseline for water quality and defining more precisely whether and where water issues exist. ORC could then target problem areas with tailored regulatory or non-regulatory approaches, alongside community education.

83. Community members were generally concerned about sewage and other discharges from upstream urbanised areas. They considered urban areas need to understand the effects of urban discharges and take responsibility. It was suggested that education would greatly improve both water quality and rural-urban relationships.

84. Food production is considered the life blood of the community, contributing to local and national identity and economy. Access to water for irrigation is integral to enabling communities to continue farming across generations. Respondents saw family run farms as custodians of the land and were concerned about any changes that would favour a move to an impersonal, corporate approach.

85. Several respondents suggested that flushing by the dams could be coordinated with the need to take and store water lower down the main stem, to increase efficiency of water use.

Long-term aspirations to inform freshwater vision development

Environmental	• Waterways have healthy, functional, and beautiful biodiverse ecosystems across pest free environments. • Attractive and stable natural character integrated with functioning biodiversity. • Future generations have access to reliable and sustainable potable water supplies. • Widely accessible and adaptable water supplies for both the community and economy in the face of hazards and climate change.
Social/Cultural	• Future generations have easy access to safe, secure, swimmable, and drinkable waterways. • Iwi have access to flourishing mahika kai sites. • Abundant recreational fishing species and access to recreational fishing.

[11] See glossary

	• The ORC and local communities working in true partnership to achieve water quality outcomes.
Economic	• Robust, resilient, and growing intergenerational farming economy supported by research and best practice. • Stable hydroelectricity power schemes working with the local communities for efficient use of water. • Widely utilised and efficient irrigation schemes for food production. • Farming practices improving the water quality through operation. • Transparent and targeted water quality monitoring reports for the community supported by education facilitated by the ORC.

North Otago FMU[12]

86. The following collates community views on the long-term freshwater vision for the North Otago FMU which ORC received principally through community workshops at Oamaru and Palmerston and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

87. North Otago FMU communities were concerned about water quality, in particular the Kakanui and its estuary. Respondents generally agreed that water quality should at least be maintained, and ideally improved across the FMU. Memories of swimming, fishing, and collecting mahika kai in rural rivers were common, as was people's desire to enable their children to do the same. Respondents also recognised that each river and catchment would need a bespoke approach, and that people would need to work collaboratively to achieve that.

88. Identified drivers of poor water quality included urban storm water, forestry, and lack of fencing of waterways. Suggested solutions included investment in storm water and sewerage infrastructure along with improved planning and regulation of forestry activities and fencing and revegetation of riparian areas and wetlands.

89. Some respondents were satisfied with current biodiversity health, though many were not. All wanted to see thriving biodiversity and healthy aquatic habitats maintained or improved. Proposed approaches included riparian planting, community education, and supporting landowners to identify, plan and manage biodiversity on their property. Trout present an issue, both having recreational value and posing a threat to native fish species.

90. Feedback showed that agriculture plays a key role in North Otago FMU's economy, making certainty of access to water vital, especially as climate change is expected to make the FMU drier. Irrigation was raised as key to future success.

91. Some community members noted that climate change could provide opportunity for diversification. This included land use practices suitable for a dryer climate and high value recreation development. The latter would rely on good water quality and healthy biodiversity.

92. Feedback provided various suggestions to ensure economic use could co-exist with environmental, social, and cultural values. General suggestions included improved use efficiency, water storage and practices to improve water retention and soil quality. Other points raised included maintaining and further developing irrigation infrastructure, identifying and protecting high value agricultural land from urban development, investing in technology for agriculture, and managing land use to ensure the right activities occur in the right places (e.g. forestry, dairying).

93. Data collection and monitoring were identified as important for all aspects of management – cultural values, water quality and quantity and biodiversity. Respondents considered that achieving long term aspirations will require more collaboration between all parties in the

[12] See glossary

FMU- landowners, businesses, agencies and councils, and more integration of policy, regulation, and spatial planning.

Long-term aspirations to inform freshwater vision development

Environmental	• Biodiversity in North Otago is flourishing - habitats have been maintained and enhanced; rivers and waterways are healthy and can support sustainable recreational fishing; biodiversity needs are considered in each catchment and in farm planning. • North Otago ecosystems are resilient, and their condition has been improving through careful stewardship and sustainable approaches to management. • The natural character of North Otago is maintained. • Management of catchments and water resource uses ensures that all water meets water quality standards. • All water is managed sustainably and there is clarity and transparency in access and administration.
Social/Cultural	• Community water access is maintained. • North Otago water heritage is recognised and maintained. • Mahika kai is understood by the community and Iwi access is maintained • Recreational fishing is enhanced in larger waterways. • A resilient and sustainable North Otago where development is sustainable and considers future generations. The North Otago community is resilient, capable and works together. • The North Otago community is thriving and growing.
Economic	• Long term sustainable farming systems and practices support a thriving economy. • Freshwater and marine fisheries are ecologically sustainable. • Irrigation is developed, managed, and maintained to support a sustainable economy. • North Otago has a culture of innovation based on its unique value proposition. • North Otago has a vibrant economy which is connected to the region; the economy is supported by a balance between the economic uses and social values of water. Development is sustainable and considers future generations. • Tourism is a high value contributor to North Otago's economy.

Taieri FMU

94. The following collates community views on the long-term freshwater vision for the Taieri FMU, which ORC received principally through community workshops at Ranfurly, Middlemarch, Mosgiel and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

95. The Taieri FMU is home to threatened species of Galaxiids, which the community wants to retain. Challenges will include retaining trout, which, despite being a threat to Galaxiids, are still valued for recreational fishing. Didymo was also considered a significant problem for both biodiversity and water quality, and these conflicts require creative ecological solutions.

96. Communities valued the FMU's unique and distinct natural character, including the scroll plains, wetlands, rocky outcrops, and Sutton Salt Lake. These are unique features and will need unique management approaches to maintain them for future generations to enjoy. There was strong opposition to forestry in the Taieri FMU, as a threat to natural character and agriculture.

97. Agriculture is the primary economic driver in the Taieri, and the communities want to see it remain this way across generations. Irrigation ensures the stability of agricultural practices, so needs to be resilient to climate change.

98. Respondents saw several initiatives as possibilities for securing their future. Water storage will be important to secure water supply and support adaptation to climate change and other hazards. Flood protection, and wastewater and water supply infrastructure improvements were seen as logical solutions for inevitable population growth. Small scale hydropower generation and other renewable energy sources could also help make farming practices more sustainable and increasingly economically viable, although the current cost associated with small scale hydroelectricity generation makes it unfeasible.

99. Monitoring and data transparency were key themes in feedback. Some suggested improving water education for the community to increase engagement on water issues across rural and urban populations. Rural and urban populations need to share responsibility for water health.

100. Across the consultation meetings it became apparent that the Taieri is made up of unique and distinct areas that may require different management approaches within the Freshwater Management Unit.

Long-term aspirations to inform freshwater vision development

Environmental	• Thriving and diverse ecology integrated with attractive riparian zones across a pest free environment. • The unique natural character and features of the Taieri are beautiful and valued, continuing to contribute to the community sense of place. • Local water quality remains pristine and resilient across generations, free of grey and black water discharges.

	• Secure and reliably stored water available for the community and economic needs.
Social/Cultural	• Accessible, resilient, and valued water stores that are integrated with well-functioning infrastructure to meet the needs of an increasing population. • Community can continue to freely access recreational fishing. • Waterways continue to be accessible, swimmable, and drinkable across generations. • Communities across ages, diversities and users who are well engaged with catchment management in partnership with the ORC. • Communities have a healthy sustained connection to their waterways and both Mahika Kai sites and Wahi Tapu are understood, thriving, and protected for Iwi.
Economic	• Agriculture remains the primary economic driver for the Taieri across generations who utilise sustainable, prosperous, and adaptable agricultural practices. • Hydroelectric power, including other renewable energy sources, is widespread and utilised for innovative, renewable, and sustainable farming practices. • Irrigation is climate change resilient and carried out efficiently and with best practice. • Waterways are monitored to establish tailored targets, and communities have access to education based on transparent water data.

Dunedin & Coast FMU

101. The following collates community views on the long-term freshwater vision for Dunedin and Coast FMU which ORC received principally through community workshops at North East Valley, Orokonui, Milton and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

102. Many Dunedin & Coast FMU community members felt a connection to the area's natural character and diversity, such as the harbour, peninsula and coastal areas, and their associated natural, social and cultural values, while acknowledging the complexity inherent in managing these alongside the activities necessary to support a growing urban area. This drove a desire to maintain and protect water quality, including connected aquatic and estuary ecosystems, and biodiversity and kai species such as whitebait, eels, and lobsters. Several felt the long-term goal should be to restore the riparian habitats and biodiversity to as close to "yesterday" as possible. Others considered it more feasible to aim for functional and healthy networked habitats and ecosystems with good water quality ki uta ki tai.

103. Community feedback indicated concern about maintaining access to swimmable and drinkable water and to mahika kai. Urban and industrial discharges into urban waterways such as Kaikorai Stream, and the cumulative impacts of these, were mentioned as particular concerns, as was the plan to develop a landfill site on Otokia Creek. Some residents living close to river mouths were concerned about low flows resulting from over-allocation upstream and considered that minimum flows need to be established. Several people also noted the councils' role in providing quality recreation facilities, such as bike tracks, to support people's connection to the environment.

104. Suggested improvements included planning infrastructure to meet population growth needs with minimal impact and controlling land use, for example protecting highly productive land, controlling carbon farming, preventing further irrigation development, encouraging sustainable rural land uses and improving forestry regulation. Some respondents suggested that, to encourage water being properly valued and efficiently used, people should pay for the water they use.

105. Hydroelectricity was discussed with some members of the community continuing to favour it as a sustainable source of energy while others preferred developing alternative sources like wind.

106. Some people called for more data to better inform future management. They considered better information was needed to understand the sources of water quality issues and effects of current actions, and to identify baselines. Cultural mapping was also raised as important to good management.

107. Several respondents wanted a catchment framework and more regular engagement and information sharing to foster stewardship and a shared understanding of issues and solutions, as well as guidance on topics like restoration, weed control, and flood mitigation. People also said councils needed to work better together, with other agencies, and with the community to manage environmental concerns, such as the impact of trout on native fish and heavy metal

poisoning from gunshot in estuaries, and provide integrated approaches to, for example, pest management.

Long-term aspirations to inform freshwater vision development

Environmental	• Biodiversity and habitats are thriving from the mountains to the sea - and are protected, enhanced, connected, and restored. Waterways are healthy and accessible and native fish are protected from introduced fish. • Mahika kai is sustainable, safe, and accessible. • Natural character of Dunedin is maintained. • Stewardship by everybody means that future generations have reliable access to sustainable quality water supplies. • Allocations are sustainable and water flows approximate natural flows which support a functional ecosystem. There is stewardship of water. • Long term stewardship approach prevents cumulative impacts.
Social/Cultural	• Future generations have easy access to safe, secure, swimmable, and drinkable waterways. • Sustainable mahika kai – with access for all. • Recreational fishing is sustainable. • Communities are empowered and engaged across generations to share and address problems in integrated and holistic way in catchments. We all know about and take responsibility for the health of the catchment; healthy environment provides for healthy people. • Rivers swimmable and drinkable, but lower priority than ecosystem health.
Economic	• Farming contributes to the local economy. Highly productive land is protected, and lifestyle blocks are restricted to marginal land. Costs of externalities are factored into prices and regulation is workable for all landowners. Opportunities for high value production are explored and supported. • Hydroelectricity generation schemes are sustainable, renewable, and low impact. • Population growth is supported by sustainable, efficient, and renewable infrastructure development. • Irrigation Is maintained to support balanced regional wellbeing.

Catlins FMU

108. The following collates community views on the long-term freshwater vision for the Catlins FMU which ORC received principally through community workshops at Owaka and through online surveys. It summarises the range of long-term aspirations participants provided and seeks to reflect the context given for local views and preferences.

Local context

109. People considered maintaining water quality in the Catlins FMU was vital to ensuring a long future for key community values such as fishing, mahika kai and recreational water pursuits such as swimming and kayaking. Community members considered some improvement in water quality was needed and could be supported by investing in proper infrastructure such as sealed roads, constructing flood prevention structures, and regulating forestry to minimise sedimentation.

110. Many people saw maintaining the FMU’s unique natural character and natural and rural landscapes as an important long-term objective, with potential to drive economic growth through tourism. This went hand in hand with maintaining biodiversity, including natural vegetation and iconic threatened species such as yellow eyed penguins. Some community members did note the negative impact of sea lions and seals on habitats and fish populations.

111. Actions proposed to support these values included planning appropriate sites for development so that the landscape is preserved, maintaining heritage values, and carefully managing tourism’s negative impacts (e.g. freedom campers) to minimise impacts on the local community. Access to drinking water supply at Owaka would also need careful consideration under growth scenarios.

112. Proposed approaches to support biodiversity included weed control, riparian protection, farm planning and an integrated approach to possum control on both private and public land. Guidance on best practice land management was seen as something that would benefit biodiversity in the long term. The community wanted better knowledge about how to manage threats to yellow eyed penguins and broader community education about threatened species.

113. The community values the FMU’s rural character and would largely prefer to maintain the agricultural base for the economy. This will require planning to manage extent and location of urban development, along with control of forestry development.

Long-term aspirations to inform freshwater vision development

Environmental	• Healthy ocean ecosystems, including fish populations; citizen science is part of research. • The amazing and unique natural character of the Catlins is maintained for children of the future and is accessible. • Water quality maintained and improved. • Water quantity will be sustainable and sufficient for both humans and ecosystem function.
Social/Cultural	• Recreational food gathering (mahika kai) is sustainable.

	• Heritage sites recognised and better used for education and raising awareness. • Community access to fishing is maintained. • Human economy sits within a sustainable ecosystem.
Economic	• Farming by NZ families is maintained as an important part of the regional economy. • Zero carbon economy.

Other feedback

FMU boundary changes

114. Workshop participants and people responding to the online survey were also able to comment on the FMU and Rohe boundaries. Feedback suggested some potential alterations:
    - Extending the Roxburgh Rohe below the Roxburgh dam and including the township of Roxburgh as well as the lake,
    - Moving the boundary between Upper Lakes FMU and Dunstan FMU up to Lake Hawea's outlet, so that the Hawea River becomes part of Dunstan FMU along with the Kawarau and Upper Clutha Mata-au.

115. ORC is considering these changes and will release the finalised boundaries as part of the notified RPS in June 2021.

General issues arising from consultation

116. Although the primary goal of the survey and workshops was to gather information for constructing FMU visions, and leading the initial work on the Land and Water Plan, they also provided an avenue for more wide ranging feedback and discussion about the ORC's performance, role and functions. Across all discussions and responses, several consistent themes emerged:

    - ORC could improve internal information sharing so groups are more aware of each other's work, and to ensure community members get the help they need without hassle;
    - ORC needs to improve its engagement processes to ensure Otago communities are up to date with ORC's activities and so that ORC keeps abreast of community needs and concerns;
    - Consultation processes need to allow time for people to be properly engaged, consider issues and respond fully;
    - ORC's monitoring network needs to be improved to meet community information requirements and support good environmental management;
    - There is a lack of understanding between rural and urban communities in Otago, and ORC can play a role in improving this through education, information, and more consistent engagement.

Where we go from here

117. ORC will use the information collected from this consultation process to create vision statements for each FMU and Rohe, which will be inserted in the RPS. Communities will be able to respond to those visions, and everything else in the RPS, when it is notified in June 2021.

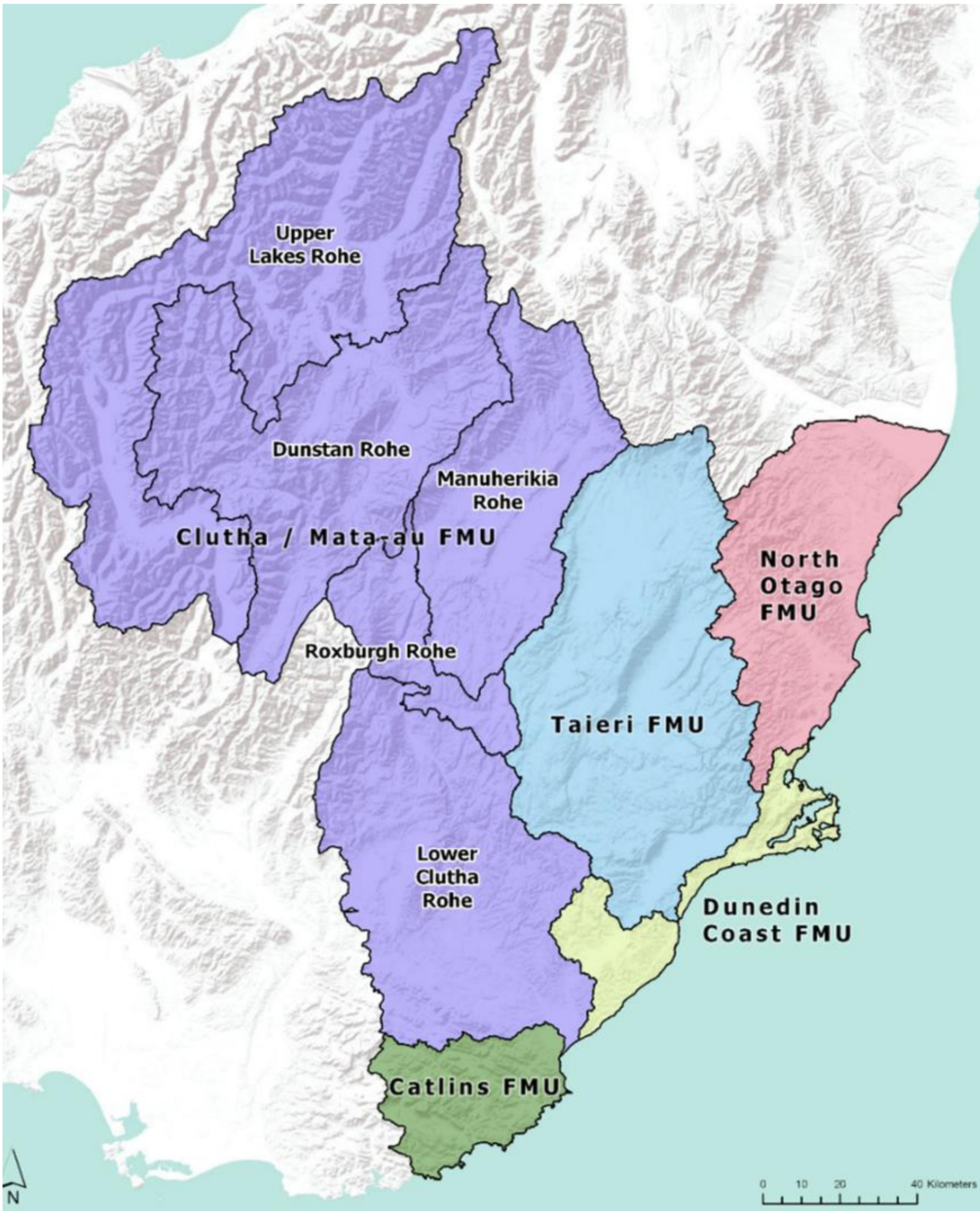
118. Visions distil a range of values, aspirations, and thoughts, into relatively brief and broad statements about future goals. While the visions development process will draw on all the information collected, the focus will be on communities' long-term aspirations, combined with scientific data the ORC holds, and the NPSFM's requirements. While the exact language and expression the community has provided may not appear in the visions, the final daft versions should still reflect the spirit and intent of community feedback.

119. The consultation process has provided a wealth of feedback that goes beyond the brief of a vision statement or in some cases, beyond the scope of the RPS, especially concerning specific issues, concerns, and short-term actions. This feedback will help to guide development of the Otago Regional Water and Land Plan and will be the seed for future consultation as part of that process.

Appendix 1: Meeting schedule

Date	FMU / Rohe	Location	Afternoon	Evening	Venue
Tue 27 Oct	Catlins	Owaka	NA	5:30 - 7.00	Owaka Memorial Hall Ovenden St Owaka
Wed 28 Oct	North Otago	Oamaru	12.30 - 2.00	6.00 - 7.30	Oamaru Opera House 90 Thames St Oamaru
Thu 29 Oct	North Otago	Palmerston	12.30 - 2.00	NA	Palmerston Community Hall 104A Ronaldsay Street, Palmerston
Mon 2 Nov	Taieri	Ranfurly	12.30 - 2.00	6.00 - 7.30	Ranfurly Town Hall Northland St Ranfurly
Tue 3 Nov	Clutha/Mata-Au and Dunstan	Cromwell	12.30 - 2.00	NA	Cromwell Presbyterian Centre Elspeth St Cromwell
	Clutha/Mata-Au and Roxburgh	Clyde	NA	5.30 - 7.00	Clyde Hall Fruitgrowers Road Clyde
Tue 10 Nov	Taieri	Mosgiel	12.30 - 2.00	NA	Mosgiel Coronation Hall 99 Gordon Road Mosgiel
	Dunedin Coast	Dunedin	NA	6.00 - 7.30	Salvation Army Hall North East Valley Dunedin
Wed 11 Nov	Dunedin Coast	Orokonui Sanctuary	NA	6.30 - 8.00	Orokonui Sanctuary 600 Blueskin Road Dunedin
Thu 12 Nov	Taieri	Middlemarch	12.30 - 2.00	6.00- 7.30	Middlemarch Memorial Hall
Tue 17 Nov	Clutha/Mata-Au and Lower Clutha	Ettrick	NA	5.30 - 7.00	Ettrick Hall Ettrick
	Clutha/Mata-Au and Roxburgh	Roxburgh	12.30 - 2.00	NA	Roxburgh Memorial Hall Scotland St Roxburgh
Wed 18 Nov	Clutha/Mata-Au and Lower Clutha	Tapanui	12.30 - 2.00	5.30 - 7.00	West Otago Community Centre (Social Room) 3 Suffolk St Tapanui
Thu 19 Nov	Dunedin Coast	Milton	12.30 - 2.00	NA	Milton Coronation Hall 98 Union St Milton
	Clutha/Mata-Au and Lower Clutha	Balclutha	NA	6.00 - 7.30	Cross Recreation Centre 18 Glasgow St Balclutha
Tue 24 Nov	Clutha/Mata-Au and Upper lakes	Queenstown	NA	6.00 - 7.30	St Peters Church Hall 2 Church St Queenstown
Wed 25 Nov	Clutha/Mata-Au and Upper Lakes	Wanaka	12.30 - 2.00	6.00 - 7.30	Lake Wanaka Centre 89 Ardmore St Wanaka
Thu 26 Nov	Clutha/Mata-Au and Dunstan	Arrowtown	12.30 - 2.00	NA	Arrowtown Bowling Club 6 Hertford St Arrowtown

Appendix 2: First proposal for FMU boundaries



Appendix 3: Online survey questions

Note:

- The questions in this appendix have been adapted from the online format to improve reading ease and questions regarding personal details have been removed. Because of this, question numbering may differ from that which respondents to the online survey experienced.
- For each question asking people to provide a vision or goals, there was a supplementary question about timeframes, which asked when they would like to see their vision or goal achieved, with options of short term (5 years), medium term (5-20 years), or long term (20+ years).

Q1: Which FMU do you live in (or wish to comment on)?

Q2: Which rohe do you live in?

Q3: While you are here, we'd like to hear if you have any comments about the boundaries of Otago's FMUs and rohe?

Q4: What is your vision or goal for water quality in waterways near you?

Q5: What is your vision or goal for water quantity in waterways near you?

Q6: What is your goal or vision for the habitat surrounding waterways near you?

Q7: What is your goal or vision for aquatic life living in waterways in your area?

Q8: What is your goal or vision for the ecology of waterways in your area?

Q9: What is your goal or vision for threatened species in your area?

Q10: What is your goal for the natural character of waterways in your area?

Q11: Are there any other environmental values, issues, or topics you'd like to raise?

Q12: What is your goal or vision for mahika kai in your area?

Q13: What is your goal or vision for wai tapu in your area?

Q14: When would you like to see this vision or goal above achieved?

Q15: What is your goal or vision for navigation, launching and landing of watercraft and Tauranga Waka?

Q16: Do you have a connectedness with a waterway or part of a waterway? If so, what is your vision or goal for continuing to have a connection with this waterway?

Q17: Are there any other cultural values or topics you'd like to raise?

Q18: What is your goal or vision for swimming or recreation in or on waterways near you?

Q19: What is your goal or vision for fishing in waterways in your area?

Q20: When would you like to see this vision or goal above achieved?

Q21: What is your vison or goal for drinking water supply?

Q22: When would you like to see this vision or goal above achieved?

Q23: What is your vision or goal for heritage and historic water use sites in your area?

Q24: When would you like to see this vision or goal above achieved?

Q25: What is your goal or vision for recreation and amenity values for waterways in your area?

Q26: When would you like to see this vision or goal above achieved?

Q27: Are there any other social values or topics you'd like to raise?

Q28: What is your vision or goal for hydroelectric power generation?

Q29: What is your goal or vision for irrigation, cultivation, and food and beverage production?

Q30: What is your goal or vision for commercial and industrial uses of freshwater?

Q31: What is your goal or vision for research values?

Q32: Are there any other economic values or topics you'd like to raise?

Q33: We would like your feedback on the draft vision for the Manuherekia Rohe. Please add your feedback below.

Appendix 6: Freshwater visions feedback from Kāi Tahu ki Otago

27 November 2020

FRESHWATER VISIONS FOR OTAGO – KĀI TAHU KI OTAGO

ORC is seeking input on the long term visions for freshwater in Otago. These visions will provide direction for developing policies and rules for managing freshwater.

This document identifies:

- Principles that Kāi Tahu ki Otago consider are important in setting freshwater visions
- The visions of Kāi Tahu ki Otago for freshwater management in all catchments
- Additional priorities for specific catchments
- The timeframes in which Kāi Tahu ki Otago want to see the visions achieved
- Management changes that Kāi Tahu ki Otago consider are needed to achieve the vision

Underlying principles

The following key principles should be recognised, and should underlie development of freshwater visions:

1. The whakapapa of mana whenua and water are integrally connected. There is a close kinship relationship, and mana whenua and the wai cannot be separated. The mana of the wai is shared with mana whenua through this relationship, and the mana is impacted on if the human connection is not there. Freshwater visions need to ensure that the connection of mana whenua with the water bodies is sustained, including through:
   - Recognition of rakatirataka
   - Enabling exercise of kaitiakitaka
   - Upholding the mauri of the water bodies
   - Providing for practice of mahika kai and other mana whenua aspirations as land and water users.
2. Freshwater visions must recognise interconnectedness across a catchment. The mauri of different parts of the water body system cannot be separated. The water body must be treated as a whole system, with all tributaries and riparian areas, including their natural characteristics and indigenous biodiversity, contributing to the vision.
3. Kawa and tikanga have been developed over the generations, based on customs and values associated with the Māori world view that span the generations. These values are inherent in the kaitiakitaka responsibility of mana whenua and need to be reflected in decision-making, management and monitoring. Recognising and honouring te mana o te wai and upholding the mauri of the wai are consistent with this value base and are the responsibility of both treaty partners.
4. Freshwater management must enable mātauraka regarding freshwater and the resources it supports to be retained, kept alive and transferred to future generations.

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Vision

The Kāi Tahu ki Otago vision for all catchments in Otago is that the following outcomes are achieved:

1. The wai is health-giving:
    - The quality where the waterway enters another receiving environment should be as good as at the source
    - We can drink the water and eat the kai.

2. The waterways are restored to the way they were when tūpuna knew them:
    - Water flow is continuous through the whole system
    - There is no further modification of river shape or braided stretches
    - Existing wetlands are restored and the area of wetlands is increased.

3. Mahika kai is flourishing, native fish can migrate easily and as naturally as possible, and taoka species and their habitats are protected from negative water quality and quantity impacts.

4. Over-allocation is reversed, and water is available and allocated to meet mana whenua aspirations.

5. The interconnection of freshwater and coastal waters is recognised:
    - Sea level rise is accommodated in planning for infrastructure and other activities near river mouths, estuaries and hāpua systems
    - Inaka habitats at the salt-water wedge are protected.

6. The quality and quantity of groundwater is protected, and the interconnections with waterways are recognised.

7. Mana whenua are integrally involved in freshwater planning, implementation and monitoring, and mātauraka is alive and being passed on.

8. Land users work together to restore catchments.

Priorities/ additional focus for particular catchments or Freshwater Management Units (FMU)

Mata-au	• Mata-au is one catchment and needs to be managed as such. • Management recognises and reflects that the wai comes directly from Tawhirimatea (the sky) to the top of the mauka and into the awa so is pure at source – the quality along the full length of the waterway should reflect this. • There is no further degradation of lakes. • There are no sedimentation effects on the ocean.
Taieri	• Healthy wetlands are restored in the upper catchment wetland complex and tussock areas. • Waipori/ Waihola wetlands are restored. • There is no sewage discharge to Lake Waihola.

	• In the long term, the gravel bed of the lower Taieri is restored and sedimentation of the Waipori/ Waihola complex is reversed.
Dunedin Coast FMU	• Waikouaiti River catchment should be included in this FMU rather than North Otago. • Pollution of the harbour is reduced. • Hidden waterways are recognised – in the long term, waterways are naturalised as much as possible, and potentially some piped areas are opened up.
North Otago FMU	• Pollution of the Waihemo (Shag), Waianakarua and Kakaunui Rivers and Trotters Gorge Creek, and their tributaries, is reduced. • Wetlands are restored throughout the North Otago catchments. • Riparian margins are healthy and are protected from the effects of stock grazing and pests.

Timeframes for achievement of vision

- From now:
  - No further loss
  - Consents are granted for a maximum of 10 years
  - Systems and resources are developed to facilitate restoration measures.
- Within 10 years:
  - Management practices have been changed and positive restoration measures are underway.
- By 20 years: Outcomes are being achieved.

Management changes needed to achieve the vision

Water quality	• Improved management of stormwater runoff, including runoff from land development and from roads • Land-based sewage and animal effluent disposal – no disposal to water • No sedimentation effects on ocean, harbour and estuaries • Reduce nutrients and effluent entering groundwater • Shorter consent terms – no more than 10 years • Consultation with mana whenua
Water quantity	• Levels and flows support flourishing mahika kai, not minimum requirements • Augmentation by off-stream storage in appropriate locations and circumstances • Shorter consent terms – no more than 10 years • Consultation with mana whenua

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River works and structures	• No modification of headwaters • Retain existing braided stretches • No further modification of the shape of rivers • No new instream dams • Rehabilitation of gravel extractions to provide for natural habitat and mahika kai • Removal or modification of flood gates in lower reaches to allow easy fish passage • Dams, headgates, floodgates and culverts are designed and managed to enable easy upstream and downstream migration of fish – this must be a priority in design • Shorter consent terms – no more than 10 years • Consultation with mana whenua
Drainage	• No further drainage, and reverse the effects of existing drainage • Consultation with mana whenua
Habitat	• Bring back diversity of riparian areas and set aside adequate buffers • Reverse loss of wetlands - restoration and increase in area • Removal of aquatic weeds • Consultation with mana whenua
Land use	• No negative land use impacts on wetlands – including their hydraulic connection, taoka species and mahika kai values • Improvement of physical access to mahika kai (including across land to the waterways) • Look at moving to dryland farming systems • Consider implications of sea level rise in 3 Waters infrastructure renewals • Provide for inward migration of estuary and hāpua systems with rising sea level – give them room to move • Consultation with mana whenua

Appendix 7: Freshwater visions feedback from Ngāi Tahu ki Murihiku

Draft Freshwater Visions

Mata-au FMU

Mata-au catchment as a whole.

The mauri of the Mata-au/Clutha River, its health and well-being as a whole, ki uta ki tai, will be restored through a Treaty partnership approach to governing and managing lands and waters in the catchment, utilising mātauranga, upholding Kāi Tahu values, valuing natural form and function, prioritising water for waterbodies, supporting all the qualities of waterbodies that provide for aquatic life and culturally safe and healthy human interactions, increasing areas and populations of indigenous flora and fauna to improve access to healthy and abundant mahika kai and to create biodiversity corridors, mindful of impacts on coastal waters, and providing for a range of Kāi Tahu associations and uses within the catchment, as well as high quality drinking water supplies, hydroelectricity generation, climate resilient economic activities, and valued social and recreational activities of communities, supported by collaborative actions.

Upper Lakes rohe

The high quality waters of the lakes and their tributaries are protected recognising the significance of the purity of these waters to Kāi Tahu, and restored within a generation wherever human activities have impacted their mauri, including phasing out all direct discharges of wastewater and stormwater to water within fifteen years, alongside cloaking their connected lands with endemic species, supporting cultural associations and uses, and enabling full enjoyment of them by mana whenua, local communities and manuhiri in a manner that ensures the same qualities of these waters are available to successive generations.

Dunstan rohe

Impact on the well-being of Kāi Tahu from loss of access to lands, waters and mahika kai over a century ago and as a result of hydroelectricity infrastructure is recognised by prioritising within a generation, and with five yearly milestones, restoration of flows in waterbodies impacted by abstraction, including streams, aquifers, springs and wetlands; as well as restoration of habitat for indigenous species, enabling restocking of species and supporting improvement in the abundance and health of aquatic species and terrestrial species on connected lands, actively managing species interactions to support indigenous populations vulnerable to predation; and increasingly utilising main stem waters as a preference to smaller tributary waterbodies through infrastructure improvements that support climate resilient economic activities and intergenerational well-being for communities, including Kāi Tahu; whilst phasing out direct discharges of wastewater and stormwater.

Roxburgh rohe

Within ten years indigenous aquatic species are protected from mortal impacts of hydroelectricity infrastructure with safe fish passage provided for diadromous species, enabling populations of these species to access the full range of their habitats within the Mata-au catchment system, while tributary waterbodies are restored within a generation, with five yearly milestones, to support their natural form, function and hydrology, and improve habitat for indigenous species, actively managing species interactions to support indigenous populations vulnerable to predation, and increasingly utilising main stem waters as a preference to smaller tributary waterbodies through infrastructure improvements that support climate resilient economic activities and intergenerational well-being for communities, including Kāi Tahu, whilst phasing out direct discharges of wastewater and stormwater.

Lower Clutha rohe

Within a generation, with five yearly milestones, remnant wetlands, areas of endemic indigenous vegetation and riparian margins are connected as biodiversity corridors that run through the rohe providing for protection and recovery of indigenous populations from the coastal margins to the headwaters of Mata-au tributaries, prioritising riparian management that stabilises banks and provides for the habitat needs of indigenous species and actively managing species interactions to support indigenous populations vulnerable to predation, whilst the quality of water and the bed of waterbodies are progressively restored where they have been adversely impacted by human activities, as is their natural hydrological function, increasing access to waters of a drinkable standard and incorporating the phasing out of direct discharges of wastewater and stormwater within fifteen years.

Catlins FMU

Within a Treaty partnership approach to governing and managing lands and waters, ki uta ki tai, priority will be given to restoration of indigenous biodiversity, taoka and mahika kai species, instream, on connected lands and in coastal environments in order to provide for an uninterrupted biodiversity network within a generation, free of barriers to fish passage, with endemic indigenous vegetation present on all banks and riparian margins, protecting waterbodies from sedimentation risks associated with bank instability and adjacent land use activities, ensuring waterbodies are free from invasive and pest species, with natural form and function characteristics and fresh water quality of a drinkable standard, including as a result of phasing out direct discharges of wastewater and stormwater, supporting economic activity that is based on and nurtures a high quality natural environment.

Appendix 8: PORPS 2021 advice from Ngāi Tahu ki Murihiku

Draft Otago Regional Policy Statement

Advice from Te Ao Marama Incorporated to inform the S32 analysis of Otago Regional Council

21 May 2021

Context

Te Ao Marama Incorporated (Te Ao Marama) represent the interests of Ngāi Tahu ki Murihiku, specifically Waihopai Rūnaka, Te Rūnanga o Awarua and Te Rūnanga Ōraka Aparima in the Otago region. Specifically, Ngāi Tahu ki Murihiku have established interests in Te Mata-au/Clutha River, the upper lakes and true right tributaries, including integrated management of lands and waters within the catchment ki uta ki tai, as well as Te Ākau Tai Toka/Catlins and associated coastal areas.

Draft ORPS Development in Partnership

Te Ao Marama have contributed, in conjunction with Aukaha Limited (Aukaha), to the development of the draft Otago Regional Policy Statement (ORPS) to date through the following channels:

- topic workshops with other interested parties
- written advice and comments on early draft policy positions in each topic area
- co-drafting of material specific to mana whenua
- meetings and written exchanges regarding key areas of interest.

Efforts have been made to contribute at key points in the development process although not all deadlines have been met for statutory milestones. Engagements have occurred within tight timeframes for delivery of the notified version and may require additional amendment.

Summary Tables

A series of summary tables, set out below, have been prepared by Te Ao Marama as an indicative guide to understand how the draft ORPS meets key outcomes and aspirations of Ngāi Tahu ki Murihiku, as recorded in relevant tribally recognised documents and position statements. The summary tables provide a high level assessment of the draft provisions and is designed to assist Otago Regional Council in drafting its Section 32 Report.

This document is not to be read as, or used as, the formal position of Ngāi Tahu ki Murihiku, including Papatipu Runanga and their environmental entities, on the draft ORPS. Rather, it provides a basic analysis of the extent to which the draft incorporates elements beneficial to Ngāi Tahu ki Murihiku rights, interests and values, as well as highlighting areas where costs to mana whenua are associated with adverse environmental conditions.

Te Ao Marama have referenced the following documents in preparing the summary tables:

- Ngai Tahu Claims Settlement Act 1998
- Fisheries Act 1996
- Ngai Tahu Freshwater Policy 1999
- Te Tangi a Tauira – the Cry of the People: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008
- Ngāi Tahu ki Murihiku statements on Te Mana o te Wai in Murihiku Southland processes

Legend – Contribution of Plan towards meeting Ngāi Tahu Objectives and Outcomes	
(green)	Optimum
(blue)	Good
(yellow)	OK – could go further
(red)	A lot more required
(black)	No contribution

Legislative – Ngāi Tahu Claims Settlement Act 1998, Fisheries Act 1996 and Native Reserves

Legislative elements	Specific provisions in RPS that address legislative requirements				Contribution of RPS towards meeting requirements	Explanation of assessment
	Issues	Objectives	Policies	Other		
Recognition of Statutory Acknowledgement Areas in Te Mata-au and Te Ākau Tai Toka and the impact of their condition on Ngāi Tahu ki Murihiku	Mana Whenua chapter SRMR-I2 RMIA–WTU-I1 RMIA-WTA RMIA-AA-I1 RMIA-CE-I5	MW-O1 IM-O1 CE-O4 CE-O5 LF-VM-O2 LF-VM-O6 HAZ-NH-O1 HAZ-NH-O2 HCV-WT-O1 HCV-WT-O2	MW-P2 IM-P3 CE-P8 LF-VM-P6 HAZ-NH-P12 HCV-WT-P1 HCV-WT-P2	MW-M1 MW-M5 IM-M1 IM-M2 CE-M3 CE-M4 CE-M5 LF-VM-M3 LF-VM-M4 HAZ-NH-M2 HAZ-NH-M3 HAZ-NH-M4 HCV-WT-M1 HCV-WT-M2 HCV-WT-M3 APP7		Mana whenua relationship with these areas is to be recognised and provided for in decision-making and their mauri actively protected. These areas are recognised as wāhi tūpuna over which mana whenua exercise rakatirataka and kaitiakitaka and providing for Kāi Tahu connection with them is part of achieving integrated management.
Recognition of Nohoanga in Te Mata-au and the impact of their condition on Ngāi Tahu ki Murihiku	Mana Whenua chapter RMIA–WTU RMIA-WTA-I2	MW-O1 IM-O1 CE-O4 CE-O5	MW-P2 IM-P3 CE-P8 LF-VM-P6	MW-M1 MW-M5 IM-M1 IM-M2		Mana whenua relationship with nohoaka is to be recognised and provided for in decision-making and their mauri actively protected. These areas are recognised as wāhi tūpuna over which mana whenua exercise rakatirataka and kaitiakitaka and providing for Kāi Tahu connection with them is part of achieving

	RMIA-AA-I1 RMIA-CE-I5	LF-VM-O2 LF-VM-O6 LF-FW-O8 HAZ-NH-O1 HAZ-NH-O2 HCV-WT-O1 HCV-WT-O2 HCV-HH-O3 EIT-INF-O4 EIT-INF-O5	LF-FW-P11 LF-FW-P12 HAZ-NH-P12 HCV-WT-P1 HCV-WT-P2 HCV-HH-P3 HCV-HH-P4 HCV-HH-P5 EIT-P13	CE-M3 CE-M4 CE-M5 LF-VM-M3 LF-VM-M4 LF-FW-M5 LF-FW-M7 HAZ-NH-M2 HAZ-NH-M3 HAZ-NH-M4 HCV-WT-M1 HCV-WT-M2 HCV-WT-M3 HCV-HH-M4 HCV-HH-M5 EIT-INF-M4 EIT-INF-M5 APP1 APP7		integrated management. These areas are also recognised as site specific wāhi taoka requiring consideration of public access and avoiding as a first priority placement of infrastructure in them. Their presence is criteria for considering a water body to be outstanding in terms of cultural and spiritual value.
Recognition of Tōpuni in Te Mata-au and and their relationship with Ngāi Tahu ki Murihiku	Mana Whenua chapter RMIA–WTU-I1	MW-O1 IM-O1 CE-O4 CE-O5 LF-VM-O2 LF-VM-O6 HAZ-NH-O1 HAZ-NH-O2 HCV-WT-O1	MW-P2 IM-P3 CE-P8 LF-VM-P6 HAZ-NH-P12 HCV-WT-P1 HCV-WT-P2	MW-M1 MW-M5 IM-M1 IM-M2 CE-M3 CE-M4 CE-M5 LF-VM-M3 LF-VM-M4		Mana whenua relationship with tōpuni is to be recognised and provided for in decision-making and their mauri actively protected. These areas are recognised as wāhi tūpuna over which mana whenua exercise rakatirataka and kaitiakitaka and providing for Kāi Tahu connection with them is part of achieving integrated management.

		HCV-WT-O2		HAZ-NH-M2 HAZ-NH-M3 HAZ-NH-M4 HCV-WT-M1 HCV-WT-M2 HCV-WT-M3 APP7		
Recognition of reserve lands, native reserves and NTCSA reserved lands, and their relationship with Ngāi Tahu ki Murihiku	Mana Whenua chapter RMIA–WTU	MW-O1 IM-O1 CE-O4 CE-O5 LF-VM-O2 LF-VM-O6 HAZ-NH-O1 HAZ-NH-O2 HCV-WT-O1 HCV-WT-O2	MW-P2 MW-P4 IM-P3 CE-P8 LF-VM-P6 HAZ-NH-P12 HCV-WT-P1 HCV-WT-P2	MW-M1 MW-M5 IM-M1 IM-M2 CE-M3 CE-M4 CE-M5 LF-VM-M3 LF-VM-M4 HAZ-NH-M2 HAZ-NH-M3 HAZ-NH-M4 HCV-WT-M1 HCV-WT-M2 HCV-WT-M3 APP7		Mana whenua relationship with these reserve areas is to be recognised and provided for in decision-making and their mauri actively protected. These areas can be recognised as wāhi tūpuna over which mana whenua exercise rakatirataka and kaitiakitaka and providing for their values is part of achieving integrated management. Mana whenua are enabled to protect, develop and use land and resources within native reserves.
Recognition of the significance of taonga species, including taonga fish species, to Ngāi Tahu ki Murihiku and provision for the needs of these species	Mana Whenua chapter SRMR-I3 SRMR-16	MW-O1 IM-O1 to IM-04 LF-WAI-O1	MW-P2 MW-P3 IM-P3 LF-WAI-P3	MW-M1 IM-M1 to IM-M5 LF-WAI-M1		Mana whenua are able to identify relationships with taoka and have those relationships recognised and provided for in decision-making. Biodiversity offsetting excludes loss of mānuka and kānuka (ie offsetting is not required where these species are cleared) although these are taonga species listed in the NTCSA and are

	SRMR-I7 SRMR-I8 RMIA-WAI RMIA-MKB RMIA-AA RMIA-CE	LF-VM-O2 LF-VM-O6 LF-FW-O8 LF-FW-O9 LF-FW-10 LF-LS-O12 ECO-O1 to ECO-O3 CE-O1 CE-O3 HCV-HH-O3 EIT-INF-O4 EIT-INF-O5	LF-VM-P6 LF-FW-P7 LF-FW-P9 LF-FW-P10 LF-FW-P13 LF-FW-P14 LF-LS-P16 LF-LS-P22 ECO-P1 to ECO-P10 CE-P2 CE-P3 CE-P4 CE-P5 CE-P8 HCV-HH-P3 EIT-INF-P13	LF-WAI-M2 LF-VM-M3 LF-VM-M4 LF-FW-M6 LF-LS-M12 LF-LS-M13 LF-LS-M14 ECO-M1 to ECO-M8 CE-M2 CE-M3 HCV-HH-M4 HCV-HH-M5 EIT-INF-M4 to EIT-INF-M6 APP1 APP2 APP3 APP4 APP7		valued by mana whenua. A range of chapters reference taonga species or indigenous species and their habitats, with some provisions specific to protecting what exists and others referencing restorative actions, recognising that there have been significant losses over time. The role of the mana whenua provisions and integrated management provisions will be important in achieving improved outcomes for listed taonga species and taonga fish species.
Recognition that a range of mechanisms in the NTCSA were intended to support maintenance and improvement of mahinga kai to address breaches of Te Tiriti o Waitangi	Mana Whenua chapter SRMR-I6 RMIA-WAI RMIA-MKB RMIA-WTA RMIA-AA	MW-O1 IM-O1 IM-O2 IM-O3 LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-FW-O8	MW-P2 IM-P3 LF-WAI-P2 LF-WAI-P3 LF-VM-P6 LF-FW-P7 LF-LS-P22 CE-P2	MW-M1 MW-M3 MW-M4 IM-M1 IM-M2 LF-WAI-M1 LF-WAI-M2 LF-VM-M3		Only provisions containing specific references are indicated here. The role of the mana whenua provisions and integrated management provisions will be important in achieving improved outcomes for mahika kai, supported by the land and fresh water, coastal environment and ecosystems and biodiversity chapters.

		LF-FW-O9 LF-LS-O12 CE-O1 ECO-O3	CE-P13 ECO-P1 ECO-P8	LF-VM-M4 LF-FW-M6 LF-LS-M11 to LF-LS-M14 CE-M1 to CE-M5 ECO-M1 to ECO-M4 APP1 APP7		
Recognition of the role of mātaitai and taiāpure in customary fisheries management and the impact of their condition on Ngāi Tahu ki Murihiku, including Puna-wai-Tōriki coastal mātaitai in Te Ākau Tai Toka/Catlins	Mana whenua chapter	MW-O1 IM-O1 IM-O2 IM-03 LF-WAI-O1	MW-P2 IM-P3 LF-WAI-P2	MW-M1 MW-M3 MW-M4 IM-M1 IM-M2 LF-WAI-M1		There are a range of provisions that can indirectly support the condition of mātaitai, both coastal and freshwater, included in the draft RPS but explicit connection to existing or potential mātaitai is sparse. The role of the mana whenua provisions and integrated management provisions will be important in achieving outcomes for mātaitai and taiāpure. Outside of those chapters the only specific reference is contained in the land and freshwater chapter methods and only in relation to freshwater mātaitai. There are no active taiāpure in the Otago region within the takiwā of Ngāi Tahu ki Murihiku although they are referenced as a customary fisheries mechanism and would be indirectly supported by a number of provisions if introduced.

Ngāi Tahu Freshwater Policy

Preferences and Objectives	Specific provisions in the draft RPS that address objectives				Contribution of Plan towards meeting objectives	Explanation of assessment
	Issues	Objectives	Policies	Other		
Integrated catchment management planning is preferred	Mana whenua chapter RMIA-WAI	IM-O1 to IM-O4 LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-VM-O7 LF-LS-O12 ECO-O1 to ECO-O3 EIT-INF-O5 HCV-HH-O3 UFD-O1 UFD-O3	IM-P1 to IM-P14 LF-WAI-P3 LF-VM-P6 LF-LS-P16 ECO-P10 EIT-INF-P17 HCV-HH-P7 UFD-P1 UFD-P4	IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 LF-LS-M11 to LF-LS-M14 ECO-M3 ECO-M4 ECO-M5 ECO-M6 EIT-INF-M4 to EIT-INF-M6 HCV-HH-M4 to HCV-HH-M6 UFD-M1		Integrated management objectives and policies combined with strategic planning and catchment planning objectives and policies provide a basis for addressing the stated preference for integrated catchment management. Notably, the coastal environment chapter does not reference integration although there is a significant connection to be made with the land and freshwater chapter.
To afford total protection to waters that are of particular spiritual significance to Ngāi Tahu (wāhi tapu)	Mana whenua chapter RMIA-WTU RMIA-WTA	MW-O1 LF-WAI-O1 LF-VM-O2 LF-VM-O6	MW-P2 LF-WAI-P2 LF-WAI-P4 LF-VM-P6	MW-M1 LF-WAI-M1 LF-WAI-M2 LF-VM-M3		Total protection may not be afforded wāhi tapu within freshwater management units (FMUs), although there is opportunity for Ngāi Tahu ki Murihiku to identify wāhi tapu through FMU processes and seek provisions specific to these areas through subsequent

	RMIA-PO RMIA-AA	LF-LS-O12 HCV-HH-O3 HCV-WT-O1 EIT-INF-O5	LF-LS-P18 LF-LS-P19 LF-LS-P22 HCV-HH-P3 to HCV-HH-P7 HCV-WT-P1 HCV-WT-P2 EIT-INF-P13	LF-VM-M4 LF-LS-M14 HCV-HH-M4 to HCV-HH-M6 HCV-WT-M1 HCV-WT-M2 HCV-WT-M3 EIT-INF-M4 to EIT-INF-M6 APP1 APP7		planning processes informed by relevant objectives and policies.
Restore, maintain and protect the mauri of freshwater resources	Mana whenua chapter SRMR-I6 RMIA-WAI RMIA-MKB	MW-O1 IM-O1 to IM-O4 LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-FW-O8 LF-FW-O9 LF-FW-O10 CE-O1	MW-P2 MW-P3 IM-P2 LF-WAI-P1 to LF-WAI-P4 LF-VM-P6 LF-FW-P7 to LF-FW-P15 CE-P2 to CE-P6 CE-P13	MW-M1 MW-M4 MW-M5 IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 LF-FW-M5 to LF-FW-M10 CE-M1 to CE-M5 Definitions		The role of the mana whenua provisions and integrated management provisions will be important in achieving outcomes for the mauri of waterbodies. Restoration, maintenance and protection are variously provided for in provisions associated with the mauri of waterbodies.
To maintain vital, healthy mahinga kai populations and habitats capable of sustaining harvesting activities	Mana whenua chapter SRMR-I7	MW-O1 LF-WAI-O1	MW-P1 to MW-P4	MW-M1 to MW-M5		Refer to the NTCSA assessment of mahinga kai provisions in the previous table. This objective is focussed on ability to harvest so only harvest references have been included in this

	RMIA-WAI RMIA-MKB	LF-FW-O8 CE-O1 CE-O4 CE-O5	LF-WAI-P1 LF-FW-P9 CE-P2 CE-P13	LF-WAI-M1 LF-FW-M6 CE-M3		assessment, in conjunction with reference to relevant mana whenua provisions. More could be done to make explicit reference to ability to harvest and maintain cultural practices for current and future generations, whilst acknowledging that there are provisions providing connection to mahinga kai and cultural values more broadly.
To promote collaborative management initiatives that enable the active participation of Ngai Tahu in freshwater management	Mana whenua chapter SRMR-I4 RMIA-WAI RMIA-MKB RMIA-WTU RMIA-WTA RMIA-AA RMIA-CE RMIA-PO	MW-O1 IM-O1 to IM-O4 LF-WAI-O1 LF-FW-O8 LF-VM-O2 LF-VM-O6 ECO-O3	MW-P1 to MW-P4 IM-P3 LF-WAI-P2 LF-FW-P7 LF-FW-P8 LF-VM-P6 ECO-P1	MW-M1 to MW-M6 IM-M2 IM-M4 LF-WAI-M1 LF-VM-M3 LF-VM-M4 LF-FW-M5 LF-FW-M6 ECO-M1		The draft RPS recognises and provides for mechanisms that involve transfer of powers, governance and decision-making, including in relation to freshwater management.

Te Tangi a Tauira – the Cry of the People Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 – Outcomes

Outcomes	Specific provisions in Plan that address outcomes				Contribution of Plan towards meeting outcomes	Explanation of assessment
	Issues	Objectives	Policies	Other		
Ki uta ki tai is the kaupapa that guides resources management as a culturally based natural resource framework assisting Ngāi Tahu ki Murihiku to achieve more meaningful rangatiratanga and kaitiakitanga i	Cross boundary matters Mana whenua chapter RMIA-WAI	MW-O1 IM-O2 LF-WAI-O1 LF-VM-O2 LF-VM-O7 ECO-O1 to ECO-O3	MW-P2 IM-P1 to IM-P14 LF-WAI-P3 LF-WAI-P4 LF-VM-P6 ECO-P10	MW-M4 IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 ECO-M1 to ECO-M7		Inclusion of ki uta ki tai within the integrated management objectives provides a link across the whole of the draft RPS to the kaupapa of the iwi management plan Primary links in the draft RPS are to the land and freshwater and ecosystems and biodiversity chapters whereas the iwi management plan extends ki uta ki tai kaupapa across all aspects and domains of resource management as described in the iwi management plan.
The rights, interests and values of Ngāi Tahu ki Murihiku are recognised in the Otago region i	Statutory Context Mana Whenua Chapter	MW-O1	MW-P1 to MW-P4	MW-M1 to MW-M6		The draft RPS recognises Ngāi Tahu ki Murihiku as mana whenua and provides for involvement commensurate with the responsibilities of mana whenua. The two previous regional policy statements in Otago would have been assessed as 'no contribution' because they failed to recognise Ngāi Tahu ki Murihiku as mana whenua such that this draft represents a significant step forward for Ngāi Tahu ki Murihiku rights, interests and values in the region.

The Treaty principle of Tino Rangatiratanga is enhanced and partnerships formed and extended in the region	Statutory Context Mana Whenua Chapter RMIA-WAI	MW-O1 IM-O1 to IM-O4 LF-WAI-O1 HCV-WT-O2	MW-P1 MW-P2 IM-P3 LF-WAI-P2 HCV-WT-P1	MW-M1 to MW-M6 IM-M1 to IM-M5 LF-WAI-M1 HCV-WT-M1 HCV-WT-M3		Exercise of Te Tiriti principles of Tino Rangatiratanga and partnership will rely primarily on mana whenua and integrated management provisions. Direct connection is made to the land and freshwater chapter and the historical and cultural values chapter, however tino rangatiratanga as understood by Ngāi Tahu ki Murihiku extends across all aspects and domains of resource management as described in the iwi management plan and is not limited to the jurisdiction of the RMA.
There is mutual understanding of iwi and local authority values and responsibilities with respect to the environment, effective management of resources by councils, and effective performance of kaitiaki by Ngāi Tahu ki Murihiku.	Mana Whenua Chapter RMIA-WAI	MW-O1 IM-O1 to IM-O4 CE-O1 CE-O4 LF-WAI-O1 ECO-O3 HCV-WT-O2	MW-P2 IM-P3 CE-P13 LF-WAI-P1 to LF-WAI-P4 ECO-P1 HCV-WT-P1 HCV-WT-P2	MW-M1 to MW-M6 IM-M1 to IM-M5 CE-M1 to CE-M5 LF-WAI-M1 LF-WAI-M2 ECO-M1 to ECO-M8 HCV-WT-M1 to HCV-WT-M3 Definitions		All references to kaitiakitaka are picked up in this assessment. Reliance is placed on the mana whenua, integrated management, coastal environment, land and freshwater, ecosystems and biodiversity, and historical and cultural values chapters to specifically provide for kaitiakitaka. The iwi management plan indicates that kaitiaki responsibilities of Ngāi Tahu ki Murtihiku extend across all aspects and domains of resource management as described in the plan.

Ngāi Tahu ki Murihiku, as kaitiaki, can work actively to ensure that spiritual values of the takiwā are upheld and sustained for future generations, including with reference to karakia, kotahitanga, mana, mauri, māoritanga, noa, Tangaroa, tapu, wairua, whakanoa, wai tapu, wai whakaheke tūpāpaku, whakapapa	Mana Whenua Chapter RMIA-WAI RMIA-MKB RMIA-WTU RMIA-WTA RMIA-AA SRMR-I4 SRMR-I6	MW-O1 IM-O1 to IM-O4 AIR-O1 AIR-O2 LF-WAI-O1 LF-VM-O2 LF-FW-O9 LF-LS-O11 LF-LS-O12 HCV-WT-O2 HCV-HH-O2 CE-O1 CE-O4 ECO-O3 EIT-EN-O1 to EIT-EN-O3 EIT-INF-O5 EIT-INF-O6 HAZ-NH-O1 HAZ-NH-O2 HAZ-CL-O3 UFD-O2 UFD-O3	MW-P1 MW-P2 MW-P3 IM-P2 IM-P3 AIR-P3 AIR-P6 LF-WAI-P1 LF-WAI-P2 LF-WAI-P4 LF-VM-P6 LF-FW-P8 LF-FW-P9 LF-FW-P10 LF-LS-P17 LF-LS-P22 HCV-WT-P1 HCV-HH-P3 to HCV-HH-P7 CE-P8 CE-P13 ECO-P1 EIT-EN-P4 EIT-INF-P13 HAZ-NH-P12 HAZ-CL-P15 UFD-P1 UFD-P9	MW-M1 IM-M1 to IM-M5 AIR-M1 to AIR-M5 LF-WAI-M1 LF-VM-M3 LF-VM-M4 LF-FW-M6 LF-LS-M11 to LF-LS-M14 HCV-WT-M1 to HCV-WT-M3 HCV-HH-M4 to HCV-HH-M6 CE-M1 to CE-M5 ECO-M3 EIT-EN-M1 EIT-EN-M2 EIT-INF-M5 EIT-INF-M6 HAZ-NH-M1 to HAZ-NH-M5 HAZ-CL-M6 to HAZ-CL-M9 UFD-M1 UFD_M2 APP1		This assessment has picked up references to spiritual, mana whenua, Te Mana o te Wai and wāhi tapu, as well as any other specific mentions of the spiritual elements identified in the iwi management plan. However, note that ki uta ki tai and rakatirataka have a spiritual dimension as recognised in the iwi management plan and have been assessed separately in this table. A range of references in the RPS provide for connection to the spiritual values of Ngāi Tahu ki Murihiku.

				APP7 APP9 Definitions		

Ngāi Tahu ki Murihiku, as kaitiaki, can work actively to ensure that cultural values of the takiwā are upheld and sustained for future generations, including in reference to ahi kā, kai hau kai, kawa, koha, manaakitanga, marae, rāhui, take raupatu, take tuku, take tūpuna, takiwā, taonga, pounamu, tauranga waka, tikanga, tōpuni, tūrangawaewae, wāhi ingoa, wāhi tapu, wāhi taonga, wānanga, whānau, whakataukī, whanaungatanga and wakawaka	Mana whenua chapter SRMR-I1 SRMR-I3 SRMR-I4 SRMR-I5 SRMR-I6 SRMR-I8 SRMR-I10 RMIA-WAI RMIA-MKB RMIA-WTU RMIA-WTA RMIA-PO RMIA-AA	MW-O1 IM-O1 to IM-O4 AIR-O1 CE-O2 CE-O4 LF-WAI-O1 LF-VM-O2 LF-FW-O8 ECO-O3 EIT-INF-O4 EIT-TRAN-O8 to EIT-TRAN-O11 HAZ- H-O1 HCV-WT-O1 HCV-HH-O3 NFL-O1 UFD-O3	MW-P1 MW-P2 MW-P4 IM-P2 IM-P3 AIR-P4 CE-P1 CE-P2 CE-P5 CE-P9 CE-P11 CE-P13 LF-WAI-P1 LF-WAI-P2 LF-WAI-P3 LF-VM-P6 LF-FW-P7 LF-FW-P9 LF-LS-P13 LF-LS-P14 LF-LS-P18 LF-LS-P19 ECO-P1 to ECO-P5 ECO-P8 EIT-INF-P10 to EIT-INF-P17 EIT-TRAN-P18 HAZ-NH-P1 to	MW-M1 to MW-M6 IM-M2 AIR-M1 to AIR-M5 CE-M1 to CE-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 LF-FW-M6 LF-FW-M9 LF-LS-M13 ECO-M1 to ECO-M7 EIT-INF-M4 to EIT-INF-M6 EIT-TRAN-M7 to EIT-TRAN-M9 HAZ-NH-M1 to HAZ-NH-M5 HCV-WT-M1 to HCV-WT-M3 HCV-HH-M4 to HCV-HH-M6 NFL-M1 to NFL-M4 UFD-M1		This assessment has picked up references to cultural, as well as any other specific mentions of the cultural elements identified in the iwi management plan. However, note that Tōpuni are cultural elements as recognised in the iwi management plan and have been assessed separately in the table addressing NTCSA mechanisms. A range of references in the RPS provide for connection to the cultural values of Ngāi Tahu ki Murihiku.

			HAZ-NH-P11 HCV-WT-P1 HCV-WT-P2 HCV-HH-P3 NFL-P1 to NFL-P7 UFD-P1 UFD-P5 UFD-P9	UFD-M2 Definitions Evaluation and Monitoring APP1 APP6 APP7 APP9		
Ngāi Tahu ki Murihiku, as kaitiaki, can work actively to ensure that mahika kai values of the takiwā are upheld and sustained for future generations, including with reference to hāpua, kaimoana, kainga nohoanga, taiāpure, tauranga ika and waimātaitai	Mana whenua chapter RMIA-AA	CE-O1 CE-O4 LF-VM-O6	CE-P2 CE-P13 LF-VM-P6	CE-M1 to CE-M5 LF-VM-P5 LF-VM-P6		Provision for mahika kai, nohoanga, taiāpure and mātaitai have been previously assessed in the table addressing NTCSA mechanisms. Kaimoana is specifically referenced in the coastal environment chapter and connection is made in the land and freshwater chapter with reference to Te Ākau Tai Toka
Ensure representation of the Māori world view and mātauranga (traditional Māori knowledge) in science based analysis	Statutory Context Mana whenua chapter SRMR-I6 RMIA-WAI	MW-O1 IM-O1 to IM-O4 CE-O1 to CE-O5 LF-WAI-O1 ECO-O1 to ECO-O3	MW-P1 MW-P2 MW-P3 IM-P3 IM-P6 CE-P13 LF-WAI-P2 ECO-P1	MW-M1 to MW-M6 IM-M1 to IM-M5 CE-M1 to CE-M5 LF-WAI-M1 LF-WAI-M2 ECO-M7		There are important references to mātauranga in the coastal environment, land and freshwater and ecosystems and biodiversity chapters. Reliance on the mana whenua and integrated management chapters will be required outside of those chapters and in relation to the evaluation and monitoring section.

Proposed climate change policies, legislation or strategies designed at national, regional and local levels must account for the Māori world view and provide and recognise for Treaty principles with respect to protection of and restoring balance within the environment.	SRMR-I1 SRMR-I2 SRMR-I7 SRMR-I8 SRMR-I11 RMIA-MKB RMIA-AA RMIA-CE	IM-O1 IM-O4 LF-WAI-O1 LF-LS-O11 LF-LS-O12 NAZ-NH-O2 UFD-O5	IM-P8 to IM-P12 LF-WAI-P3 LF-LS-P20 HAZ-NH-P1 HAZ-NH-P6 HAZ-NH-P11 UFD-P1	IM-M1 IM-M3 IM-M4 LF-WAI-M1 LF-WAI-M2 LF-LS-M11 to LF-LS-M14 HAZ-NH-M2 HAZ-NH-M5 UFD-M1 Definitions Evaluation and Monitoring APP6		Inclusion of climate change provisions in the integrated management chapter is a valued introduction to the RPS. Specific reference is missing from the coastal environment and ecosystems and biodiversity chapters although significant impacts are expected as a result of human induced climate change. Ngāi Tahu ki Murihiku have had specific climate change policy in the iwi management plan since 2008 and worked with Te Rūnanga o Ngāi Tahu to develop the 2018 tribal climate change strategy. Ngāi Tahu ki Murihiku recognise that climate change effects and climate change response have an impact across the breadth of mana whenua rights, interests and values.

Prior statements[1] of Ngā Tahu ki Murihiku relevant to implementation of Te Mana o te Wai

Statements	Specific provisions in Plan that address outcomes				Contribution of Plan towards meeting outcomes	Explanation of assessment
	Issues	Objectives	Policies	Other		
Ki uta ki tai is the management framework within which the lens of Te Mana o te Wai is applied when managing waterbodies	How the draft RPS works Cross boundary matters Mana whenua chapter RMIA-WAI	MW-O1 IM-O2 LF-WAI-O1 LF-VM-O2 LF-VM-07 ECO-O1 ECO-O2	MW-P2 IM-P1 to IM-P14 LF-WAI-P3 LF-WAI-P4 LF-VM-P6 ECO-P8	MW-M4 IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 ECO-M1 to ECO-M7		The structure of the RPS with inclusion of ki uta ki tai in the integrated management chapter supports Ngāi Tahu ki Murihiku understanding of the relationship between ki uta ki tai and te mana o te wai.
Upholding Te Mana o te Wai acknowledges and protects the mauri of the water. Another way of saying this is that the needs of the waterbody are put first. Te Mana o te Wai puts a korowai (cloak) over water to recognise its significance in its own right and provides an overarching principle of protection in freshwater management.	Mana whenua chapter	LF-WAI-O1	LF-WAI-P1 to LF-WAI-P4	LF-WAI-M1 LF-WAI-M2		There is no explicit reference to the concept of Te Mana o te Wai acting as a korowai over water. However, the Te Mana o te Wai provisions provide an overarching guide for management of lands and freshwater with the primary objective that the mauri of Otago's water bodies and their health and well-being is protected, and restored where it is degraded, such that the provisions have the effect of acting as a korowai. The health and well-being of water bodies and freshwater ecosystems, te hauora o te wai and te hauora o te taiao, are afforded first priority.

[1] Prior statements have been made by Ngāi Tahu ki Murihiku through the proposed Southland Water and Land Plan process. For the purposes of this analysis the *Ngāi Tahu ki Murihiku Freshwater Objectives* report has been referenced as a source of consolidated statements and direction from mana whenua, which can be found at the following link: Reports - Environment Southland Water and Land (es.govt.nz). As this report has guided the combining of mātauranga and environmental science to produce draft narrative and numeric freshwater objectives the resulting report *Draft Murihiku Southland Freshwater Objectives: Providing for hauora, the health and well-being of waterbodies in Murihiku Southland* has also been referenced.

Ngāi Tahu ki Murihiku understand te hauora o te wai to be a prerequisite to being able to achieve te hauora o te tangata (including healthy cultural practice such as mahinga kai). Te hauora o te taiao (a healthy environment) also requires lands and waters to be in a good state. Te Mana o te Wai therefore requires identification of the qualities that come together to support hauora, or healthy resilience, within waterbodies, and their associated environment and communities. Hauora is understood to be a state of health, which can be thought of as meaning fit, well, vigorous and robust.	SRMR-I2 SRMR-I11	IM-O3 CE-O1 LF-WAI-O1 LV-VM-O6 LV-VM-O7 LF-FW-O8 LF-FW-O9 LF-FW-O11 LF-LS-O13	IM-P10 IM-P12 CE-P10 LF-WAI-P1 LF-WAI-P2 LF-WAI-P3 LF-VM-P6 LF-FM-P6 LF-FW-P7 LF-FW-P11 LF-FW-P12 LF-LS-P13 LF-LS-P14 LF-LS-P17	IM-M4 CE-M1 to CE-M5 LF-WAI-M1 LF-VM-M3 LF-VM-M4 LF-FW-M6 LF-FW-M9 LF-LS-M13		This assessment has picked up references to hauora, health, health and well-being and resilience in connection with lands and waters. The mana whenua chapter does not use any of these terms, while the significant resource management issues section of the RPS does reference resilience of natural systems in reference to climate change. The integrated management chapter provides provisions addressing resilience in the context of climate change. The coastal environment chapter references resilience of the coastal environment in provisions. Ngāi Tahu ki Murihiku view the health and well-being of coastal waters as integrated with the health and well-being of freshwater in a ki uta ki tai framework. Consistency of terminology would assist integrated management. Te Mana o te Wai provisions make the connection with coastal waters. The land and freshwater chapter provisions address hauora, health, health and well-being and resilience with reference to wai, taiao and tangata.
Assessing the state of waterbodies with reference to hauora requires use of Ngāi Tahu Indicators of Health.	Mana whenua chapter RMIA-WAI	IM-O1 to IM-O4 LF-WAI-O1	IM-P3 IM-P6 LF-WAI-P2	IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-FW-M9		The RPS recognises the value of mātauranga and the need for provisions that reference mātauranga, including in relation to environmental monitoring. The land and freshwater chapter provides for the expectation of Ngāi Tahu ki Murihiku regarding use of Ngāi Tahu Indicators of Health.
The nature and behaviour of particular waterbodies is important to understand when assessing their state	Mana whenua chapter RMIA-WAI	LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-FW-O11	LF-WAI-P1 LF-WAI-P2 LF-VM-P6 LF-FW-P11 LF-FW-P12	LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-VM-M4 LF-FW-M6 APP1		Within the land and freshwater chapter this analysis has picked up specific reference to natural, behaviour and characteristics of waterbodies.

The way water is managed will: recognise and provide for rangatiratanga, customary rights and development rights; enable customary use and protection and restoration of cultural heritage; and utilise and support the intent of Ngāi Tahu Settlement instruments.	Mana whenua chapter RMIA-WAI RMIA-MKB RMIA-WTA RMIA-CE	MW-O1 LF-WAI-O1 LF-FW-O8 EIT-INF-O5 CE-O1 CE-O5 ECO -O1 to ECO-O3 HCV-WT-O1 HCV-WT-O2	MW-P1 to MW-P4 LF-WAI-P2 LF-FW-O9 EIT-INF-P13 CE-P3 CE-P13 ECO-P4 HCV-WT-P1 HCV-WT-P2	MW-M1 to MW-M6 LF-WAI-M1 LF-WAI-M2 LF-FW-M5 to LF-FW-M10 EIT-INF-M4 to EIT-INF-M6 CE-M1 to CE-M5 ECO-M1 to ECO-M8 HCV-WT-M1 to HCV-WT-M3 APP7		Tino rangatiratanga is addressed in the table that references the iwi management plan. Rights of mana whenua are referenced in the mana whenua chapter and supported by provisions in that chapter. Rights of mana whenua are referenced in the Explanation section of the land and freshwater chapter although not specifically referenced in related provisions. Customary protected rights are referenced in an infrastructure chapter policy. Customary uses are specifically referenced in coastal environment chapter provisions. The term cultural heritage is not used in the RPS. Historic heritage is understood to incorporate cultural heritage within the RMA definition. Cultural heritage can have modern expression (eg raranga, mahinga kai) which would need to be picked up through other references in the RPS to cultural values. The table that addresses NTCSA mechanisms covers the relationship of the RPS with Ngāi Tahu Settlement instruments.

All waterbodies that have been degraded will be returned to a state of hauora, which will in turn improve provision for cultural use and association.	Mana whenua chapter RMIA-WAI RMIA-MKB RMIA-WTA RMIA-CE SRMR-I6 SRMR-I7 SRMR-I8 SRMR-I9 SRMR-I10 SRMR-I11	MW-O1 IM-O1 to IM-O4 LF-WAI-O1 LF-FW-O9	MW-P3 IM-P13 LF-WAI-P1 LF-WAI-P2 LF-WAI-P4 LF-FW-P7 to LF-FW-P15	MW-M1 to MW-M6 IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-FW-M5 to LF-FW-M10		The health and well-being of waterbodies is to be restored where degraded and given first priority. Ngāi Tahu ki Murihiku understand health and well-being with reference to hauora. Land and freshwater chapter provisions are supported by mana whenua chapter provisions.
Communities and catchment groups will be supported to understand Ki Uta Ki Tai, Te Mana o te Wai, Hauora and Mahinga Kai, and will be provided with the means to work effectively towards a state of hauora for each waterbody	Mana whenua chapter RMIA-WAI SRMR-I5	IM-O1 to IM-O4 LV-VM-O2 LV-VM-O6 ECO-O3	IM-P1 to IM-P14 LF-VM-P6 ECO-P1 ECO-P8	IM-M2 IM-M5 LF-VM-M3 ECO-M8		FMU processes provide an opportunity to build understanding of these key concepts of importance to Ngāi Tahu ki Murihiku and develop associated action plans. Methods in the integrated management chapter and ecosystems and biodiversity chapter also provide support more broadly for improving understanding.
Ngāi Tahu ki Murihiku seek consistent outcomes between the Southland and Otago regions with regard to wetlands and indigenous land cover, restoring what has been lost over a generation within a generation (25 years) in each FMU	Mana whenua chapter RMIA-WAI	MW-O1 IM-O1 to IM-O4 LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-FW-O9	MW-P3 IM-P13 LF-WAI-P1 LF-WAI-P2 LF-WAI-P4 LF-VM-P6 LF-FW-P10 LF-FW-P14	MW-M1 to MW-M6 IM-M1 to IM-M5 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-FW-M6 LF-FW-M8		No extent of restoration is specified for wetlands and indigenous vegetation, although rohe within Te Mata-au and Te Ākau Tai Toka will need to meet vision statements within a generation. Ngāi Tahu ki Murihiku can pursue desired outcomes through FMU processes.

Ngāi Tahu ki Murihiku seek consistent outcomes between the Southland and Otago regions with regard to restoring water quality, restoring what has been degraded over a generation within a generation (25 years) in each FMU	Mana whenua chapter RMIA-WAI RMIA-CE	MW-O1 IM-O1 to IM-O4 CE-O1 LF-WAI-O1 LF-VM-O2 LF-VM-O6 LF-FW-O9 LF-LS-O11 LF-LS-O12	MW-P3 IM-P13 CE-P2 CE-P3 LF-WAI-P1 LF-WAI-P2 LF-WAI-P4 LF-VM-P6 LF-FW-P10 LF-FW-P14 LF-LS-P16	MW-M1 to MW-M6 IM-M1 to IM-M5 CE-M3 LF-WAI-M1 LF-WAI-M2 LF-VM-M3 LF-FW-M6 LF-LS-M11		No timeframes are set for restoring degraded water quality, although rohe within Te Mata-au and Te Ākau Tai Toka will need to meet vision statements within a generation. Ngāi Tahu ki Murihiku can pursue desired outcomes through FMU processes.
Ngāi Tahu ki Murihiku seek consistent outcomes between the Southland and Otago regions with regard to the phasing out of direct discharges of wastewater and stormwater to water within fifteen years in Te Mata-au and Te Ākau Tai Toka	Mana whenua chapter SRMR-I2 SRMR-I6 SRMR-I9 SRMRI10 RMIA-WAI RMIA-WTA	LF-VM-O2 LF-FW-O8 UFD-O3 UFD-O4	LF-VM-P6 LF-FW-P15 UFD-P1 UFD-P8	LF-VM-M3 LF-FW-M6 UFD-M1 UFD-M2		No timeframes are set for phasing out direct discharges of wastewater and stormwater to water, however policy in the land and freshwater chapter favours discharge to land. Ngāi Tahu ki Murihiku can pursue desired outcomes through FMU processes.

Appendix 9: Assessment of the Clean Heat Clean Air programme

11. MATTERS FOR NOTING

11.1. An assessment of the Clean Heat Clean Air program's effectiveness

Prepared for:	Technical Committee
Activity:	Environmental - Clean Air Implementation Initiatives
Prepared by:	Deborah Mills, Environmental Scientist
Date:	2 May 2018

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1. Précis

The purpose of this paper is to provide an assessment of the Clean Heat Clean Air (CHCA) programme's effectiveness. CHCA was designed to provide a financial incentive for homeowners to upgrade their solid-fuel burners to cleaner heating options. A paper presented to the Finance and Corporate Committee on 13 September 2017[1] detailed the financial status of the programme. This paper examines the environmental outcomes related to work done for the CHCA initiative, fulfilling s an annual plan target in the Air Management Planning project (A4 – Air Quality).

The CHCA programme was a central element of the Otago Regional Council's air quality strategy of 2007. This paper assesses the programme in relation to its original objectives; it is not an assessment of the air quality strategy itself.

Section 2 outlines the origin of the programme with consideration to the air quality strategy at the time. Details of the work accomplished through the programme are given in Section 3. Section 4 evaluates the effectiveness of the programme in relation to its original goals as well as some of the co-benefits that were achieved. Section 5 outlines some of the issues that arose from the evaluation of the programme to be considered in any future initiative.

2. Background

In 2004, wood burner emission and efficiency standards were introduced with the National Environmental Standards for Air Quality (NESAQ)[2]. Those standards served as a tool to assist councils in meeting the ambient air quality standards.

In 2007, Council developed a regional air quality management strategy[3] to provide direction for meeting the NESAQ. The strategy allowed for a regulatory framework, monitoring and reporting, communication with stakeholders, collaboration, and the provision of incentives. The expected outcomes from the strategy were:

1. Meeting the NESAQ by 2013 (the original date, since revised by central government to 2020)
2. Improving the health of Otago residents
3. Enhancing resident and visitor well-being

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[1] ORC Report, *Clean Heat, Clean Air Initiative*, Report Number 2017/1032, Presented to the Finance and Corporate Committee on 13 September 2017

[2] All wood burners installed from 1 January 2005 on properties less than two hectares are to have a discharge of less than 1.5 grams per kilogram of dry wood burnt and a thermal efficiency of not less than 65%.

[3] ORC Report, *Otago Regional Council Clean Air Strategy: 2007-2013*, Report Number 2007/451, Presented to the Policy and Resource Planning Committee on 5 September 2007,

As part of the regulatory framework, the Otago Regional Plan: Air (Air Plan) addressed home heating discharges to air. Due to the severity of particulate pollution in Air Zone 1 towns, the Air Plan set stricter emission standards[4] for all heating appliances installed after 14 April 2007 (Alexandra, Arrowtown, and Cromwell) or 1 April 2009 (Clyde). In addition, ORC implemented a burner "phase-out" rule; as of 1 January 2012, the use of heating appliances with particulate discharges greater than 1.5g/kg became a prohibited activity in all Air Zone 1 towns.

Due to their age, most solid-fuel burners would not have met the new standards for emissions and efficiency at the time the air strategy was developed. As a consequence, approximately 3,200 solid-fuel burners[5] were due to be phased out of use in the four Air Zone 1 towns by 1 January 2012 (Alexandra, Arrowtown, Clyde, Cromwell).

An early project incentivising burner change, initiated in 2007/2008 by central government, showed that the community was interested in taking up financial incentives to change their home heating.

With that knowledge, a key component of the air strategy was Council's partnership with the central government when the Warm Homes Clean Heat project began in 2009 (run by the Energy Efficiency and Conservation Authority (EECA)). Through this programme, the ORC participated in and promoted financial subsidies as part of an effort to assist homeowners in Air Zone 1 with upgrading and phasing out their older solid-fuel heating appliances. This became the Clean Heat Clean Air programme in Otago (CHCA). The programme has run continuously since that time.

The next section details the work done in the CHCA programme in Air Zone 1 and Milton (AZ1+M), which was added to the scheme in 2009 once monitoring revealed the extent of the air quality issue over winter months.

3. CHCA Data

The original model of the CHCA programme provided financial incentives in the form of subsidies for insulation (where needed) and/or a new heating appliance. Over the life of the programme to 2018, approximately 2,150 claims have been filed with Council. Table 1 provides a high-level breakdown of those claims.

[4] All heating appliances to have a discharge of less than 0.7 grams per kilogram of fuel burnt and a thermal efficiency of not less than 65%

[5] 2013 Census meshblock dataset, *Area unit data about dwellings in the Otago Region,* containing data from 2001, 2006, and 2013. Stats NZ

Number	Activity	Description
2,150	Total claims	Includes all insulation and appliance installations in all areas of Otago (2008-2017, inclusive)
1,250	Number of appliances installed in Air Zone 1 and Milton (AZ1+Milton)	The majority of these are wood burners as opposed to no-emission appliances[6].
250	Number of insulation-only claims	No appliance retrofitted
700	Number of CSC holders	This was a priority group for the CHCA programme
650	Number of claims from areas outside of AZ1+M	From 2009 to 2012 the scheme was available in all of Otago; the majority of these claims were insulation-only

Table 1. Breakdown of CHCA claims from 2008-2017 inclusive

Figure 1 provides the annual and geographic distribution of appliances installed in AZ1+M. Most of the activity took place in Alexandra and Cromwell and peak activity in most towns occurred during 2011. EECA ended their general insulation subsidy in 2013, a move which clearly impacted Council's regional programme.

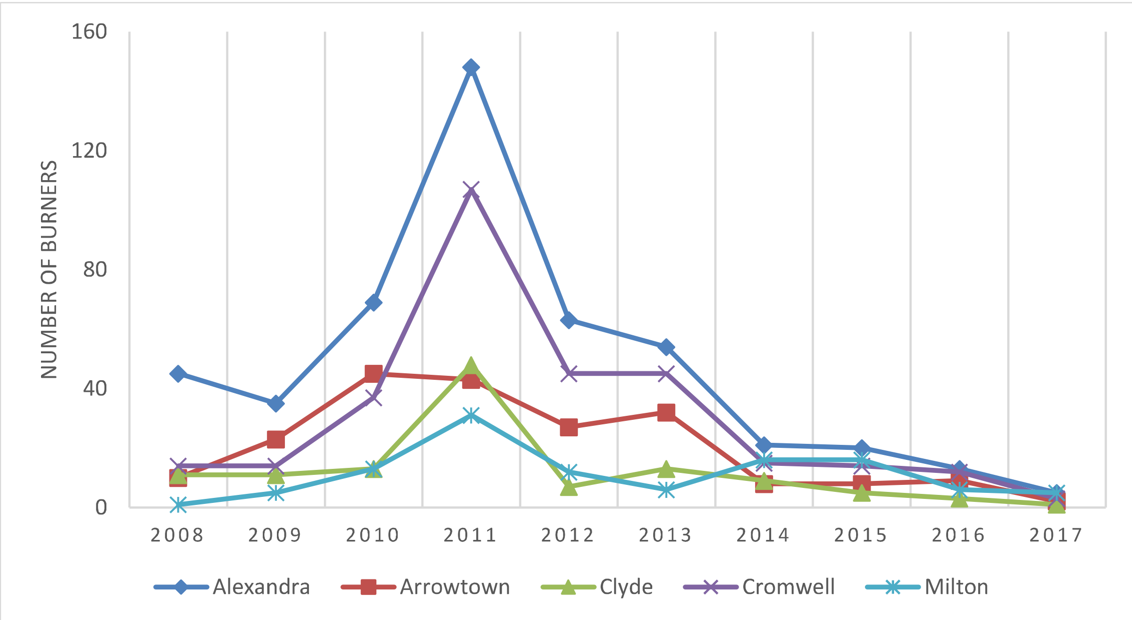

Figure 1. Distribution by year and town of the number of appliances installed through the CHCA programme

[6]Originally, the Warm Homes Clean Heat project required a no-emission appliance to replace a solid-fuel appliance, e.g. a heat pump, but due to resistance from the community ORC allowed for wood burner replacements.

Not all home heating installation activity that occurs is associated with the CHCA programme. Over the last 10 years, CHCA-related upgrades accounted for approximately 58% of all burners installed in existing houses in AZ1+M (Table 2).

Total # of solid-fuel burners in use at 2006	Total # of wood burners replaced since 2008	Total # installed using CHCA	Percentage of CHCA-related installations	Town
1,270	678	468	69%	Alexandra
640	326	219	67%	Arrowtown
300	212	132	62%	Clyde
970	606	318	52%	Cromwell
690	348	111	32%	Milton
3,870	2170	1248	58%	TOTAL

Table 1. Breakdown by town of total number of appliances installed in AZ1+M and how many were related to the CHCA programme

4. Programme evaluation

An incentive programme was a central element of council's original air quality strategy. The programme focused primarily on Air Zone 1 to create an accelerated push to replace old, non-compliant burners in order to meet the NESAQ by its original deadline of 2013. Council worked closely with central government, territorial authorities, and contractors to deliver maximum effort. Within Council, work streams supporting the programme cut across communications, operations, science, and the consents team.

This assessment looks at 3 main factors:

1. Did the CHCA programme accelerate the natural uptake of clean heat?
2. What were the effects on the environment in Air Zone 1 and Milton?
3. Have other co-benefits been realised as a result of the CHCA programme?

It also highlights some of the issues that arose during administration of the programme and what opportunities might exist for any future programme.

4.1 Programme Uptake

The programme was designed not only to <u>assist</u> homeowners with upgrading their old solid-fuel heating appliances, but to <u>actively encourage</u> homeowners to change to cleaner heating ahead of the phase-out date. Based on recent invoices, a household can expect to pay anywhere from $2500 to $8000 (median of $4000) for the installation of a new solid-fuel burner. CHCA programme incentives generally ranged from $1000-$2500.

Over the past 10 years (2008-2017), CHCA-assisted burner upgrades comprised the majority of all burner replacements in Air Zone 1 towns. The percentage of CHCA-assisted replacements in Milton is about one-third of total replacements (Figure 2). NB: There is no phase-out rule in Milton requiring the removal of old, inefficient burners.

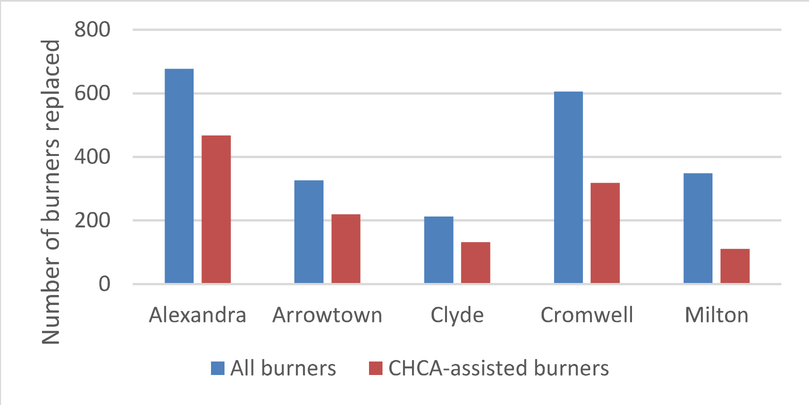

Figure 2: The total number of burners installed in existing houses from 2008-2017 (blue) and the number which were CHCA-assisted (red).

Every year a certain number of households replace their solid-fuel burners; a building consent from the local territorial authority is required for this activity. An analysis of those building consents for the three years prior to the CHCA's inception (2005-2008) and the four years after the EECA programme's funding ceased (2014-2017) indicates that the typical rate of replacement is between 3-4% per annum in Air Zone 1 towns and Milton.

During the period when the CHCA programme was most active (2009-2013), overall burner replacement rates were significantly higher than normal in every town (Table 3), ranging from 7 to 9%.

	2009	2010	2011	2012	2013	Average Replacement Rate (inc. CHCA)
Alexandra	5%	6%	12%	9%	5%	8%
Arrowtown	6%	7%	9%	6%	7%	7%
Clyde	5%	9%	17%	10%	6%	9%
Cromwell	5%	3%	14%	11%	7%	8%
Milton	12%	4%	9%	5%	5%	7%

Table 2 Overall burner replacement rates during years of key CHCA activity.

It does seem reasonable to assume that the CHCA incentive did encourage additional homeowners to take up burner replacements, i.e. people who may not have been inclined to change burners did so, given the financial incentive.

There is no hard evidence available to understand homeowner motivation; however, main programme messages included encouraging homeowners to upgrade their burners ahead of the phase-out date (2012), and encouraging those people selling their houses to upgrade as a benefit to potential buyers[7].

4.2 Effect on the environment

The desired outcome of burner phase-outs and/or a shift to clean heat appliances was to achieve lower particulate emissions and, therefore, lower particulate concentrations in airsheds. In this case, the term 'clean heat' refers to no-emission (heat pumps, gas, etc.) and low-emission (conventional burners at less than 1.5g/kg emissions and pellet fires) appliances.

[7] Personal communication, Lauren McDonald

Regular emission inventory surveys provide information regarding particulate emission trends in towns. The latest inventory performed for Otago (2016) included Alexandra, Arrowtown, and Milton.[8] Results of that study indicate that emissions reduced by approximately 50% in these areas from 2005 to 2017. Most of that change was attributed to "reduced coal use for domestic heating and the replacement of older wood burners with burners that meet the National Environmental Standard design criteria for wood burners" (Wilton).

State of the Environment (SoE) air quality monitoring data complement the emission inventory and provide a second measure as to the real effect on the environment. All of the towns targeted by the CHCA programme have 10 years of PM_{10} data. With that length of record, the effects of weather on particulate levels will be smoothed and trends resulting from interventions should appear.

Three indicators are used to track trends:

- Number of Exceedances during the calendar year (green bar)
- Winter average PM_{10} from May-August (red line)
- Average PM_{10} of the highest 10 days (purple line)

Except for exceedances, which are measured in number of days, the other two metrics are measured in micrograms of PM_{10} per cubic metres of air. The rationale for these metrics follows:

The <u>number of exceedances</u> is based on short-term, daily averages of PM_{10}. In instances where pollution levels are high this is a rather blunt measure, but useful to understanding the margin of improvement that is needed to meet the NESAQ.

<u>Longer-term winter averages</u> are taken by averaging the PM_{10} for the 123 days of winter (May through August); it indicates the seasonal pollution level. Lowering these averages requires a sustained and real change to particulate levels.

The trend in the <u>average of the 10 highest days</u> (top 8% of winter) is a useful measure of whether the PM_{10} load is reducing and is regarded as an early indicator of change.

Figures 3-7 indicate these metrics for the five towns under discussion.

[8] Emily Wilton, Environet Ltd., *Alexandra, Arrowtown, Mosgiel and Milton Air Emission Inventory – 2016 (2017 Amendment),* Prepared for the Otago Regional Council, August 2017

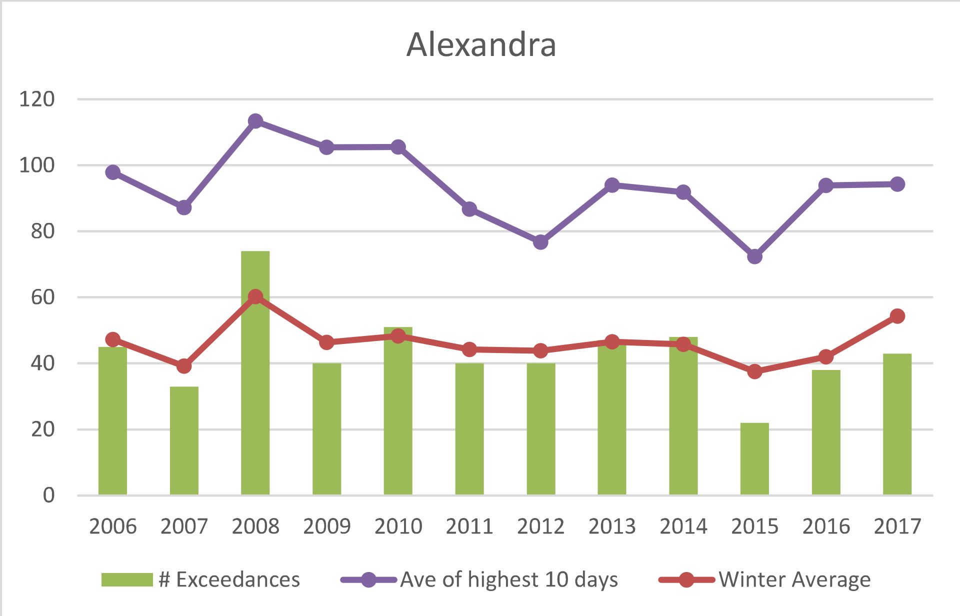

Figure 3: PM_{10} values for Alexandra from 2006-2017

In Alexandra (Figure 3), the number of exceedances and the winter average have stayed relatively consistent over the years. Of note is the significant decrease in the highest PM_{10} levels during the time the CHCA programme was most active. Since 2013, that indicator has plateaued.

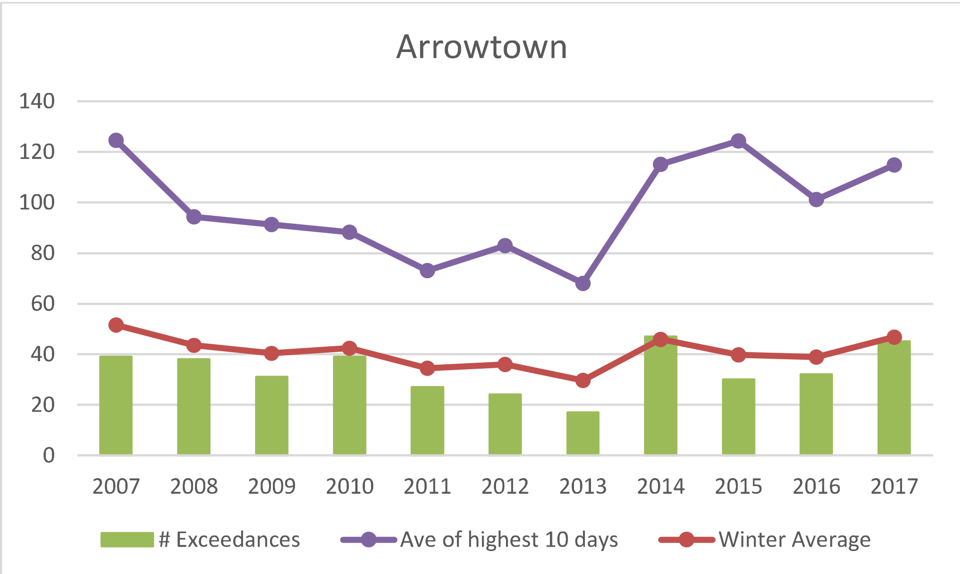

Figure 4: PM_{10} values for Arrowtown from 2007-2017. NB: In 2014 the monitor was moved to a new location.

It is noted that the monitoring site was moved for the start of 2014 due to expansion of the Arrowtown School. There appears to be significant change to all indicators from the beginning of the record until that move. The new location is obviously located in a more polluted environment and it will take several more years of monitoring to identify any trends.

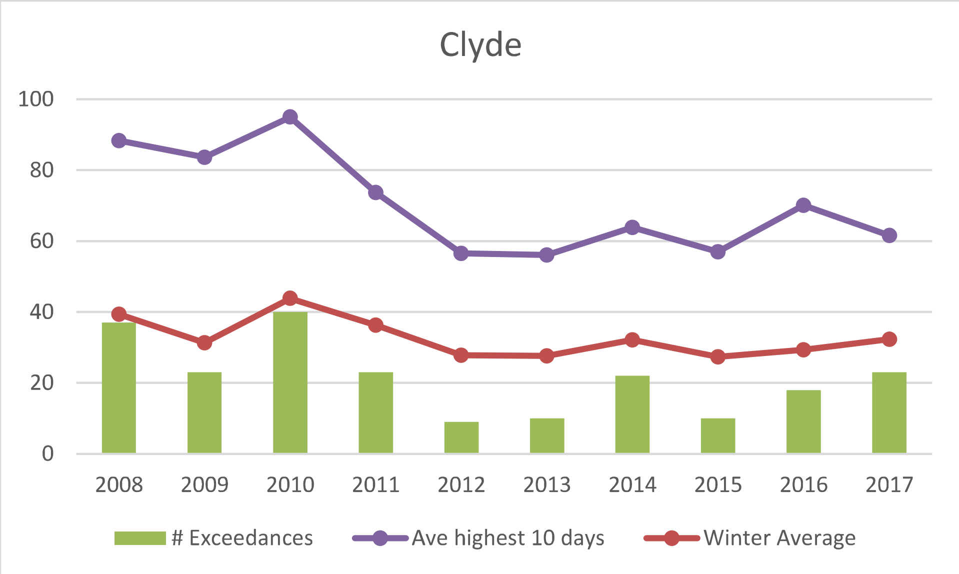

Figure 5: PM_{10} values for Clyde from 2008-2017

PM_{10} indicators all trended sharply downwards from 2010 through 2012 and have subsequently plateaued.

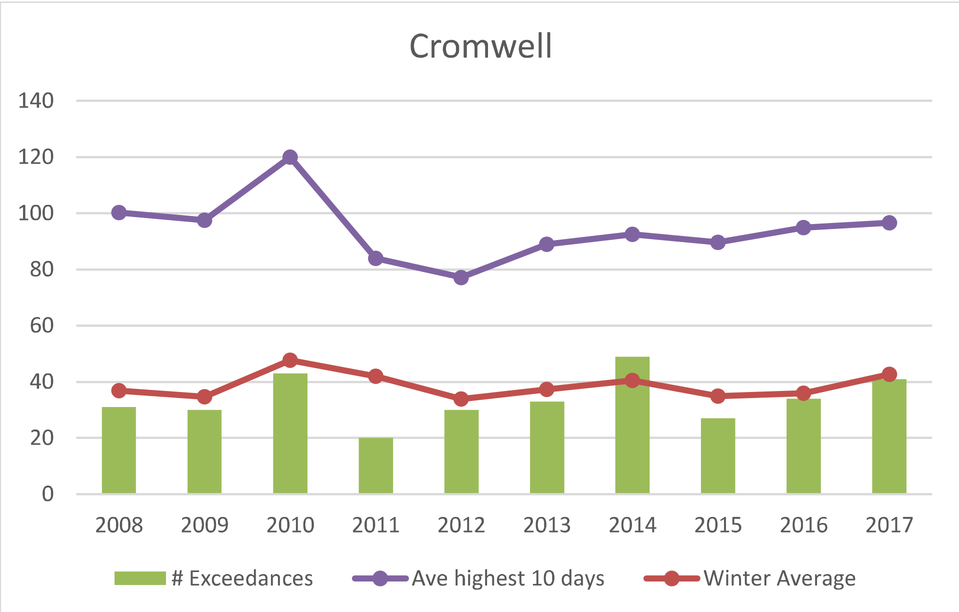

Figure 6: PM10 values for Cromwell from 2008-2017

The highest levels of PM_{10} trended downwards from 2008 through 2012 when the CHCA programme was most active. There appears to be an upward trend since that time, but it is unclear at this point whether that trend is valid.

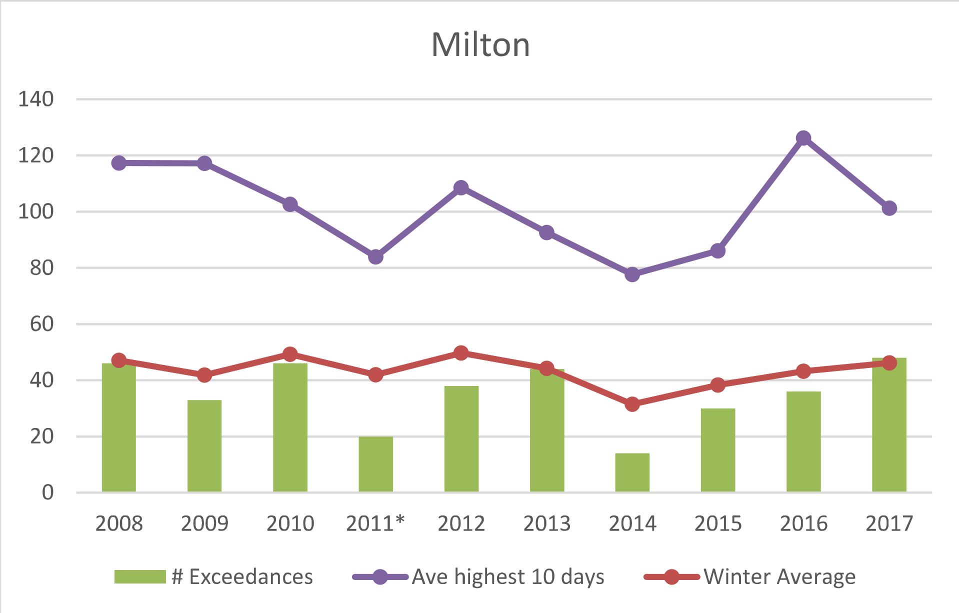

Figure 7: PM_{10} values for Milton from 2008-2017. Data for 2011 is excluded due to excessive missing data.

For the most part, Milton's particulate indicators are highly variable and a real trend is yet to be identified. The winter average has stayed fairly consistently between 40-50µg/m^3, one of the highest in the region and comparable to Alexandra's winter average.

In Central Otago towns where there was an active programme with a deadline date for phase-outs there was an improvement to air quality. This is evidenced by the downward trend in the highest PM_{10} values and, in some cases, in the exceedances and winter averages. The objective of the CHCA programme was to assist homeowners in changing their heating appliances, not necessarily to ensure that the NESAQ was met. The initiative was one part of a larger, coordinated programme including an education and awareness campaign that took place during the programme's most active phase.

The trend in improving air quality tended to level off after 2013, which was when EECA closed its programme and our own programmes across Council were scaled back.

Further emission-reduction analyses indicate that in Central Otago, even if all solid-fuel burners had been upgraded to low-emission style burners (0.7g/kg or 1.5g/kg emission rates), it is highly unlikely that the NESAQ would be met. The airsheds are, in a sense, over-allocated, even with the lower emissions and improvements that have been made.

4.3 Co-benefits achieved by the CHCA programme

In addition to improved outdoor air quality the CHCA programme likely provided co-benefits to the communities and participants, including savings to household energy costs, improved indoor comfort and quality of life, and attendant health savings.

While household energy saving seems an obvious benefit, research has shown that when the thermal nature of a house improves there will be people that take that improvement in what is termed a 'take-back' or rebound effect. Instead of saving money on energy, they take-back the improvement in the form of greater comfort from being able to increase the indoor temperature for the same amount of money[9].

[9] Philippa Howden-Chapman, et al., *Warm homes: Drivers of the demand for heating in the residential sector in New Zealand,* Energy Policy 37, 2009

Some of the increased comfort from elevated indoor temperatures will result in improved health outcomes for residents, particularly the most vulnerable in the population. An evaluation of the effects of EECA's Warm Up New Zealand: Heat Smart programme on health services utilisation and costs was performed in 2011 by the *House and Health Research Programme, a consortium of health researchers in New Zealand*[10].

Results of the analysis indicates that in terms of changes in total hospitalisations and total pharmaceutical costs, there is an overall on-going annual benefit of $563 per household for retrofitted insulation. For CSC holders, the benefit is predicted to be about $820 due to improved health outcomes from warmer and drier homes; for non-CSC holders the benefit may be approximately $230.

Of the 2150 total CHCA claimants, there were 590 claims that included insulation; of those, 435 claims were from CSC holders. According to the predicted health cost savings, the annual on-going benefit from retrofitted insulated is estimated to be approximately $390,000.

In 2013 an insulation and heating appliance scheme (*Warm Dunedin)* was run in Dunedin by the Dunedin City Council. Participants were surveyed afterwards on their perceptions of the change in their houses[11]. Of the respondents:

- 88% feel their house is warmer
- 47% feel their house is healthier
- 73% feel their house is more comfortable
- 73% feel their house is more efficient to heat

This is a strong indication that participation in such a scheme can result in positive tangible and intangible outcomes for households.

5. Issues for consideration

The CHCA programme was a key element of the Otago Regional Council's 2007 air quality strategy, sitting within a wider framework. On its own, the programme accomplished its goal of incentivising homeowners to upgrade their solid-fuel heating appliances to cleaner, more efficient wood burners. In addition, the programme provided financial assistance for insulation, thereby improving the thermal envelope of older homes.

Ambient air quality did improve in most Air Zone 1 towns from 2009 to 2013 as a result of the concerted effort made Council-wide during that time; however, since then particulate levels have plateaued and burner replacement rates have declined. Several key issues can be pulled from the experience of the CHCA initiative, its delivery, and its effectiveness.

<u>Programme design</u>
The CHCA programme did affect ambient air quality, but it may have had a more pronounced effect with a different design:

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[10] Lucy Telfar Barnard, et al., *The impact of retrofitted insulation and new heaters on health services utilisation and costs, pharmaceutical costs and mortality: Evaluation of Warm Up New Zealand: Heat Smart*, Commissioned by the Ministry of Economic Development, Wellington, 2011
[11] Dunedin City Council Report, *Warm Dunedin Targeted Rates Trial, Participants Survey, Report for April 2014,* Dunedin

- The programme was available to anyone willing to remove any non-compliant burner in Air Zone 1, and was not targeted at the largest emitters first, i.e. open fires, multi-fuel burners and coal appliances
- The programme mostly resulted in the replacement of old burners with compliant solid fuel burners rather than no or ultra-low emissions appliances (heat pumps, gas, pellet etc.). ORC's latest estimates show that a large uptake of compliant burners will not be sufficient in meeting the NESAQ standards.
- There was no control over what became of the burners being replaced, and whether they had been disposed of, or re-used in another household.

<u>Understanding community motivation</u>
There is an obvious difference in the programme take-up rates between the Air Zone 1 towns and Milton. Understanding the reason(s) for that difference may be important for any future work that might be done in the region.

Air Zone 1 town residents were faced with a deadline for burner phase-outs while Milton residents were not; this likely provided added impetus and interest in the CHCA programme. Even though the nature of compliance monitoring was not originally included in the air strategy, the notion that there was a deadline would likely have spurred action on some participants' part.

Admittedly, not all homeowners in Air Zone 1 towns have converted to compliant burners so it is possible that all of the 'low-hanging fruit' has been taken and the rest will require some further council intervention.

How the programme is tailored may also influence its effectiveness. There is a significant difference in the socio-economic setting between towns, e.g. Milton and Arrowtown lie at opposite ends of the deprivation index (as described by Stats NZ). It is possible that the amount of financial incentives offered in Arrowtown may not be scaled appropriately in Milton.

<u>Knowledge Gaps</u>
Thorough planning at the start of any programme should include setting out the parameters for assessment so that appropriate data can be collected during the programme. Examples of data that would be useful but have not been collected are:

- Reasons for homeowner participation – these could be varied and include the amount of the financial incentive, the suppliers chosen, the products available, sale of house, etc. Understanding this could help tailor any new programme.

- A record of what types of appliances, e.g. open fire, multi-fuel, etc. were taken out of circulation. These data would have helped to refine emission modelling.

- Information on participant satisfaction – a timely survey of participants could have provided data on house warmth and satisfaction after an upgrade.

Much of these data could be obtained through survey (pre- and post-participation) and paperwork submitted by suppliers at the time of delivery.

All of these considerations can inform thinking around the development of any future programmes.

6. Recommendation

a) *That this report be received.*

b) *That this report be used to inform the review of ongoing financial incentives for Air Quality, proposed for 2018/2019 in the 2018-2028 Draft Long-Term Plan.*

Endorsed by: Gavin Palmer
Director Engineering, Hazards & Science

Attachments

Nil

Appendix 10: Technical implications of the 2020 NESAQ proposal

Document Id: A1334295
From: Sarah Harrison, Air Quality Scientist
Date: 4 May 2020
Re: Technical Implications of the 2020 NESAQ Proposal

Summary

The proposed NESAQ limits for $PM_{2.5}$ will mean that a higher number of exceedances will be recorded in Otago towns than for the current PM_{10} limit, which is already exceeded up to 100 times per year. This will require a more intensified effort to reduce these exceedances in the Air Zone 1 towns and Milton, and potentially in other towns that are not currently monitored. Due to the high contrast between summer and winter emissions in many Otago towns, the proposed annual limit may be achievable sooner than the 24-hour limit.

It is recommended that a screening monitoring programme is established to determine the latest PM_{10} or $PM_{2.5}$ in the airsheds that have experienced high population growth, ones that have had PM_{10} exceedances in the past, and that the monitoring sites are still representative of others in their category. ORC will also need to focus on the relationship between emissions and concentrations in order to plot a course for reducing exceedances.

Introduction

The main air quality pollutant of concern in Otago is particulate matter. In 2004 the MfE released the National Environmental Standards for Air Quality (NESAQ), which set the concentration limit for PM_{10} (particulate matter with an aerodynamic diameter of less than 10 microns) to 50 µg/m³ for a 24-hour average (midnight to midnight).

In 2005 the World Health Organisation (WHO) released guidelines for ambient air quality, and these included limits for $PM_{2.5}$, the smaller size fraction of PM_{10}, as being a more appropriate indicator of human health, due to having more adverse impacts. In New Zealand, the Parliamentary Commissioner for the Environment recommended that a $PM_{2.5}$ standard be explored as an annual average, for the purpose of monitoring long-term concentrations. In March 2020 the MfE released the proposal for an update to the NESAQ, which included the shift to focus on $PM_{2.5}$ rather than PM_{10}, and introducing respective limits.

In 2018 ORC evaluated the impact of a $PM_{2.5}$ standard for the management of Otago's air quality, and found that neither an annual limit of 10 µg/m³, nor a daily limit of 25 µg/m³ are likely to be met in Air Zone 1 towns, and it recommended that commitment to the current air implementation strategy is the most effective way to decrease PM_{10} and $PM_{2.5}$ concentrations (ORC, May 2018).

This report will provide updated estimates of $PM_{2.5}$ concentrations within Otago airsheds, the likely average numbers of exceedances in each airshed, and discuss the implications of this from a management perspective.

Table 1. Existing and proposed NESAQ limits

Pollutant	Averaging Time	NESAQ 2004		WHO Guidelines		Proposed NESAQ 2020	
		Value ($\mu g/m^3$)	Allowable exceedances	Value ($\mu g/m^3$)	Allowable exceedances	Value ($\mu g/m^3$)	Allowable exceedances
PM_{10}	24-hour	50	1 per annum	50	None	50	1 per year
	Annual	20*	NA*	20	NA	NA	NA
$PM_{2.5}$	24-hour			25	None	25	3 per year
	Annual			10	NA	10	NA

*NESAQ Guideline only

$PM_{2.5}$:PM_{10} ratios and number of exceedances

As PM_{10} is the more widely monitored parameter in New Zealand, NIWA estimated annual $PM_{2.5}$:PM_{10} ratios for all NZ airsheds, however as Central Otago towns have strong seasonal variation it was decided that different summer and winter ratios should be calculated for these exceedance estimations. The NIWA calculated annual ratios were as follows: Air Zone 1 (Alexandra): 0.7, Air Zone 2 (Mosgiel): 0.68 and Air Zone 3 (Dunedin): 0.49 (NIWA, 2019).

The average number of potential exceedances for the proposed $PM_{2.5}$ NESAQ limits was calculated using the PM_{10} data from the previous three years (2017-2019 inclusive), and applying a calculation based on estimated $PM_{2.5}$:PM_{10} ratios.

Table 2: Predicted number of exceedances and annual averages

Site	$PM_{2.5:10}$ ratio[1]		Number of Exceedances		Annual Average	
	May-Aug (winter)	Sep-Apr (summer)	PM_{10}	Synthetic $PM_{2.5}$	PM_{10}	Synthetic $PM_{2.5}$
Alexandra - original[2]	0.9	0.55	40	99	26.0	18.8
Alexandra - current			1	33	14.4	10.3
Arrowtown			30	85	18.9	14.4
Clyde			0	52		
Cromwell			15	75		
Dunedin	0.48	0.48	0	0	14.0	6.9
Milton	0.9	0.55	17	55		
Mosgiel	0.68	0.68	1	13	18.0	12.2
Limit			50 $\mu g/m^3$ **1 per year**	25 $\mu g/m^3$ **3 per year**		**10**

[1] Ratios used were from the ORC 2018 report (A1099054), except for Dunedin which was based on ORC data.

[2] The Alexandra site was replaced during 2017-2018. The original site was located in an area of town that experienced higher concentrations than the current site; original site data is still calculated using the following calculation: PM_{10}(original site) =1.886(PM_{10}(current site)-0.49)

Figure 1: Number of average predicted exceedances of the 24-hour average limits

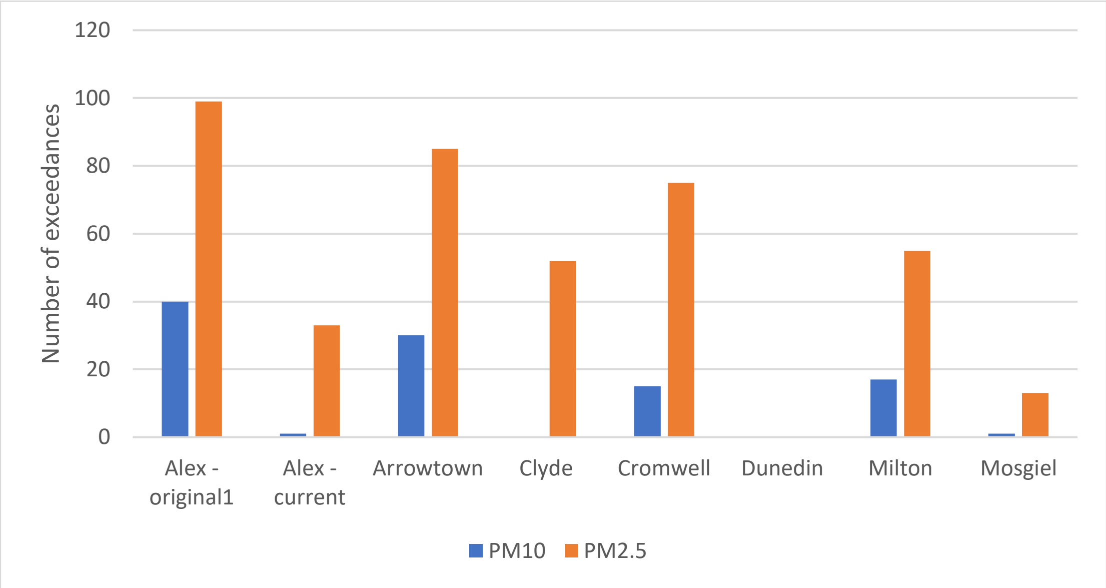
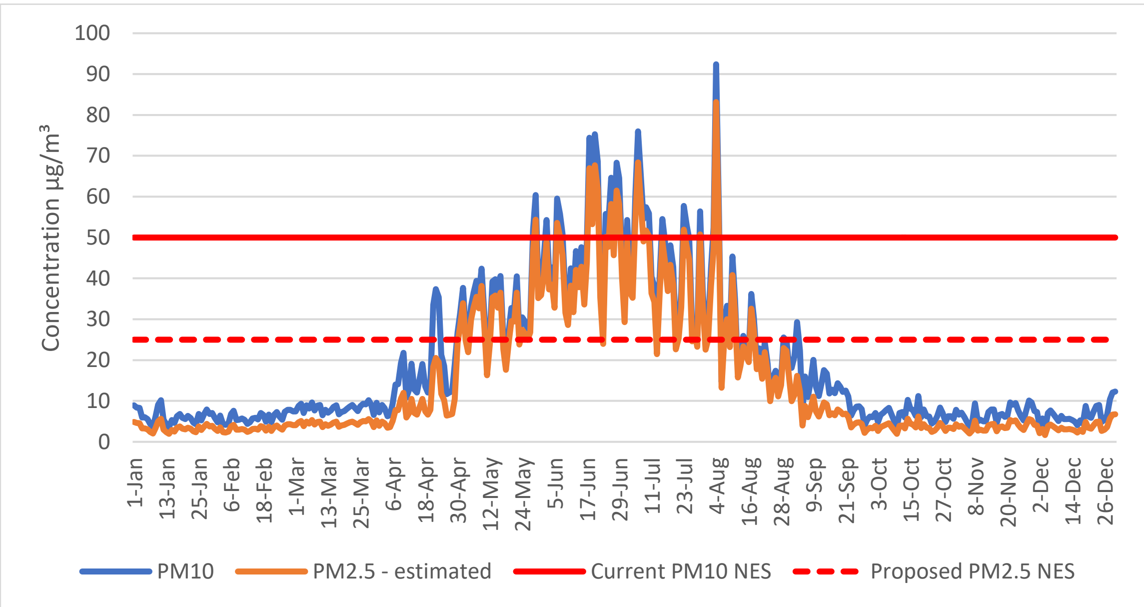


Figure 1 shows that the number of 24-hour average $PM_{2.5}$ exceedances will be much higher than the number of PM_{10} exceedances in all towns. The proposed allowed number of $PM_{2.5}$ exceedances will be three exceedances per 12-month period, and only the Dunedin site is likely to meet this on a frequent basis.

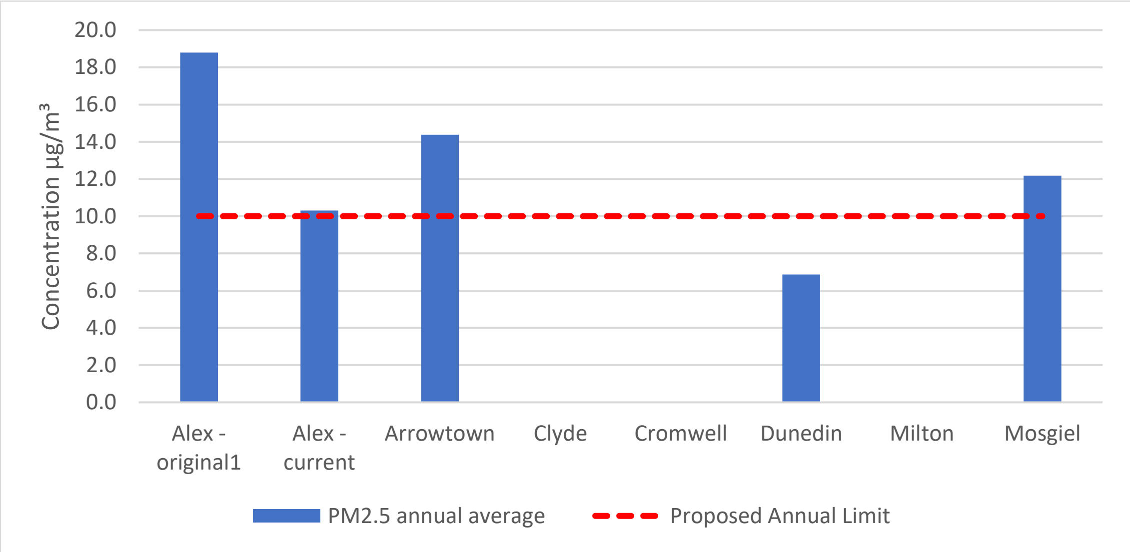
In Air Zone 1 and Milton, the ratio of $PM_{2.5}$ to PM_{10} is quite high during winter. Figure 2 shows how similar daily concentrations between the two categories are, compared with the proposed NESAQ limit.

Figure 2: Estimated 24-hour average concentrations of PM_{10} and $PM_{2.5}$ in Arrowtown



The proposed annual average limit for $PM_{2.5}$ is 10 µg/m³. This is likely to be exceeded in most Air Zone 1 towns and potentially also in Air Zone 2 towns (Figure 3). Note that there is currently no annual average for Clyde, Cromwell and Milton because these towns are only monitored during winter months.

Figure 3: Estimated $PM_{2.5}$ annual average concentrations



Airshed categories

There are 22 towns (or parts of town, in Dunedin's case) in Otago that have been gazetted as airsheds under the NESAQ. These same towns have been additionally categorised into air zones for management purposes (Table 3), which is a unique system amongst New Zealand's regional councils. The designation of airsheds is based upon likely number of exceedances and meteorological conditions, and was put in place after several years of temporary monitoring conducted in the late 1990's and early 2000's.

Due to changes in population size and emission reduction technology, some of these airsheds and/or air zones may be rearranged during the Air Plan review, in terms of category they occupy, and in terms of geographic borders. Towns like Wanaka and Queenstown have grown beyond the boundary of their air zones, and others like Clyde, have potential to in the near future.

In terms of number of exceedances, historical data suggests that large coastal towns like Oamaru, and central towns like Queenstown may have exceeded the $PM_{2.5}$ limits in the past, but investigations need to be conducted to confirm this in present day, as there has been improvement in emissions over the last couple of decades, and a large decrease in the use of coal as fuel for home heating.

Table 3: Current airshed and air zone designations in Otago

Designation	Airsheds	Air Zones
1	Alexandra*	Alexandra
	Arrowtown*	Arrowtown
	Clyde	Clyde
	Cromwell	Cromwell
	Naseby	
	Ranfurly	
	Roxburgh	
2	Palmerston	Balclutha
	Mosgiel*	North Dunedin
	South Dunedin	Central Dunedin
	Green Island	South Dunedin
	Milton	Green Island
		Hawea
		Kingston
		Milton
		Mosgiel
		Naseby
		Oamaru
		Palmerston
		Port Chalmers
		Queenstown
		Ranfurly
		Roxburgh
		Waikouaiti
		Wanaka
3	Balclutha	Rest of Otago
	North Dunedin	
	Central Dunedin*	
	Oamaru	
	Port Chalmers	
	Waikouaiti	
4	Hawea	N/A
	Kingston	
	Queenstown	
	Wanaka	
5	Rest of Otago	N/A

*Key monitoring sites

Emissions reductions

Emissions reduction has been occurring in many Otago towns over time for different reasons: the gradual decrease in household coal use and occurrences of wood burner upgrades have been both related and unrelated to ORC's Clean Heat Clean Air (CHCA) programme. The CHCA programme was responsible for 68% of burner replacements in Air Zone 1 towns (towns where the CHCA subsidy was promoted and available) between 2008 and 2018 (ORC, June 2018). It can be assumed that some burner replacements have also been happening in other parts of Otago by consumer choice, driven by needed replacements, and/or market improvements motivated by the 2011 update of the NESAQ.

The ORC Air Plan rules require that Air Zone 1 town domestic solid fuel burners meet an emissions rate of 0.7g/kg or less if installed since 2007 (or 2009 in Clyde), with a phase out period occurring between then and 2012, where the NESAQ standard of 1.5g/kg was permitted. The proposed NESAQ will have an emission standard of 1.0g/kg, which will be more stringent in Air Zones 2 and 3 and may help improve air quality over time.

ORC (May 2018) estimated that there would need to be a 70-80% reduction in emissions in Air Zone 1 towns in order to meet the proposed NESAQ for $PM_{2.5}$, whereas the decrease needed to meet the PM_{10} standard would be 55-60%. The methods for achieving this would be the same, however – replacing older wood burners with low emission heating. Additionally, each airshed capacity should be evaluated, as there is evidence that some are over-allocated for emissions. For example, a 53% emissions reduction in Alexandra only produced a 25% decrease in concentrations between 2005 and 2016 (ORC, 2016). This may mean that a shift towards non-solid fuel heating is required in future in some airsheds.

Emissions reduction was driven in central Dunedin by targeting industrial emissions using consent conditions. This has been effective in reducing concentrations in this airshed because it is no longer considered polluted (has had one or less exceedance in the last five years).

References

Longley, I., and Coulson, G., 2019. *$PM_{2.5}$ in New Zealand: Modelling the current (2018) levels of fine particulate air pollution.* Prepared for the Ministry for the Environment. NIWA Ltd.

ORC, 2018. *An assessment of the Clean Heat Clean Air program's effectiveness*. Technical Committee Report, 13 June 2018.

ORC, 2016. *Emissions reduction analysis 2016*. Internal file note, Objective reference A1097061.

ORC, 2018. *Implications of a $PM_{2.5}$ standard on air quality management.* Technical Committee Report, 2 May 2018.

World Health Organisation, 2006. *Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: Global update 2005: Summary of risk assessment.* Retrieved from https://www.who.int/airpollution/publications/aqg2005/en/

Appendix 11: Airshed boundaries (Arrowtown, Kingston, Wanaka)

2019

Map 3 - Arrowtown

2009

1:25,000 @ A3

Gazetted Air Sheds

Otago Regional Council

Information on this map may not be used for the purposes of any legal disputes. The user should independently verify the accuracy of any information before taking any action in reliance upon it.

2019

Map 1 - Kingston

2009

1:10,000 @ A3

Gazetted Air Sheds

Otago Regional Council

Map 1 - Kingston

2019

2009

1:35,000 @ A3

Gazetted Air Sheds

Otago Regional Council

Information on this map may not be used for the purposes of any legal disputes. The user should independently verify the accuracy of any information before taking any action in reliance upon it.

Appendix 12: Wildlands Report (2020a)

MAPPING OF SIGNIFICANT HABITATS FOR INDIGENOUS FAUNA IN TERRESTRIAL, FRESHWATER, AND MARINE ECOSYSTEMS IN OTAGO REGION

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Wildlands

R5015b

MAPPING OF SIGNIFICANT HABITATS FOR INDIGENOUS FAUNA IN TERRESTRIAL, FRESHWATER, AND MARINE ECOSYSTEMS IN OTAGO REGION

Contract Report No. 5015b

July 2020

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EXECUTIVE SUMMARY

Significant habitats of indigenous fauna were mapped across Otago Region, across terrestrial, freshwater, and marine ecosystems. Twenty-two different habitat layers were created, to address 22 different fauna groups.

Otago Region contains breeding habitat for approximately 87 indigenous bird species, of which 38 are classified as Threatened or At Risk. Data from the eBird database, important bird areas (IBA) defined for seabirds, and other databases were used to define areas that comprised important habitat for several of the Threatened and/or At Risk birds, and wetland and river birds. Significant habitats of forest birds were identified as those indigenous and areas of exotic forest and scrub that contained records of koekoea/long tailed cuckoo, South Island kaka, tītitipounamu/rifleman, toutouwai/South Island robin, pipirihika/brown creeper, or mohua/yellowhead. In addition, areas defined in the land cover database (LCDB) v5 as 'indigenous forest', and areas 10 hectares or larger of LCDB 'broadleaved indigenous hardwoods' and 'mānuka or kānuka' were mapped as significant habitat of indigenous forest birds. The resulting forest bird layer was manually inspected and numerous misclassified polygons were removed. Significant forest bird habitat defined and mapped using the above methods is notably scarce in Central Otago District, but widespread in Clutha District, Dunedin City District, and Queenstown Lakes District. In Waitaki District, significant habitat of forest birds is concentrated in the Waianakarua and Kakanui catchments.

Significant habitats of long-tailed bats were mapped by establishing a buffer of 11 kilometres around known bat records obtained from the Department of Conservation Bat Distribution database (Accessed 5 June 2019) to indicate likely bat habitat. The 11 kilometer buffer closely approximates the median home range span for long-tailed bats. Other sources of information were used to find two additional records of bats which were similarly treated. Long-tailed bats are current found in habitats close to the main divide in the Dart and Makarora catchments, in the Catlins, and with recent unconfirmed reports at Leithen Bush and near Warrington. Ten areas that are priorities for future bat surveys were also determined.

Otago Region provides habitat for at least 24 currently-recognised lizard taxa, of which all but three are classified as Threatened or At Risk. Lizard locations were determined from a variety of sources including the Department of Conservation Herpetofauna Database, latest field guides, scientific papers, technical reports, discussions with other herpetologists, and Wildlands staff expert knowledge based on more than a decade of working with lizards across the Region. These records were then used to define boundaries around known significant habitats of lizards, and potentially significant habitats lacking information on lizard occurrences. Eighty-seven significant habitats and 106 potentially significant habitats were identified in this way. A precautionary approach should be applied to release of public information on several lizard species, due to issues with wildlife trafficking of lizards.

One hundred and thirty-eight significant habitats of terrestrial invertebrates were identified and mapped, based on a long history of entomological surveys of sites in Otago undertaken by BHP over the period 1984-2018. These sites were selected on the basis of the presence of representative, diverse, distinctive, and/or rare invertebrate assemblage and taxa. Most of these sites are on conservation land or sites assessed under the Protected Natural Areas Programme.

Otago has freshwater habitats for 25 species of indigenous fish, of which 18 are classified as Threatened or At Risk. Significant habitats of indigenous fish were defined as freshwater

stream segments associated with records of Threatened indigenous fish, and streams in Freshwater Ecosystems of New Zealand (FENZ) catchments that were ranked in the top 10% regionally or nationally. In addition, significant inanga spawning habitats were mapped based on information provided by Otago Regional Council.

Information from existing layers, scientific information, student theses, maps, publicly-available reports and statements from a variety of databases and websites were used to identify significant habitats of indigenous fauna in the marine environment. These included biogenic and rocky reefs, kelp beds, important seabird and marine mammal feeding areas, cockle beds, and seagrass beds. Important terrestrial habitats of marine mammals were identified during consultation with Department of Conservation staff and staff of the New Zealand Sea Lion Trust, and were mapped at a number of sites on the Otago Peninsula and in other areas on the Otago coast.

Significant habitats mapped in this project represent a starting point for mapping of indigenous fauna habitats, based on the information available now. They can be improved as further fauna surveys are undertaken and provide new information that can be taken into account.

Nonetheless, the significant habitats of indigenous fauna mapped during this project will provide an important basis for evaluating sites in terms of RMA Section 6(c), which specifies that the protection of significant areas of indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance that shall be recognised and provided for. Significance assessments have generally focussed on the identification of significant indigenous vegetation and much more rarely on the identification of significant habitats of indigenous fauna. To the extent that this has resulted from a lack of collated information, the sites identified by the mapping presented in this report will help to address this deficiency.

CONTENTS

STATEMENT FOR REDACTING INFORMATION ON LIZARD LOCATIONS

The mapping and location of threatened lizard species in the Otago region has been redacted from this report. These redactions are made pursuant to sections 7(2)(c) and 7(2)(j) of the Local Government Official Information and Meetings Act 1987. Any request for this information is likely to be refused to these sections.

1. INTRODUCTION

Otago Regional Council commissioned Wildland Consultants Ltd to map the significant habitats of indigenous fauna across Otago Region, including the coastal marine part of the Region.

The maps are intended to be used to:

- Prioritise areas within Otago that would benefit most from active biodiversity management.
- Provide a baseline of the integrity and extent of indigenous biodiversity within Otago.
- Inform the upcoming reviews of the Regional Water Plan and the Regional Plan Coast.

The key outputs of the project are maps of:

- Terrestrial habitat of significant indigenous fauna.
- Freshwater habitats of significant fauna.
- Coastal marine habitats of significant indigenous fauna.

This report describes the methods that were used to map significant habitats of indigenous fauna across Otago Region. A companion report (Wildland Consultants 2020) describes the mapping of potential and current natural ecosystems across across Otago's terrestrial, freshwater, and marine ecosystems.

2. METHODS AND FINDINGS

2.1 Overview

Rather than mapping all terrestrial, freshwater, and/or marine fauna in a single layer, which would have resulted in numerous overlapping polygons, different fauna groups were mapped in different layers. By intersecting these layers, areas that are important for multiple fauna groups can be identified. Table 1 summarises the fauna habitat layers that were created.

The layers summarised in Table 1 were compiled from:

- Existing layers (e.g. seabird Important Bird Areas) which in some cases were amended based on additional information
- Raw data on species occurrences, either by drawing generalised polygons around areas with high densities of records, or by utilising habitat outlines (e.g. wetland habitats) to determine the extent of significant habitat
- Habitat polygons used alone to define significant habitat (e.g. LCDB cover classes above certain size thresholds).

Not all species could be mapped using these methods, for example it proved difficult to map significant habitats of kea (*Nestor notabilis*) or karearea (*Falco novaeseelandiae* 'eastern'). While no specific mapping of significant habitats of these two species was undertaken, generalised mapping of forest bird habitat would include many of their habitats.

Table1: Key information sources for mapping of indigenous fauna habitat in Otago Region by fauna group. Each fauna group is mapped in a separate GIS layer.

Fauna Group	Summary of Methods
Forest birds	Indigenous forest areas above size thresholds; forest which support selected bird species based on eBird records.
Rock wren	Polygons generalised from eBird records.
Whio/blue duck	Polygons generated from eBird and Whio Forever records.
Kaka/mohua	Polygons generalised from eBird records and indigenous forest.
Crested grebe	OSNZ survey data and lake polygons.
Matuku hūrepo/bittern	Wetlands with matuku/bittern records; eBird, DOC matuku/bittern database, Wildlands staff knowledge.
Mātātā/fernbird	Wetlands and scrub with mātātā/fernbird records; eBird, Wildlands staff knowledge.
Seabird breeding sites	Coastal and Inland IBAs and Wildlands staff knowledge.
Seabird feeding areas	High density of eBird, iNaturalist records, dense hoiho tracks from MoveBank.
Bats	Habitat based on maternal home range size and DOC bat distribution records.
Lizards	DOC herpetofauna database, Wildlands staff knowledge.
Terrestrial invertebrates	Habitat based on a long history of surveys; Wildlands staff knowledge.
Inanga spawning sites	Amended polygons provided by Otago Regional Council.
Regionally highly-ranked FENZ catchments	Streams and rivers within FENZ regional ranked 3rd-order catchments 1-151.
Nationally high-ranked FENZ catchments	Streams and rivers within FENZ national ranked 3rd-order catchments 1-2,697.
Threatened freshwater fish	Stream reaches with known occurrences of freshwater fish classified as Threatened by Dunn *et al.* (2018).
Highly ranked lakes	FENZ ranking of Otago lakes.
Marine mammal sites	Consultation with DOC, NZ Sea Lion Trust, literature.
Biogenic and rocky reefs	Modelled biogenic reefs, known rocky reefs, trawl data.
Kelp beds	Sea Sketch information.
Seagrass beds	Sea Sketch information.
Estuaries	Cockle beds and seagrass beds in estuarine habitats.

2.2 Birds

Otago has about 87 bird species which have breeding populations within the Region. In addition, Otago supports non-breeding populations of at least two indigenous species: white heron (*Ardea modesta*) and kuaka/eastern bar-tailed godwit (*Limmosa lapponica baueri*). Many other international migratory bird species regularly use Otago estuaries and coastlines during their non-breeding season. Offshore, a diverse community of pelagic seabird species is present. Criteria were developed to identify significant habitats for birds which focused on Threatened and At Risk species (Robertson *et al.* 2017), as well as locations of burrowing seabird colonies, which are highly threatened on mainland New Zealand. Table 2 lists Threatened and At Risk species with mainland breeding populations in Otago.

Table 2: eBird records of Threatened and At Risk avifauna species with breeding populations in Otago Region.

Common Name	Numbers of eBird Records (one or more individuals)	Threat Classification
Matuku/bittern	24	Threatened-Nationally Critical
Black-billed gull	1,694	Threatened-Nationally Critical
Black stilt	34	Threatened-Nationally Critical
Black-fronted tern	577	Threatened-Nationally Endangered
Kea	883	Threatened-Nationally Endangered
Reef heron	35	Threatened-Nationally Endangered
Southern rock wren	287	Threatened-Nationally Endangered
Yellow-eyed penguin	971	Threatened-Nationally Endangered
Wrybill	55	Threatened-Nationally Vulnerable
Banded dotterel	455	Threatened-Nationally Vulnerable
Caspian tern	555	Threatened-Nationally Vulnerable
New Zealand kākā	724	Threatened-Nationally Vulnerable
Whio/blue duck	151	Threatened-Nationally Vulnerable
Australasian grebe	611	Threatened-Nationally Vulnerable
Blue penguin	1,124	At Risk-Declining
South Island oystercatcher	2,454	At Risk-Declining
Australasian pipit	438	At Risk-Declining
Marsh crake	3	At Risk-Declining
Mātātā/South Island fernbird	462	At Risk-Declining
Red-billed gull	5,643	At Risk-Declining
White-fronted tern	1,850	At Risk-Declining
New Zealand robin	742	At Risk-Declining
Sooty shearwater	1,021	At Risk-Declining
Variable oystercatcher	2,549	At Risk-Recovering
Karearea/New Zealand falcon	1,212	At Risk-Recovering
Pied shag	141	At Risk-Recovering
Otago shag	1,753	At Risk-Recovering
Mohua/yellowhead	785	At Risk-Recovering
Broad-billed prion	21	At Risk-Relict
Common diving petrel	24	At Risk-Relict
Red-crowned parakeet	14	At Risk-Relict
Fairy prion	148	At Risk-Relict
White-faced storm petrel	8	At Risk-Relict
Buff weka	N/A	At Risk-Relict
Northern royal albatross	1,480	At Risk-Naturally Uncommon
Black shag	1,405	At Risk-Naturally Uncommon
Black-fronted dotterel	17	At Risk-Naturally Uncommon
Royal spoonbill	1,549	At Risk-Naturally Uncommon

Sources used to describe significant habitats of birds included:

- The eBird global database (Cornell Lab of Ornithology).
- Important Bird Area documents (BirdLife International/Forest and Bird).
- Otago Regional Council significant wetland habitats (data available via the Otago Regional Council website).
- Other published and unpublished sources of information, including Wildlands reports.
- Expert knowledge.

These sources are described in the following sections.

2.2.1 eBird database

eBird is a citizen science, global database, which is available online. New Zealand data were requested and downloaded in May 2019 (Sullivan *et al.* 2009; eBird 2019). This data set contains 147,145 species records for the Otago Region; each record may consist of one or more individuals of the same species (for example, the database contains seven observations of 10,000 or more sooty shearwaters seen in one location)[1].

Use of the data set requires an understanding of its limitations. Anyone can submit data to the website. In Aotearoa/New Zealand, records are submitted by a range of people, from not-so-skilled bird watchers to highly experienced observers, or people working in environmental fields submitting data collected during field trips, such as Department of Conservation staff. Records submitted to eBird may include misidentifications, or locations may be imprecise. Importantly, the eBird data set is also biased towards areas where people visit, such as tourist areas, tracks, and towns. This has implications when using these data to determine 'significant' habitats.

eBird records were used to examine the distribution of all At Risk and Nationally Threatened bird species in Otago. The following examples show how the data were used:

- Karearea/New Zealand falcon (At Risk-Recovering) data were analysed by mapping 'positive' records of the species against all eBird records. The species was found to be distributed throughout the Otago Region; that is, virtually everywhere that eBird records have been logged also included records of karearea/ falcon. This made it difficult to determine significant habitat.
- The same process was undertaken for kea (Threatened-Nationally Endangered). The species was observed throughout all habitats in the western parts of the Otago Lakes District, but only occasionally in the eastern parts of the district. The western part of Otago was not mapped as significant kea habitat due to the broad scale of this subregion.
- South Island kākā (Threatened-Nationally Vulnerable) and mohua (At Risk-Recovering) eBird records were strongly associated with presence of indigenous forest in the Caples, Greenstone, Dart, Rees, Matukituki, Wilkin, and Makarora valleys, while mohua also have significant habitat in the Blue Mountains and Catlins. Both species were largely absent from the Richardson Mountains.
- Significant southern rock wren (Threatened-Nationally Endangered) sites were mapped where concentrations of eBird records were located (Figure 1); the actual distribution of the species, based on eBird records, is much wider.
- Significant wetland habitats identified by Otago Regional Council that are potentially or known significant bird habitats were checked for relevant eBird data. In many cases, eBird data provided further information on the diversity and abundance of bird species present.

2.2.2 Important bird areas

The 'Important Bird Area' (IBA) concept was developed by BirdLife International, and has been in use for over 30 years. Identification of an IBA is based on a relatively simple set of criteria that can be applied in both terrestrial and marine environments. Over 12,000 IBAs have been identified worldwide. The identification of IBAs is based on

[1] iNaturalist is another online citizen science database that contains bird records for Otago. However, the data set is very small compared to eBird. A relatively new development is that searches within eBird can now include verified data from iNaturalist. This particular analysis does not include iNaturalist data.

the presence of globally threatened bird species as identified by IUCN Red List criteria, not the New Zealand threat classification system.

In New Zealand, only seabird IBAs have been identified to date. Seabird IBAs are described in three major documents which addressed seabird IBAs at sea (Forest & Bird 2014), coastal sites and islands (Forest & Bird 2015), and rivers, estuaries, coastal lagoons and harbours (Forest & Bird 2016). The identification process was undertaken by a seabird scientist, Chris Gaskin, on behalf of Forest and Bird (a partner of Birdlife International), and involved extensive published and grey literature reviews and communications with species experts. For this project, a 'seabird' was defined as a species that spends some part of its life cycle feeding over the open sea. This definition includes species such as black-billed gulls and black-fronted terns. Because of this, 'seabird' IBAs have been identified on inland braided riverbeds in various part of Aotearoa/New Zealand.

Criteria for the identification of an IBA are:

- A_1 - More than threshold numbers of one or more globally threatened species.

- A_2 - More than threshold species complements of restricted-range species.

- A_3 - More than threshold species complements of biome-restricted species.

- A_4 - More than threshold numbers of one or more congregatory species, including:
    - A_{4i} >1% of the biogeographic population of waterbirds.
    - A_{4ii} >1% global population of seabirds.
    - A_{4iii} >10,000 pairs, seabirds or 20,000 individuals, waterbirds.
    - A_{4iv} > Threshold numbers at migration bottleneck sites.

Nineteen seabird IBAs have been identified in the Otago Region: four extensive marine IBAs, six coastal IBAs, and nine river IBAs (Figure 2). The relevant IBA reports provide extensive information on both the 'trigger' species, along also all other bird species known to be breeding or potentially breeding within each site.

Excessive visitation by humans can adversely affect hoiho, hence information documenting hoiho breeding sites needs to be managed sensitively.

2.2.3 Other mapping approaches

Significant whio/blue duck habitats were mapped based on records obtained from the Department of Conservation's 'Whio Manager', a database with extensive, up-to-date information on whio sightings and management, and from eBird records, where high concentrations of observations were found, the latter of which showed a wide distribution in the tributaries of the Makarora; (Figure 1).

Significant crested grebe habitats were defined from the most recent survey undertaken by the Otago branch of Birds New Zealand (Thompson and Schweigman 2009). Whole lakes were mapped (Figure 1) but actual records within the lakes are patchier, although often widespread.

Significant habitats of matuku hūrepo/bittern (*Botaurus poiciloptilus*) was mapped across Otago Region by assembling matuku/bittern distribution data, then delineating polygons around sites with a high density of matuku/bittern records, a long time sequence of matuku/bittern records, and/or contained known wetland habitats of matuku/bittern. Significant habitats of matuku/bittern are widespread in Otago, comprising wetland habitats in both coastal and inland areas (Figure 3). A similar approach was also used to map significant habitats of mātātā/South Island fernbird (*Bowdleria punctata punctata*; Figure 1).

Significant habitats of forest birds included both indigenous and exotic forest and shrubland that contained recent records of koekoeā/long tailed cuckoo (*Eudynamus taitensis*), South Island kākā (*Nestor meridionalis meridionalis*), tītipounamu/ rifleman (*Acathissita chloris*), toutouwai/South Island robin (*Petroica australis*), pipirihika/brown creeper, or mohua/yellowhead (*Mohoua ochrocephala*). All areas classified in the Landcover Database (Version 5, LCDB) as 'indigenous forest' were also mapped as significant forest bird habitat, as these areas comprise mature indigenous forest that will support higher population sizes of forest birds, and contain a greater diversity of forest bird habitats and seasonal food sources for forest birds. In addition, areas of 10 hectares or larger of 'broadleaved indigenous hardwoods' and 'mānuka or kānuka' were mapped as significant habitat of indigenous forest birds. These younger successional stands of forest vegetation have also been shown to provide important habitat for indigenous forest birds (Wildland Consultants 2016). A larger size threshold was used to capture these cover types due to the more numerous misclassifications of these types in LCDB. For example, the LCDB 'broadleaved indigenous hardwoods' layer often captures non-coniferous exotic trees around farm houses and operational bases and in woodlots. The layer was manually inspected and many obvious misclassifications that had been captured by the 10 hectare threshold were removed. This checking process found and removed numerous misclassifications where groves of exotic trees were classified as indigenous forest habitat. Despite this checking process, there will inevitably be misclassifications due to thematic errors and spatial resolution of the LCDB polygons used for this analysis.

The capture of 'matagouri or grey scrub' polygons was also attempted using a similar size threshold, as often areas mapped as this cover class contains indigenous trees and forest remnants. Also, where indigenous forest is absent, these larger shrubland areas are significant for the more widespread indigenous forest birds such as riroriro/grey warbler (*Gerygone igata*), pipihi/silvereye (*Zosterops lateralis*), piwakawaka/ fantail (*Rhipidura fuliginosa*), and/or kōparapara/bellbird (*Anthornis melanura*). However the LCDB mapping of 'matagouri or grey scrub' is too inconsistent, and use of this approach would likely result in adverse feedback from end users if it was used to define significant habitat of indigenous forest birds.

Significant forest bird habitat defined and mapped using the above methods is notably scarce in Central Otago District, but widespread in Clutha District, Dunedin City District, and Queenstown Lakes District (Figure 4). In Waitaki District, significant habitat of forest birds is concentrated in the Waianakarua and Kakanui catchments.

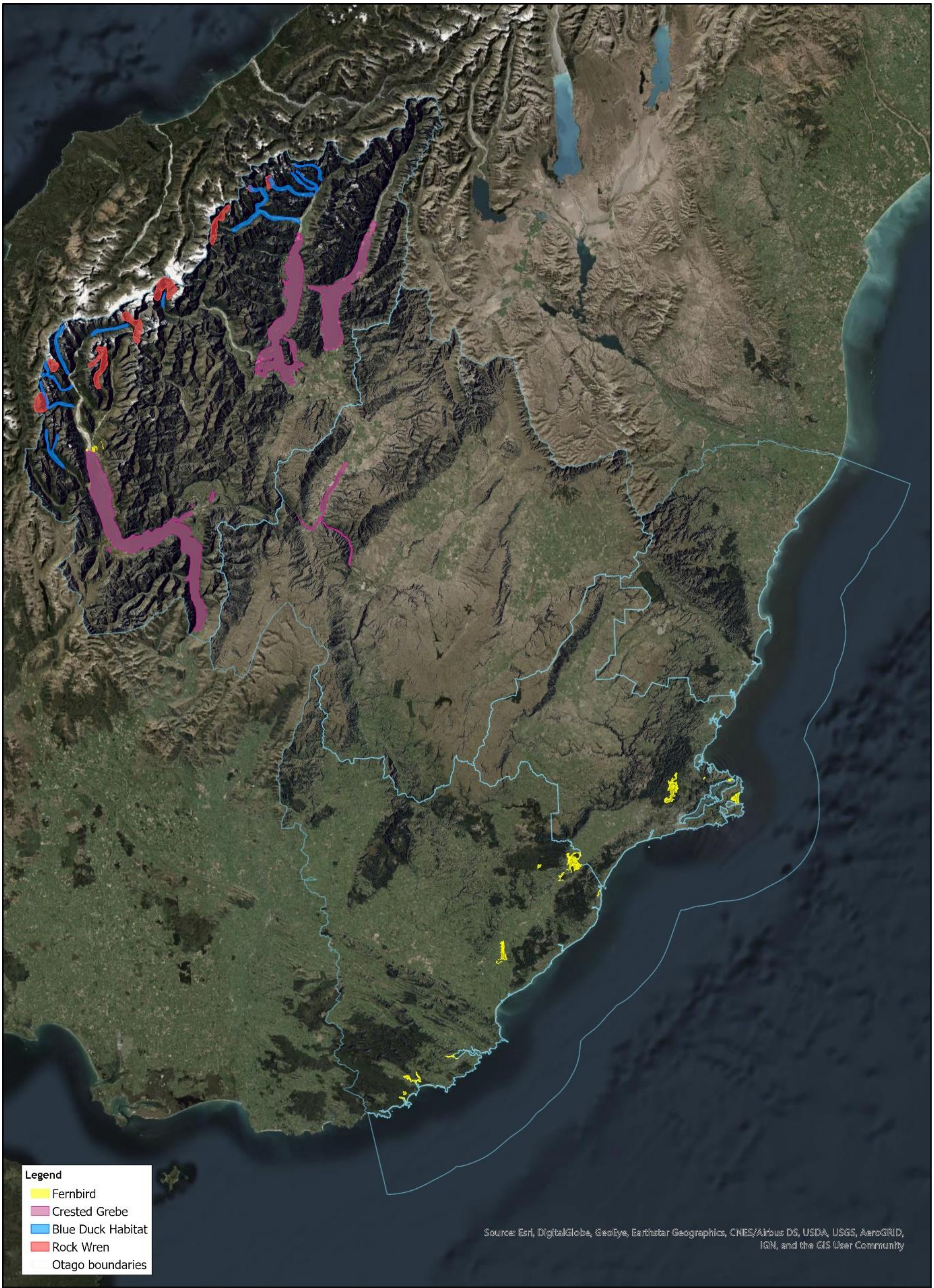

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Figure 1: Significant habitat for selected bird species in Otago

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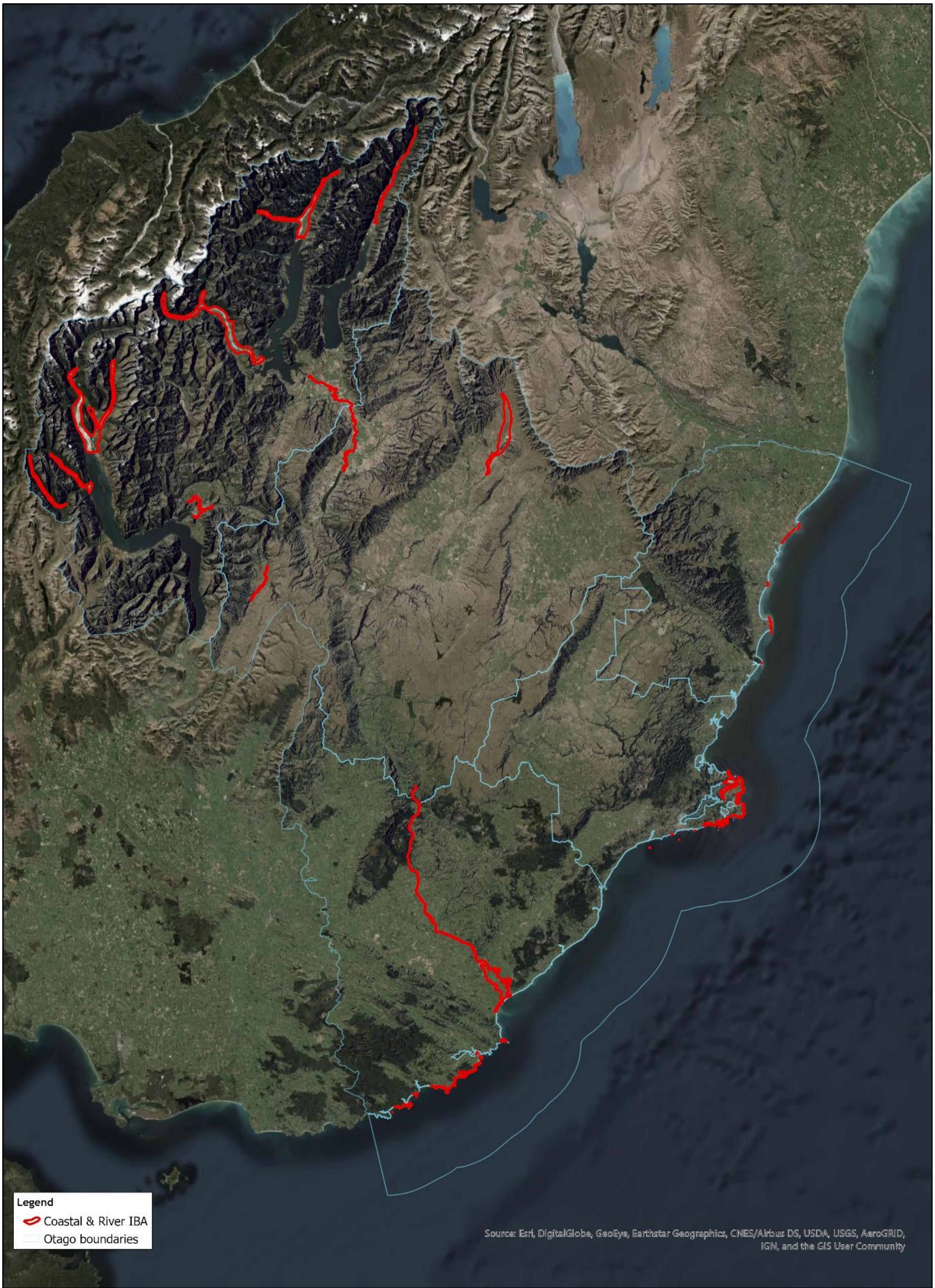

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Figure 2: Coastal and river IBAs for seabirds in Otago

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Figure 3: Significant habitats of Australasian bittern in Otago

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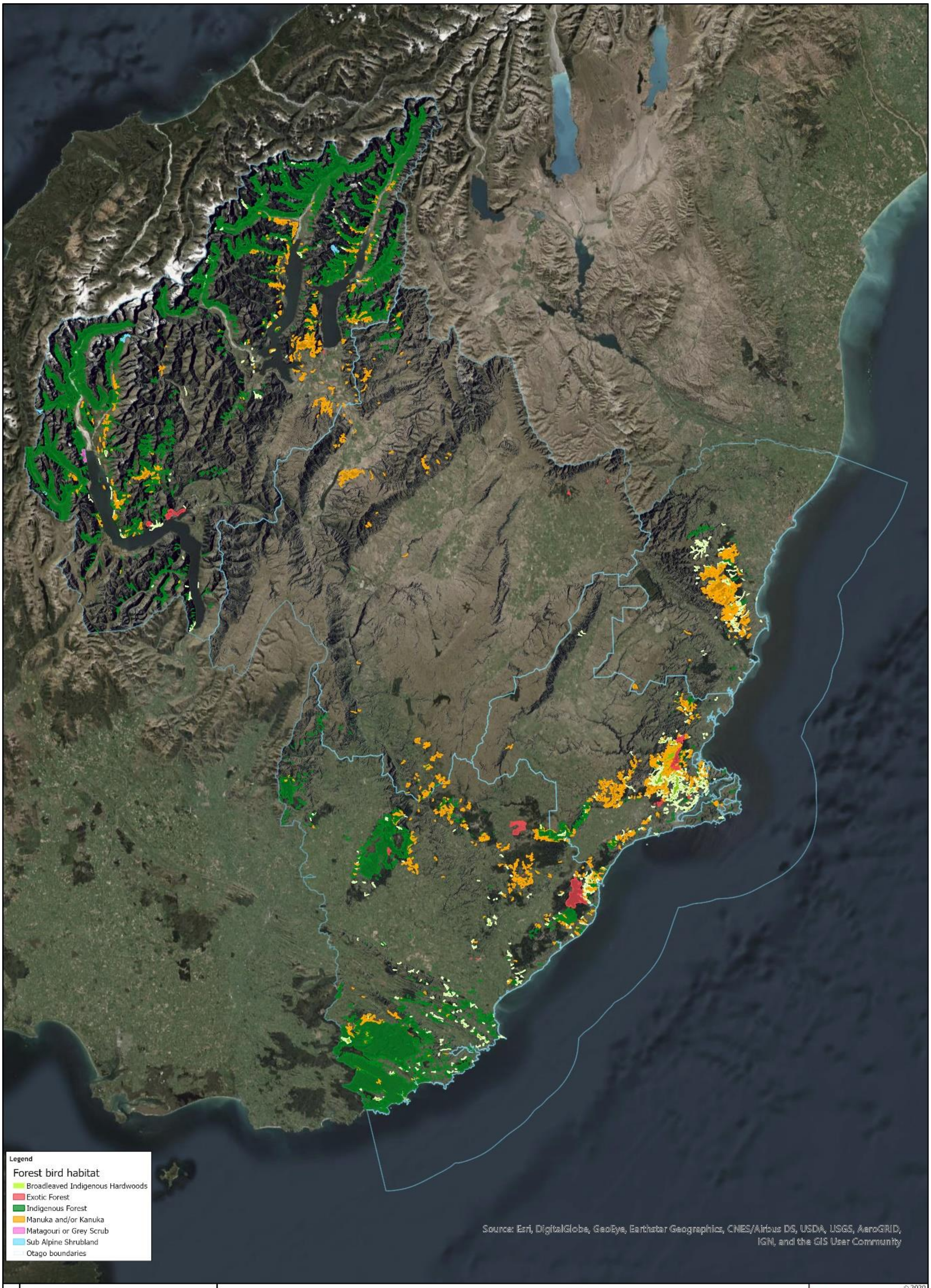

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Figure 4: Significant habitat of forest birds in Otago

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2.3 Bats

Mapping of significant bat habitat was undertaken using the following methods:

- A buffer of 11 kilometres was used around known bat records obtained from the Department of Conservation Bat Distribution database (Accessed 5 June 2019) to indicate likely bat habitat. These records included those of long-tailed bats (*Chalinolobus tuberculatus*), lesser short-tailed bats (*Mystacina tuberculata*), and unknown bat species. Eleven kilometres was chosen as the buffer distance because this closely approximates the median home range span - the distance from one side of a bat's home range to the other extreme - for both long-tailed bats and lesser short-tailed bats[1]
- In addition to this, a variety of sources were used to attempt to seek records of bats and prioritise sites for survey within the Otago Region. These included discussions with locally- and nationally-based bat ecologists, Department of Conservation staff, searches via the internet for bat sightings, and Wildlands staff expert knowledge. Two additional records of bats were obtained in this way.

Sedgeley and O'Donnell (2012 Page 7) suggest that the following criteria are used to identify areas to survey for the presence of bat populations:

- Areas where historic records indicate that important bat populations were once present.

- Areas where no previous work on bats has been undertaken, e.g. parts of Southland, the West Coast, Northwest Nelson, eastern North Island, and Northland.

- Sites such as mainland islands, Operation Ark sites, and kiwi zones where management of threats (e.g. through predator control) is being undertaken for other reasons. Inventory at these sites would be worthwhile because, if bats are found to be present, the likely benefits of the management to the bat population can be monitored in the future.

Because large areas of Otago appear to have never been surveyed for bats a habitat approach was used to identify potential sites for future surveys. Habitat types were identified that corresponded to bat records using the LCDB cover types, and other sites with the same habitat types were mapped, but where there were no bat records. These are areas where additional bat surveys are warranted.

2.4 Current bat habitats

Long-tailed bats are known to be present in various parts of Otago Region. Long-tailed bats are classified as 'Threatened-Nationally Critical', the highest threat classification in the Department of Conservation threat classification system (O'Donnell *et al.* 2018). Therefore all sites where bats occur comprise significant habitats of indigenous fauna.

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[1] For long-tailed bats the largest median home range spans were for adult male bats 10.85 km (Interquartile range = 3.41 – 14.01 km); post-lactating female 10.73 km (IQR = 8.89 – 13.35 km) (O'Donnell 2001). For southern lesser short-tailed bats the home range span of post-lactating females was 10.9 km (IQR = 7.1 – 11.2 km); the home range spans of adult male bats were amongst the smallest of those measured (Christie and O'Donnell 2014).

There are very few known long-tailed bat populations east of the Southern Alps. These known populations include those in South Canterbury (Geraldine-Temuka-Timaru-Albury), the Catlins (Owaka-Catlins Forest Park-Papatowai), and Waikaia Forest in northern Southland (Figure 5; Department of Conservation Bat Distribution Database, Version 5 June 2019). However, very few bat surveys have been undertaken in other areas more distant from the Southern Alps.

Within Otago, the Department of Conservation bat database also shows records of long-tailed bats being detected along the river valleys near Glenorchy, notably in the Dart River-Te Awa Whatipu catchment (Figure 5). There are also sightings of unknown bat species in this area. The database also shows detections of long-tailed bats near Makarora, along the Makarora-Lake Hawea Road (Figure 5).

Of these known populations, two - Dart and Catlins - have been identified by the Department of Conservation as “recommended priority sites for management of bat populations” (Sedgeley and O’Donnell 2012). Sedgeley and O’Donnell (2012) noted that these populations were not however considered ‘secure’.

In addition to these records, there are anecdotal reports of bats being seen flying at Leithen Bush in Clutha District, by hunters (Ian Davidson-Watts, pers. comm., 9 August 2019), and Warrington, Dunedin City (by an anonymous source, Catriona Gower, pers. comm., 9 August 2019). Surveys should take place to confirm these populations, but on a precautionary basis, bat habitat has been mapped around these locations as being significant (Figure 5). Note that Warrington is close to the 307 hectare Orokonui Ecosanctuary, where pest eradication has occurred and intensive pest animal control has been undertaken adjacent to the Ecosanctuary. No bat surveys have been undertaken within the Ecosanctuary (Elton Smith, Orokonui Ecosanctuary, pers. comm., 28 May 2020).

There are no records of lesser short-tailed bats in Otago Region, although there are records nearby, particularly along the Te Anau-Milford Highway, less than two kilometres from the Otago Region boundary (Department of Conservation Bat Distribution Database, Version 5 June 2019). The sub-species present in this area is the southern lesser short-tailed bat. Southern lesser short-tailed bats may therefore be present in Otago.

Short-tailed bats are notoriously difficult to detect because their calls attenuate over short distances and are emitted at relatively low intensity (S. Parsons, unpublished data, cited in Borkin and Parsons 2010). This species is more likely to use forest interiors than edges (O’Donnell *et al.* 2006), where surveys are usually targeted. Even where short-tailed bat populations are suspected to be present, it may take multiple surveys for these bats to be detected (Borkin and Parsons 2010).

Southern lesser short-tailed bat has a threat classification of “At Risk-Recovering” (O’Donnell *et al*. 2018). This is because the last known mainland population, at the time of the last assessment, was protected by effective predator control over large areas. The other extant population occurs on the predator-free Whenua Hou/Codfish Island (O’Donnell *et al*. 2018). Any population that is subsequently identified will likely be in decline if not protected by an extensive area of predator control.

Using the LCDB database, bat records from the Department of Conservation Bat Distribution Database (Version 5 June 2019) were found to be present in the following habitat types: mānuka and/or kānuka; broadleaved indigenous hardwoods; deciduous hardwoods; indigenous forest; and exotic forest.

Figure 5 shows these habitats within 11 kilometres of known bat records in Otago Region.

2.5 Priorities for further bat survey

Surveys for bats should be prioritised in areas that have bat habitat but where surveys have not yet taken place. This generally corresponds to forested areas with the following LCDB cover types: mānuka and/or kānuka; broadleaved indigenous hardwoods; deciduous hardwoods; indigenous forest; and exotic (plantation) forest.

Based on these criteria, a number of areas have been identified as high priority areas for bat surveys: coastal Otago, Blue Mountains area, and additional sites in the western lakes area (Figure 6). In the Dunedin area the Orokonui Ecosanctuary is a high priority for bat survey. Even if all these areas are surveyed there will remain a large area without any information about the distribution of bats. This includes exotic plantation forests. Bats commonly use exotic trees and forest and in other regions plantation forest managers often survey their forests for the presence of bats using automated bat monitoring devices (ABMs).

Relatively few bat surveys have taken place within the Region and some were undertaken using equipment that has limitations. For example, there are no records of surveys that have been undertaken in the Dunedin City area using modern automated bat monitoring devices (ABMs). Surveys that took place in 1995 within Dunedin did not detect bats, and these surveys were likely to have been undertaken using hand-held bat detectors or old technology ABMs. Hand-held bat detector surveys may miss bats due to the short time period over which surveys take place, i.e. when people are available, and may be biased due to tiredness, or concentration (Stahlschmidt and Brühl 2012). There is, however, one reported sighting of bats of an unknown species in this area, seen flying around lights in Warrington (sighting reported to Catriona Gower, 9 August 2019).

2.6 Future bat survey methodology

Future bat surveys should utilise best practice bat survey methods. Currently the Department of Conservation recommends placing multiple automated bat monitoring devices (ABMs) at each survey location for at least 15 fine nights where use of the site is likely to be occasional or bat populations may be small (Moira Pryde, Department of Conservation, pers. comm., 8 August 2019).

Surveys should target both long-tailed bats and southern lesser short-tailed bats. To maximise chances of detecting long-tailed bats, Sedgeley (2012 Page 20) suggests that ABMs should be placed *"in edge habitats (e.g. along bush-grassland edges, on tracks or roads through bush, in bush clearings, alongside riparian vegetation, by ponds)"*. In comparison, surveys designed to target southern lesser short-tailed bats should place

ABMs along *"terraces and saddles between catchments within old age forest"* (Sedgeley 2012, Page 20). Short-tailed bats do fly through edge and open areas but they are less likely to be detected in these places (Sedgeley 2012).

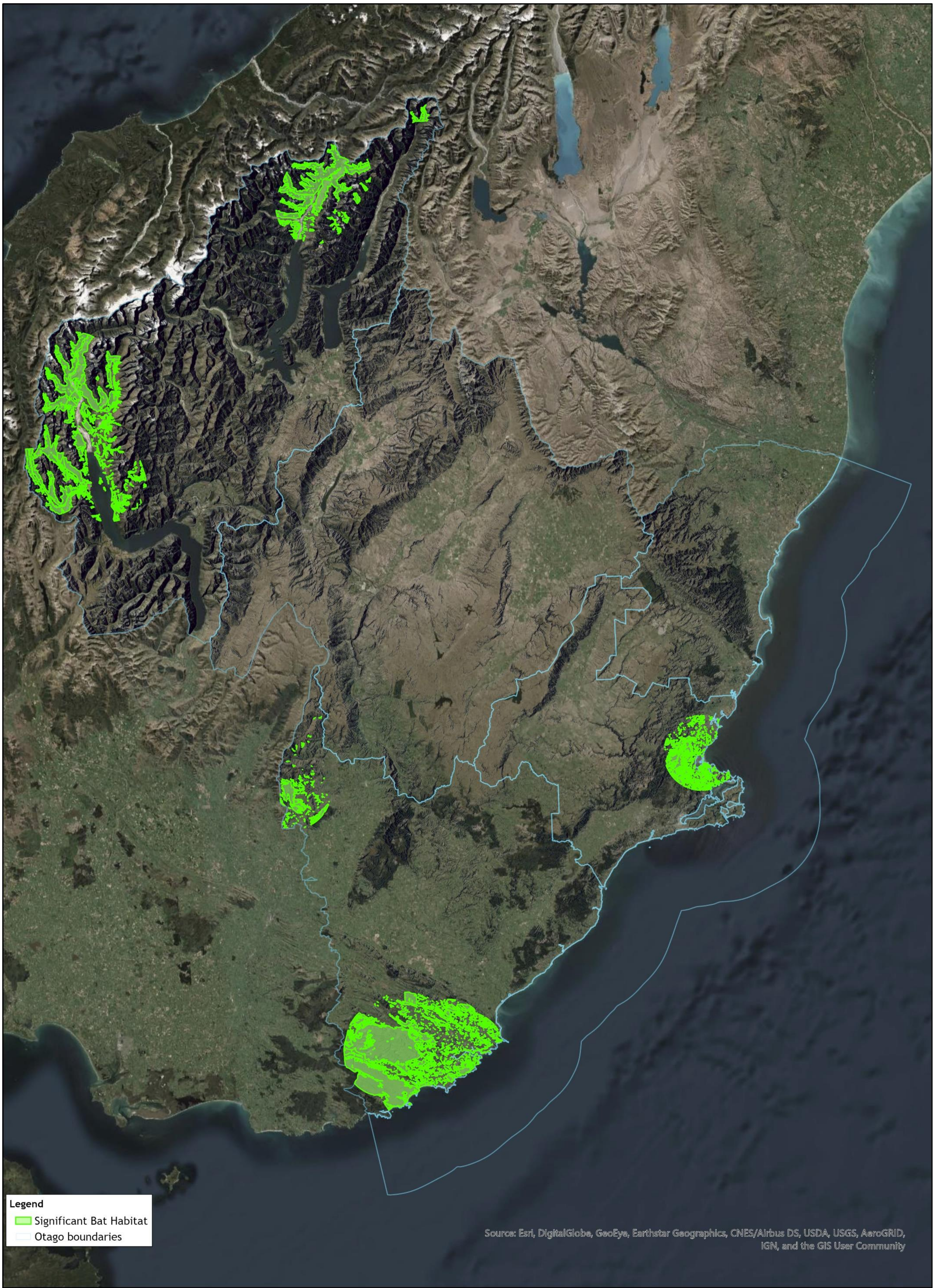

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Figure 5: Significant bat habitat in Otago

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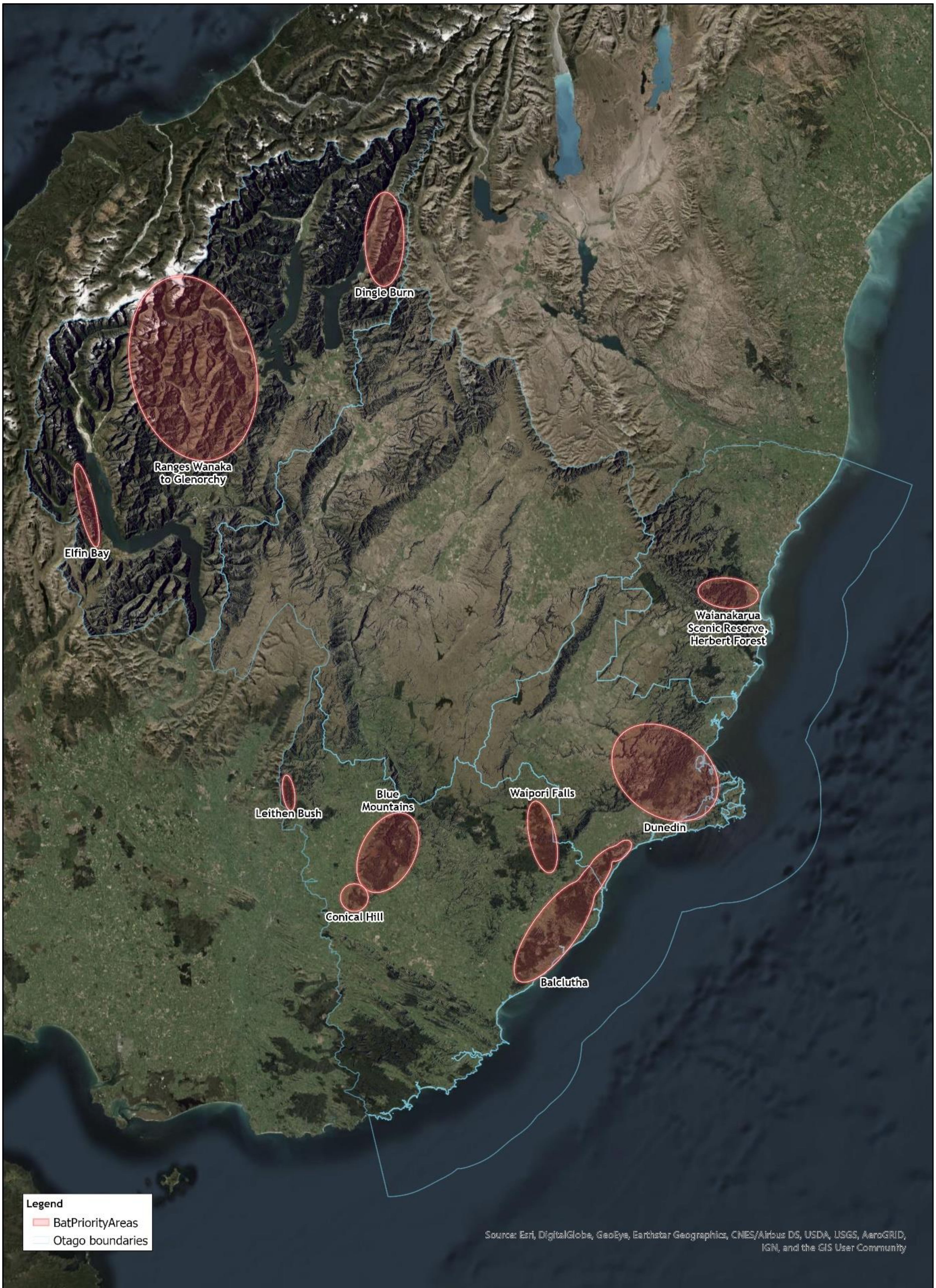

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Figure 6: Priority areas for future bat surveys

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2.7 Lizards

Otago Region has a total of 24 currently recognised lizard taxa, as shown in Table 3 below. Known distributions of these taxa were used as a basis from which to begin mapping of significant lizard habitats across Otago Region.

To assist with mapping, all known lizard records from across Otago were collated. Records came from a variety of sources including the Department of Conservation Herpetofauna Database, latest field guides, scientific papers, technical reports, discussions with other herpetologists, and Wildlands staff expert knowledge based on more than a decade of working with lizards across the Region. All available lizard information was then pooled and a spatial layer constructed from these records with different sub-layer for each lizard taxon.

Table 3: Lizard taxa (24) currently known from the Otago Region. Threat status is from Hitchmough *et al*. (2016) unless otherwise indicated.

Common name	Scientific name[1]	Threat Status
McCann's skink	*Oligosoma maccanni*	Not Threatened
Southern Alps gecko	*Woodworthia* "Southern Alps"	Not Threatened
Short-toed gecko	*Woodworthia* "Southern Mini"	Not Threatened
Korero gecko	*Woodworthia* "Otago-large"	At Risk-Declining
Schist gecko	*Woodworthia* "Central Otago"	At Risk-Declining
Kawarau gecko	*Woodworthia* "Cromwell"	At Risk-Declining
Southern grass skink	*Oligosoma polychroma*; Clade 5	At Risk-Declining
Cryptic skink	*Oligosoma inconspicuum*	At Risk-Declining
Otago green skink	*Oligosoma* aff. *chloronoton* "East Otago"	At Risk-Declining
Southland green skink	*Oligosoma* aff. *chloronoton* "Southland"	At Risk-Declining
Jewelled gecko	*Naultinus gemmeus*	At Risk-Declining
Orange-spotted gecko	*Mokopirirakau* "Roy's Peak"	Threatened-Nationally Vulnerable
Lakes skink	*Oligosoma* aff. *chloronoton* "West Otago"	Threatened-Nationally Vulnerable
Takitimu gecko	*Mokopirirakau cryptozoicus*	Threatened-Nationally Vulnerable
Nevis skink	*Oligosoma toka*	Threatened-Nationally Vulnerable
Scree skink	*Oligosoma waimatense*	Threatened-Nationally Vulnerable
Rockhopper skink	*Oligosoma* sp.	Threatened-Nationally Vulnerable[2]
Tautuku gecko	*Mokopirirakau* "southern forest"	Threatened-Nationally Endangered
Grand skink	*Oligosoma grande*	Threatened-Nationally Endangered
Otago skink	*Oligosoma otagense*	Threatened-Nationally Endangered
Alpine rock skink	*Oligosoma sp.*	Threatened-Nationally Endangered[2]
Oteake skink	*Oligosoma* aff. *inconspicuum* "North Otago"	Threatened-Nationally Critical[2]
Burgan skink	*Oligosoma burganae*	Threatened-Nationally Critical
North Otago black-eyed gecko	*Mokopirirakau* aff. *kahutarae* "North Otago"	Threatened-Nationally Critical[2]

These lizard records - in combination with evaluation of aerial imagery - were used as a basis to begin defining potential boundaries around significant lizard habitats. Whilst drawing these boundaries it became clear that many areas were poorly known or lacked recent reports of lizard taxa. It was therefore decided to split areas into two categories - 'significant' and 'potentially significant' - based on the level of confidence about what was known of the lizard fauna within these areas [redacted] Potentially significant areas require field assessment to increase confidence of exactly what lizard taxa are present, but can be treated as being significant on a precautionary basis until

[1] Taxonomic descriptions and field guides are currently lagging behind field knowledge and continuing discoveries mean that not all taxa have been taxonomically described, but all are thought likely to be unique species. Where this is the case a 'tag name' is used to denote a likely unique species that has not yet been allocated a scientific name e.g. Tautuku gecko (*Mokopirirakau* "southern forest"). The majority of these taxa have genetic support for being unique species, except for three which are currently being assessed.

[2] Threat status suggested by Wildland Consultants (2019).

the lizard fauna is better known. These sites could then be moved to the significant category or considered to be not significant subject to the lizards that are present.

Each site was assessed against the ecological significance criteria in the proposed Otago Regional Policy Statement (RPS). The criteria for assigning sites to 'significant' and 'potentially significant' categories, and how this corresponds to the RPS significance criteria, is outlined below in Table 4.

Table 4: Criteria used to assign lizard habitat sites to either 'significant' or 'potentially significant' and assessment against ecological significance criteria in the Otago Regional Policy Statement.

RPS Significance Criteria	Explanation
2a(i)	Presence of one or more 'Threatened' lizard species.
2a(ii)	Presence of jewelled gecko, Otago green skink, or Southland green skink[1].
3	Presence of three or more lizard taxa, excluding 'Not Threatened' species
4	Presence of an unusually high-density lizard population (regardless of species), an outlier population at their distributional limit, or a unique morphological form of a taxon.

A total of 193 sites were identified as important lizard habitat, including 87 'significant' habitats and 106 'potentially significant' habitats [redacted] These sites are summarised below within 10 geographical areas (or sub-regions) for ease of interpretation [redacted]

As there is concern about wildlife trafficking of indigenous lizards, a precautionary approach should be applied to information on sites that contain any of the following gecko and/or skink taxa:

- Jewelled gecko (*Naultinus gemmeus*).
- Tautuku gecko (*Mokopirirakau* "southern forest").
- Orange-spotted gecko (*Mokopirirakau* "Roy's Peak").
- Takitimu gecko (*Mokopirirakau cryptozoicus*).
- Southern black-eyed gecko (*Mokopirirakau* "North Otago").
- Otago skink (*Oligosoma otagense*).
- Grand skink (*Oliogosoma grande*).

This could potentially be done by making significant sites publicly-known, but restricting publication of information on the lizard taxa that are present in these sites, although even this approach would have risks.

[1] These three taxa are considered the rarest three of the eight 'At Risk-Declining' taxa in the Otago region by some margin. Hence their habitats are considered significant.

2.8 Terrestrial invertebrates

The approach used to identify significant habitat of terrestrial invertebrates relied on numerous entomological surveys of sites in Otago undertaken over the period 1984-2018 (see numerous report citations with B.H. Patrick as author in the References section). These were mainly undertaken on conservation or other reserve land, or during assessment of Recommended Areas for Protection (RAPs) for Protected Natural Areas Programme (PNAP) surveys. Sites on conservation land or in other reserves were sometimes defined as the cadastral parcel that the significant invertebrate assemblage occurred in, or by generalised outlines that captured the typical vegetation the invertebrate assemblage was present in. RAP boundaries were mapped by hand, based on figures presented in the various PNAP survey reports, then digitised using ARCGIS. Coordinates for salt pan sites in Table 1 of Allen and McIntosh (1997) were converted in ARCGIS data files and site boundaries were mapped based on Wildlands staff knowledge of these sites.

Sites were generally determined as significant habitats for terrestrial invertebrates based on areas or habitats where representative, diverse and/or distinctive invertebrate assemblages occurred, or areas that had records of Threatened, At Risk, or locally uncommon invertebrates.

One hundred and thirty-eight (138) significant habitats of terrestrial invertebrates were identified (Figure 8; Appendix 1). As most of the invertebrate survey records were from sites on conservation land or sites assessed under the PNAP, these sites make up the bulk of those that were mapped.

2.9 Freshwater habitats

2.9.1 Overview

Otago Region has a total of 27 species of indigenous freshwater fish, as shown below in Table 5.

Table 5: Freshwater indigenous fish species records for Otago Region from the NIWA New Zealand Freshwater Fish Database.

Common Name	Scientific Name	Number of Records	Threat Status
Alpine galaxias	*Galaxias paucispondylus*	70	At Risk-Naturally Uncommon
Banded kōkopu	*Galaxias fasciatus*	195	Not Threatened
Black flounder	*Rhombosolea retiarii*	37	Not Threatened
Bluegill bully	*Gobiomorphus hubbsi*	136	At Risk-Declining
Canterbury galaxias	*Galaxias vulgaris*	773	At Risk - Declining
Common bully	*Gobiomorphus cotidianus*	558	Not Threatened
Common smelt	*Retropinna retropinna*	66	Not Threatened
Dusky galaxias	*Galaxias pullus*	330	Threatened-Nationally Endangered
Eldon's galaxias	Galaxias eldoni	514	Threatened-Nationally Endangered
Estuarine triplefin	*Grahamina sp.*	5	Not threatened
Flathead galaxias	*Galaxias depressiceps*	435	Threatened-Nationally Vulnerable
Giant bully	*Gobiomorphus gobioides*	36	At Risk-Naturally Uncommon
Giant kōkopu	*Galaxias argenteus*	91	At Risk-Declining

Common Name	Scientific Name	Number of Records	Threat Status
Gollum galaxias	*Galaxias gollumoides*	279	Threatened-Nationally Vulnerable
Inanga	*Galaxias maculatus*	276	At Risk-Declining
Kōaro	*Galaxias brevipinnis*	548	At Risk-Declining
Lamprey	*Geotria australis*	199	Threatened-Nationally Vulnerable
Longfin eel	*Anguilla dieffenbachii*	1,477	At Risk-Declining
Lowland longjaw galaxias	*Galaxias cobitinis*	666	Threatened-Nationally Critical
Redfin bully	*Gobiomorphus huttoni*	167	Not Threatened
Roundhead galaxias	*Galaxias anomalus*	471	Threatened-Nationally Endangered
Shortfin eel	*Anguilla australis*	267	Not threatened
Torrentfish	*Cheimarrichthys fosteri*	191	At Risk-Declining
Upland bully	*Gobiomorphus breviceps*	1,487	Not Threatened
Yelloweye mullet	*Aldrichetta forsteri*	12	Not Threatened

Sources used to determine significant habitats of freshwater fish included:

- New Zealand Freshwater Fish Database (NIWA).
- Inanga spawning sites (Otago Regional Council).
- Freshwater Ecosystems of New Zealand (Department of Conservation).

These sources are described in the following sections.

2.9.2 New Zealand Freshwater Fish Database (NZFFD)

NZFFD records the occurrence of fish in fresh waters of New Zealand, including major offshore islands, and was established in 1977. Data collected include the site location, the species present and their abundance, as well as information such as the fishing method used and a qualitative assessment of the site's physical features. Data, which are recorded in the field on pre-printed forms, are contributed voluntarily to the online database by NIWA, Fish and Game New Zealand, the Department of Conservation, regional councils, environmental consultants, universities, and interested individuals. A user guide assists users of the NZFFD to perform effective searches from the web site and enter their own data.

Using these records, stream reaches were identified that contain nationally Threatened indigenous fish (Dunn *et al.* 2018), and these reaches were mapped as significant (Figure 9).

2.9.3 Significant freshwater habitats

Freshwater Ecosystems of New Zealand (FENZ) was used to identify high-ranking catchments in Otago, both on a national scale and regional scale. These rankings were undertaken using zonation software, taking account of pressures and connectivity constraints, and identify the relative value of third-order stream catchments (Leathwick *et al*. 2010). Regional third-order catchment rankings are undertaken within each FENZ biogeographical unit, and are therefore useful for identification of within-unit priorities. National river rankings are provided for third-order catchments across biogeographic units, thus highly-ranked catchments have been recognised across all of Aotearoa/New Zealand. The top ranked (top 10%) catchments on a regional scale are the catchments that rank from 1-151, while the top ranked catchments on a national basis are those ranked 1-2,697. Streams passing through these high-ranking catchments were mapped as significant freshwater habitat. In addition, as described above, stream and river segments were added that had known locations of Threatened indigenous fish, based on the threat classification of Dunn *et al*. (2018). This was particularly important for identification of significant habitats of inland galaxiids, which are not taken account of in FENZ rankings. In the spatial layer produced from these data, segments with Threatened fish supplant both national and regional catchment rankings, and nationally-ranked segments supplant regionally-ranked segments (Figure 9).

There was not a great deal of overlap between catchments that had high ranks regionally and nationally, and many Threatened indigenous fish records were located outside of these highly-ranked catchments. Highly-ranked catchments on a national scale were located in the western mountains, on the Garvie Mountains/Old Woman Range/Old Man Range complex, on the Manorburn and Lammerlaw uplands, and along the lower Clutha/Mata Au River (Figure 9). Catchments with high regional rankings were mostly located in the Taieri catchment, on the slopes of Maungatua, in coastal Otago and on the Otago Peninsula, and in the Tahakopa River catchment in the Catlins (Figure 9). Stream reaches identified as significant because of the presence of Threatened indigenous fish were located in a number of inland catchments (Figure 9), reflecting the high diversity of Threatened inland galaxiid fish taxa in Otago.

2.9.4 Inanga spawning sites

After around six months in fresh water, mature inanga (*Galaxias maculatus*) migrate downstream in large schools to spawn in estuarine areas. Inanga eggs develop above normal river levels amongst vegetation that is flooded by spring tides. This layer of moist overlying vegetation results in the high humidity and moderate temperatures necessary for egg development. Most spawning takes place during late summer and autumn, but some occurs at other times. Successive inanga generations often use the same spawning sites year after year and allows these ecologically-sensitive areas to be identified, improved, and protected (Richardson and Taylor 2002)

A shapefile of inanga spawning locations was provided by Otago Regional Council and processed in ARCGIS. These locations were based on field surveys of inanga spawning behaviour during spring tides and searches of riparian vegetation for eggs. Polygons were drawn around these locations (Figure 10) to encompass areas of suitable habitat, particularly tall rank vegetation comprising graminoids such as grasses and sedges, including species such as Yorkshire fog, creeping bent, tall fescue, jointed rush (*Apodasmia similis*), harakeke (*Phormium tenax*), and/or raupo (*Typha orientalis*) (Richardson and Taylor 2002).

2.9.5 Significant lakes

FENZ was also used to identify and map significant lake habitats in Otago. This layer was compiled directly from the FENZ outputs of a zonation analysis similar to the one undertaken for third-order river catchments.

The FENZ layer identifies 381 lakes in Otago Region with a minimum size of one hectare. These lakes include the well-known larger western lakes, but also constructed lakes and reservoirs, hydro-lakes, and the larger ephemeral wetlands and alpine tarns. FENZ broadly characterises lakes based on depth and surface area (Figure 11).

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Figure 8: Significant habitats of terrestrial invertebrates in Otago

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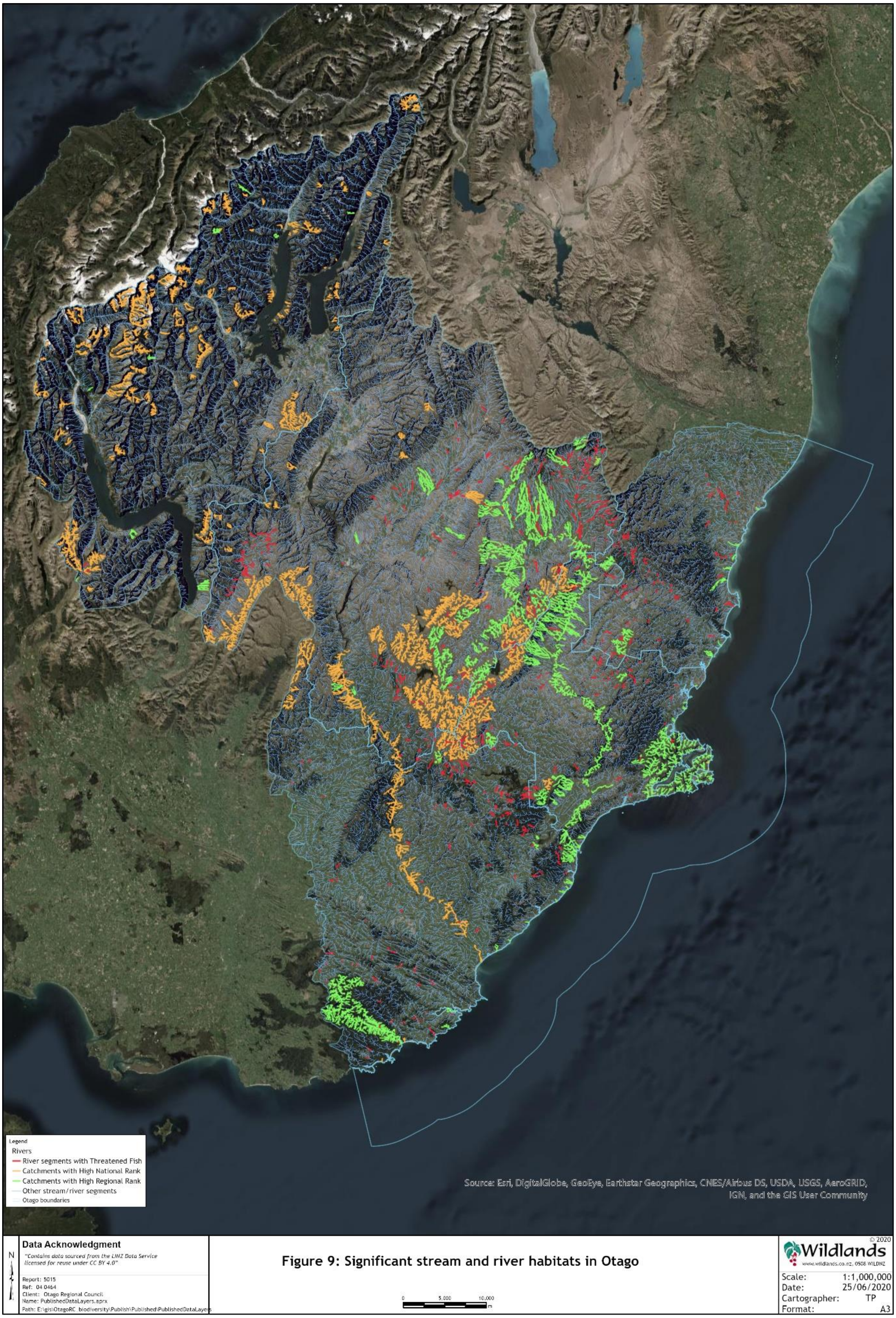

Figure 9: Significant stream and river habitats in Otago

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Figure 10: Selected significant inanga spawning habitats

0 5,000 10,000 m

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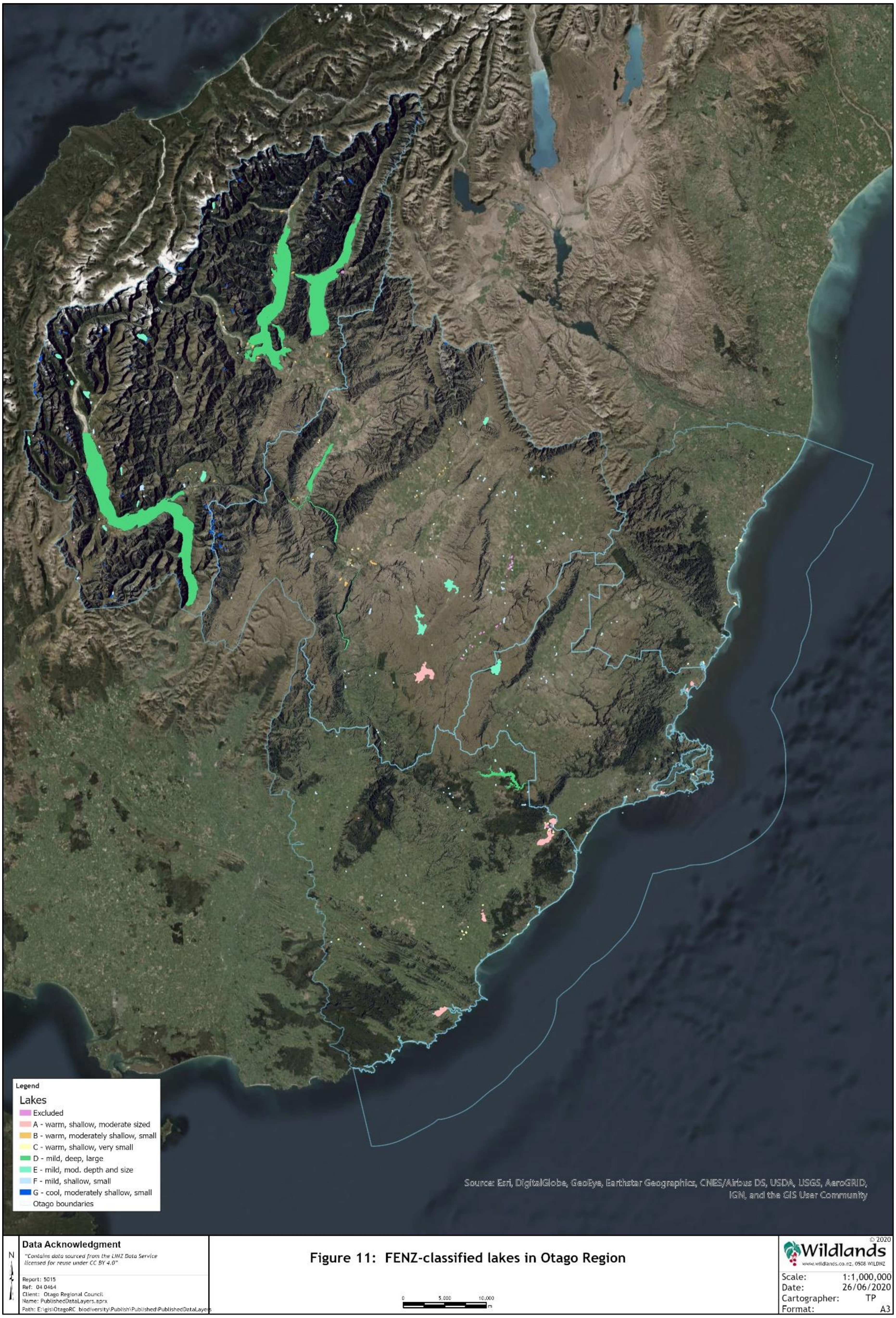

Figure 11: FENZ-classified lakes in Otago Region

2.10 Marine ecosystems

Extensive desktop research was carried out to collate relevant scientific publications and reports, student theses, maps, publicly-available reports and statements from a variety of databases and websites.

Ecosystem types of a higher resolution were mapped based on information in reports by the South-East Marine Protection Forum (2018) and various scientific publications as well as reports by environmental consultancies, Crown Research Institutes, and central government agencies. Polygons of the ecosystem types were created in a separate layer and associated data was added to an Excel spreadsheet.

Biogenic reefs were mapped from based on existing modelling and research (Probert *et al.* 1979; Wood & Probert 2013). The ecosystems types based entirely on modelling (denoted ‘Bryoz.pos’ 1-6 in the mapping layer) used standard and widely-used criteria in all of the models. Furthermore, the distribution and position of feeding grounds for pelagic birds, hoiho, and marine mammals support the data.

The information collated from a variety of sources allows identification of a range of knowledge gaps, in particular the information gaps on biogenic reefs, their composition and size, and former ecosystem types or habitat of indigenous fauna that have been lost could also be mapped. Using the current reduced baseline can limit future management as protection and rehabilitation of habitat and ecosystems may not be taken into account, e.g. the effective size of marine protected areas (Edgar *et al.*2014).

2.11 Significant marine habitats

Habitats of significant indigenous marine fauna were identified using a similar approach. Primary scientific literature and scientific reports were used as a source of information. Marine feeding areas for hoiho were based on records from tracked hoiho[1] off breeding colonies along the Otago coast (Mattern *et al.* 2007; 2013). These were hand-digitised based on areas that were densely tracked by hoiho (Figure 12).

Seabird location records were obtained from databases such as iNaturalist and Ebird, and used to determine areas where seabirds congregated for feeding. These feeding areas were mapped as significant habitat.

The coastal zone from Karitane to Brighton appears to support a greater abundance and diversity of marine ecosystems and fauna than elsewhere along the Otago coastline. This may be because ecosystems outside this area are not as well understood, or are less intensively researched, hence relatively less information is available. Also, as loss of former habitat has not been taken into account, loss of the marine fauna that would have used this habitat has also not been taken into account.

Important terrestrial habitats of marine mammals were identified during consultation with Department of Conservation staff and staff of the New Zealand Sea Lion Trust. Information on New Zealand fur seal rookeries was obtained from Lalas and Harcourt (1995). Examples of this mapping are shown in Figure 13.

[1] https://www.movebank.org/cms/webapp?gwt_fragment=page=search_map

Estuarine habitat comprising seagrass beds and cockle beds were mapped as significant habitats of indigenous fauna, drawing on information reported by Ismail (2001), Leduc *et al.* (2006), and Mills & Berkenbusch (2009) (Figure 14). Estuaries have been identified as highly productive key habitats for feeding, breeding, and resting, providing shelter and refuge for a diverse range of fauna. (Halpern *et al.* 2008, Cloern *et al.* 2016). As they act as a buffer zone and corridor between land and sea, deterioration of estuaries will affect functions and services of coastal marine ecosystems. Marine fauna (e.g. migrating birds, euryhaline fish, spat, fish eggs, zooplankton, and phytoplankton) also utilise various ecosystems with connected terrestrial and freshwater habitats and would also be negatively affected by deterioration of estuaries. Estuarine ecosystems provide fundamental services including coastal protection, maintenance of fisheries, nutrient cycling, filtering, and detoxification (Barbier *et al.* 2011).

Kelp beds were also mapped as significant habitat for indigenous fauna, based on information published in Seasketch[1] as part of the southeast Otago marine protected area consultation process. They provide habitat for a wide range of finfish, crustaceans, molluscs, and other algae species Wernberg *et al.* (2019). Kelp beds protect local coasts from erosion and play a crucial part in the coastal marine - terrestrial nutrient flow through carbon sequestration and nutrient uptake. They are described as some of the most ecologically dynamic and biologically diverse habitats and are considered to be a keystone ecosystem. If lost, there can be significant shifts in community composition and abundance.

[1] https://seasketch.doc.govt.nz/seas_metadata/otago/Macrocystis.html

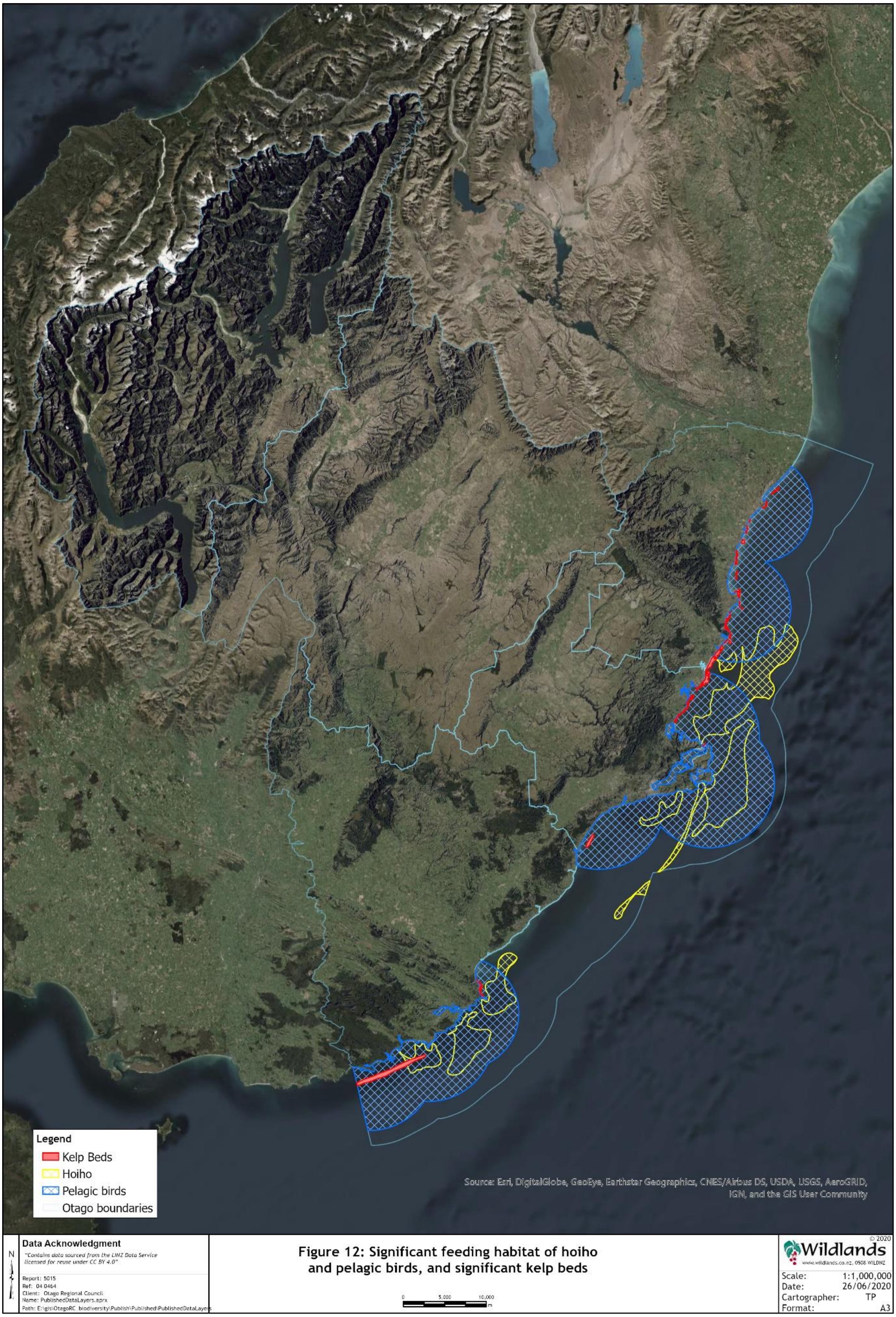

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Figure 12: Significant feeding habitat of hoiho and pelagic birds, and significant kelp beds

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Figure 13: Significant coastal and marine habitat in the vicinity of Otago Peninsula

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Figure 14: Significant cockle and seagrass habitats in Otago Harbour

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3. CONCLUSIONS

Mapping of significant fauna habitats across Otago Region was a challenging task which drew on information from a wide range of sources, including existing data layers, information in databases, articles, and reports, information provided during interviews with stakeholders, and Wildlands staff knowledge. Significant habitats were mapped across terrestrial, freshwater, and marine habitats, and covered a wide range of taxa, including birds, bats, lizards, invertebrates, and fish in terrestrial and freshwater habitats, and marine mammals, seabirds, bryozoans, and cockles.

The mapping identified gaps in information, and from this priority areas were identified for surveys for lizards and long-tailed bats. In the marine environment, more information on marine habitats and fauna was available for the area off the Dunedin City District coastline, and was more scarce for other parts of coastal Otago.

Significant habitats mapped in this project represent a starting point, based on the information available now. They can be improved as further fauna surveys are undertaken, providing new information that can be taken into account.

Nonetheless, the significant habitats of indigenous fauna mapped during this project will provide an important basis for evaluating sites in terms of RMA Section 6(c), which specifies that the protection of significant areas of indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance that shall be recognised and provided for. Significance assessments have generally focussed on the identification of significant indigenous vegetation and much more rarely on the identification of significant habitats of indigenous fauna. To the extent that this has resulted from a lack of collated information, the sites identified by the mapping presented in this report will help to address this deficiency.

ACKNOWLEDGMENTS

Jim Fyffe and Tom Waterhouse (Department of Conservation), Will Rayment (NZ Sea Lion Trust), and Trudi Webster (Yellow-eyed Penguin Trust) provided very helpful information on the distribution of terrestrial breeding, resting, and refuge habitats of marine fauna. Catriona Gower and Dr Ian Davidson-Watts are thanked for useful discussions regarding priority sites for future bat surveys. Colin O'Donnell (Department of Conservation) is thanked for facilitating provision of the database of matuku/bittern records.

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SIGNIFICANT HABITATS OF TERRESTRIAL INVERTEBRATES IN OTAGO REGION

SITE NAME	ATTRIBUTES	REFERENCES
DUNEDIN ECOLOGICAL DISTRICT		
Doctor's Point	The At Risk-Declining red katipo spider (*Latrodectus katipo*) is present in sand dunes at its natural southern distributional limit. The dune landscape and flora are highly modified.	Barker *et al.* 2003; Patrick 1990c; Patrick 2002; Peat and Patrick 1995.
Aramoana Saltmarsh	Representative and diverse saltmarsh habitat for specialist estuarine and dune insects including chafer beetle (*Pericoptus truncatus*), and moths and butterflies. From salt-marsh ribbonwood and flax through to extensive herbfield, a multitude of specialist moths thrive on their particular hostplant. Many of the moths are diurnal and colourful such as the geometrid *Arctesthes catapyrrha.*	Barker *et al.* 2003; Peat and Patrick 1995; Patrick 1990c; Patrick 1995a.
Blueskin Bay including Rabbit Island	Representative estuarine saltmarsh herb moths and other insects. Of note is the only lowland population of a normally low-alpine, winter-emerging moth species. It is the diurnal moth - *Eurythecta leucothrinca* - significantly with a short-winged flightless female also.	Barker *et al.* 2003; Peat and Patrick 1995; Patrick 1990b and c.
Mount Cargill Scenic Reserve	Representative and diverse habitats including lowland to upper montane forest and shrubland, basalt bluffs and upper montane herbfield on its summit, for a wide range of insects including moths, butterflies, beetles, grasshoppers, stick insects, peripatus and bugs. One of the standout moths is the distinctive dayflying *Charixena iridoxa* whose caterpillars form a zigzag pattern on the leaves of the sedge *Astelia nervosa* high up on Mount Cargill. This is the only eastern South Island record of a Main Divide species. These forests are also a stronghold for the "valuable moth" the South Island zebra moth (*Declana egregia*) that is featured on the New Zealand $100 banknote. Its caterpillars defoliate five and three finger foliage (*Pseudopanax* species). The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the forests here too, particularly from 500 m to the summit grassland at 680 m.	Allen *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.
Caversham Bush	This Dunedin City Council forest reserve primarily protects one of the only known habitats of an undescribed species of peripatus - ancient invertebrates linking worms (Annelida) with Arthropoda including insects and spiders.	Allen *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.
Hereweka - Harbour Cone	A rich and representative insect fauna including bugs, beetles and moths is supported by a hardwood - podocarp forest. The uncommon lacewing *Micromus bifasciatus* is found here associated with rimu and other podocarps.	Patrick 1990c; Peat and Patrick 1995.
Heyward Point Scenic Reserve	A representative and rich insect fauna associated a mixed hardwood - podocarp forest and special lianes and populations of small-leaved, deciduous tree daisies. All supporting a specialist insect fauna, some of it rare and local.	Patrick 2000c; Peat and Patrick 1995 reprint 2014.
Okia Flat - Taiaroa Bush	Representative insect fauna of a large forest remnant of characteristic species including some podocarps with abundant and diverse lianes and tree species. Adjacent extensive	Barker *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.

SITE NAME	ATTRIBUTES	REFERENCES
	saltmarsh flats and dunes supports many diurnal moths, beetles and bugs thriving in this natural open habitat.	
Swampy Summit - Flagstaff Reserves - Leith Saddle (Water Catchment and Scenic Reserves) - upper Leith Valley down to 300 m. (Site traverses both Dunedin and Waikouaiti EDs)	Representative and highly diverse range of natural habitats including extensive low alpine snowgrass area with sphagnum wetlands, shrublands, herbfield and flanked by forest below supporting a wide range of insect groups including moths and butterflies, beetles, cicadas, grasshoppers, stoneflies, caddisflies and beetles. The shrublands of *Hebe odora* are particularly rich in specialist moth species including geometrids, plumemoths and leaf-rollers. The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the wet flushes above 600 m but also in the Leith Valley. The caddisflies *Olinga fumosa* and an undescribed species of *Pseudoeconesus* are endemic to Swampy Summit streams and seepages. A flightless and undescribed stonefly in the genus *Apteryoperla* is found here in copper tussock wetlands. It joins an undescribed cave wētā that tunnels in the sphagnum moss on the summit wetlands too. The giant ghost moth *Aoraia rufivena* with a male wingspan of up to 7 cm and a short-winged flightless female, is locally common in these montane forests through to the snowgrass community. The rare and localised diurnal crambid moth *Scoparia tuicana* was described from the "Waitati Hills" and rediscovered here and on the Slopedown Range in the Catlins. Additionally, the local endemic carabid beetle *Oregus inaequalis* lives in the summit grasslands and wetland edges. Ground beetles including this species are a special feature of the uplands above Dunedin in terms of biodiversity and conservation.	Lloyd and Patrick 2018; Mark *et al.* 2003; Patrick 1990c; Peat and Patrick 1995; Lloyd and Patrick 2018; Patrick 2018.
Cape Saunders	Cliff and cliff-top habitat with lichen encrusted rock, herbs and shrubs support a specialist insect fauna that is representative of such coastal habitats.	Barker *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.
Sandymount Recreation Reserve - Sandfly Bay Wildlife Refuge	This large and diverse area supports a representative Otago Peninsula insect fauna of forest remnants, shrublands including tree nettle and *Helichrysum lanceolatum*, cliffs covered with lichens and herbs, dunes, and saltmarsh.	Barker *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.
Woodhaugh Gardens	High quality and representative lowland forest remnant with abundant lianes and shrubs and trees with specialist insects including rare and Threatened noctuid moths *Meterana pansicolor* (Nationally Uncommon), and rare *M. octans* whose larvae are specialist defoliators of *Streblus.* Also present is the elegant small moth *Parectopa aethalota* whose larvae mine the foliage of *Parsonsia* vines, and a suite of specialist moths on the mistletoe *Ileostylus micranthus*, which has a particularly strong population here as do its specialist moths. These moths include three species classified as At Risk - the leaf mining *Zelleria sphenota*, and defoliators *Tatosoma agrionata* and *Declana griseata*.	Allen *et al.* 2003; Patrick 1990c; Peat & Patrick 1995; Hoare *et al*. 2017.
Mihiwaka - Mount Kettle	The summit wetlands and shrublands, and forested slopes down to 300 m support a diverse and representative insect fauna of such habitats in eastern Otago. The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the wetlands at about 560 m. Specialist moths on various tree species abound including a suite of standout species on silver beech patches and shrubs of *Dracophyllum longifolium*. These include leaf miners, flower feeders and defoliators of the foliage for both species.	Allen *et al.* 2003; Patrick 1990c; Peat and Patrick 1995.

SITE NAME	ATTRIBUTES	REFERENCES
TOKOMAIRIRO ECOLOGICAL DISTRICT		
Waipori Gorge (includes Waipori Falls Scenic Reserve)	Waipori Gorge forests support a rich and representative insect fauna, particularly of moths and butterflies, many of which are specialists on particular elements of the flora from lianes, herbs through to trees. Silver beech forest and its specialist moths are a feature. The red admiral butterfly (*Vanessa gonerilla*) has a particularly strong population here also, with its larvae on the appropriately named nettle *Urtica ferox.* The forest also supports the rare geometrid moths *Asaphodes obarata* (Threatened-Nationally Critical), present at one of its only known localities over the past 100 years, large ghost moth *Aoraia rufivena*, locally uncommon *Austrocidaria parora* and tiny day-flying jawed moth *Sabatinca quadrijuga*.	Allen *et al.* 2003; Peat and Patrick 1995; Hoare *et al*. 2017.
Akatore Creek (forest and saltmarsh)	Riparian-coastal forest and shrubland here supports a representative butterfly and moth fauna including the Threatened day-flying moth *Cephalissa siria* (Nationally Vulnerable) whose caterpillars feed on the liane *Fuchsia perscandens.* The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the damper parts of the forests here too.	Allen *et al.* 2003; Hoare *et al*. 2017; Peat and Patrick 1995.
Chrystalls Beach Reserve	A representative insect fauna of sand dunes, rock face (Cook's Head Rock) and coastal cushionfield is present here. A local endemic Boulder copper butterfly (*Lycaena* new species) present in the reserve's carpark is a Threatened species and listed as Nationally Critical. The restricted cushionfield supports many diurnal moth species that are now rare as their habitat is much reduced Otago-wide.	Barker *et al.* 2003; Hoare *et al*. 2017; Patrick 1992b, 2016b and c.
Otago Coast Forest	This large mixed forest supports a representative insect fauna of forest, shrubland and understorey species including a rich butterfly and moth fauna specialist on tree nettle *Urtica ferox*. The large ghost moth *Aoraia rufivena* is found here. It has a male with a 7 cm wingspan while its female is short-winged and flightless, but with a large abdomen fill of eggs.	Allen *et al.* 2003; Patrick 2018.
Lakes Waipori and Waihola wetland	Representative and rich insect fauna associated with wetland habitat is present here.	Huryn *et al.* 2003; Patrick 1993b.
Taieri River Scenic Reserve (larger area of mouth to gorge)	Representative and rich insect fauna of river gorge forests, shrublands and open steep rock faces. Of note is the high diversity in geometrid moth genus *Dichromodes* whose caterpillars feed on rock face lichens and the adult moths fly by day.	Allen *et al.* 2003; Patrick 1992a; Patrick 2018.
MANIOTOTO ECOLOGICAL DISTRICT		
Patearoa Saline Area (QE II Covenant)	Representative and significant saltpan habitat for specialist saline insects including Threatened day-flying saltpan moths *Loxostege* n.sp. *and Paranotoreas fulva* (both At Risk-Relict); and *Sporophylla oenospora* (Nationally Critical).	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Patrick 2004b; Peat and Patrick 1999; Hoare *et al*. 2017; Mark *et al.* 2003; Matthews and Patrick 1998.
Belmont Salt Pans (QE II Covenant)	Representative and significant saltpan habitat for specialist saline insects including the At Risk-Relict saltpan moth *Paranotoreas fulva.*	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat & Patrick 1999; Hoare *et al*. 2017.

SITE NAME	ATTRIBUTES	REFERENCES
Conroys Dam (DoC)	Representative and significant saltpan habitat for specialist saline insects including the At Risk-Relict saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva.*	Grove 1994b; Mark *et al.* 2003; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat & Patrick 1999; Hoare *et al*. 2017.
Rockdale (Private)	Representative and significant saltpan habitat for specialist saline insects including the At Risk-Relict and diurnal saltpan moth *Paranotoreas fulva.*	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat & Patrick 1999; Hoare *et al*. 2017.
Chatto Creek (Private)	Representative and significant saltpan habitat for specialist saline insects including the At Risk-Relict and diurnal saltpan moths *Loxostege* n.sp. *and Paranotoreas fulva.*	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat and Patrick 1999; Hoare *et al*. 2017.
Chapman Road (Private - RAPs 10 & 11))	Representative and significant saltpan habitat for specialist saline insects including the diurnal saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict).	Grove 1994b; Mark *et al.* 2003; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat and Patrick 1999; Hoare *et al*. 2017.
Patrick's Place (Private - RAP 12)	Representative and significant saltpan habitat for specialist saline insects including the dayflying saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict), and day-flying *Sporophylla oenospora* (Nationally Critical); Type locality for Threatened dayflying noctuid *Australothis volatilis* (Nationally Critical).	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat and Patrick 1999; Hoare *et al*. 2017; Matthews and Patrick 1998.
Blackmans (Private - Pastoral Lease - RAP 13)	Representative and significant saltpan habitat for specialist saline insects including the dayflying saltpan moths *Loxostege* n.sp. *and Paranotoreas fulva* (both At Risk-Relict).	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat and Patrick 1999; Hoare *et al*. 2017.
Wilsons Road (Private - RAP 15)	Representative and significant saltpan habitat for specialist saline insects including the diurnal saltpan moth *Paranotoreas fulva* (At Risk-Relict).	Grove 1994b; Mark *et al.* 2003; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a; Patrick 1994c and e; Peat and Patrick 1999; Hoare *et al*. 2017.
MANORBURN ECOLOGICAL DISTRICT		
Flat Top Hill Conservation Area	Representative dryland insects of montane Central Otago; Specialist saltpan moth fauna including the saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict) & undescribed geometrid *Pseudocoremia* new species (Nationally Endangered). The last named is a specialist on the tree daisy *Olearia odorata* where it is joined by other *Olearia* moths including the noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict). Insects associated with large tors are a feature too with moths in the genus *Dichromodes* exemplifying this diversity and ecology. The seven Lepidoptera with their Type locality in the Manorburn ED are listed in Patrick (1989b) with most being in the Ida Valley. The rare	Hoare *et al*. 2017; Peat and Patrick 1999; Patrick 1989b; Patrick 2000c.

SITE NAME	ATTRIBUTES	REFERENCES
	flightless chafer beetles *Prodontria modesta* and *P. bicolorata* have significant populations here too.	
Galloway Saline Areas 1 & 2	The saltpans here support a representative saltpan moth fauna including the diurnal saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict).	Grove 1994b; Mark *et al.* 2003; McIntosh, Beecroft and Patrick 1990 and 1991; Patrick 1989a and b; Patrick 1994c Peat and Patrick 1999.
Moa Creek Saline Area	The saline soil habitat here supports a representative range of specialist saltpan moths including the diurnal saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict).	Grove 1994b; McIntosh, Beecroft and Patrick 1990 and 1991; Peat and Patrick 1999; Patrick 1989a and b; Patrick 1994c.
South Rough Ridge to Pinelheugh including Long Valley Ridge and Greenland Reservoir wetlands	Alpine grassland, cushionfield, herbfield and extensive wetlands with prominent copper tussock and moss bogs, and tors down to 750 m support a highly representative alpine insect fauna including moths, butterflies, grasshoppers and cicada species. Wetland moths such as large-bodied ghost moths (*Aoraia* species), diurnal crambids (*Orocrambus* and *Scoparia* species) and geometrids (*Notoreas*, *Dasyuris*, *Arctesthes* and *Aponotoreas*) are a feature. Another feature is the winter-emerging moth fauna exemplified by the Threatened geometrid moth *Theoxena scissaria* (Nationally Vulnerable) and a suite of day-flying tortricid moths breeding in the montane-low alpine grassland-shrublands here. Another ghost moth present is the colourful, sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining.	Hoare *et al*. 2017; Huryn *et al.* 2003; Mark *et al.* 2003; Patrick 1989a and b; Peat and Patrick 1999; Patrick 2004a; Patrick 2018.
RICHARDSON ECOLOGICAL DISTRICT		
Mounts Aurum - Larkins including Lochnagar (all land above 1000m)	Representative alpine and high alpine snowgrass and herbfield communities with high insect biodiversity for beetles and moths, and Type Locality for the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon)	Mark *et al.* 2003; Patrick 2016; Peat and Patrick 1999.
Pigeon, Pig and Tree Islands in Lake Wakatipu	Representative insects of significant and natural mixed beech-podocarp forests and associated shrubland and herbfield.	Allen *et al.* 2003; Legge 1991; Peat & Patrick 1999.
Rees River flats (Camp Hill to Diamond Lake and to Rees Valley Homestead)	Representative and rich moth fauna associated with groves of small-leaved tree daisies in genus *Olearia* such as *O. hectorii* on the riparian flats. New and Threatened species of moth in the genera *Pyrgotis*, *Protosynaema* (both Nationally Vulnerable) and *Stigmella* (Nationally Critical) were discovered here.	Hoare *et al*. 2017; Patrick 1991b; Patrick 2000c; Peat and Patrick 1999.
EYRE ECOLOGICAL DISTRICT		
Von River wetlands	Representative insect fauna of wetland, herbfield and associated grassland and shrubland. It is the Type locality for local endemic dayflying geometrid moth *Arctesthes titanica.* It is also a Threatened species and classified as Nationally Vulnerable. A colourful ghost moth present here is the sphagnum ghost moth *Heloxycanus patricki*, which is classified as At Risk-Declining.	Huryn *et al.* 2003; Patrick *et al*. 2019; Peat and Patrick 1999; Hoare *et al*. 2017.
Te Kere Haka Scenic Reserve	Representative silver beech and grassland area for a moderately rich fauna of insects of several Orders.	Mark, Dickinson and Patrick 1987.

SITE NAME	ATTRIBUTES	REFERENCES
Glen Allen Scenic Reserve	Representative montane to alpine area with a mixed beech forest and snow tussock grassland, which supports a moderately rich range of insects.	Mark, Dickinson and Patrick 1987.
Eyre Mountains (extensive montane beech forest to alpine - high alpine area from West Dome to Cecil Peak, and from Jane Peak to Symmetry Peaks (400 -2,035 m), with 950 m in areas not marked in Mark *et al.* 1987.	Representative montane, alpine and high alpine zones with rock bluff, scree, snowbank, cushionfield, grassland, herbfield, wetland and shrubland habitat, all with a distinctive insect fauna. Nationally a particularly rich insect fauna across many groups including beetles, grasshoppers, cicadas, moths, butterflies and aquatic groups. This insect fauna includes the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon), and rare moths including *Xanthorhoe frigida* (Nationally Vulnerable), *Helastia salmoni*, *Asterivora exocha*, *Epichorista* n.sp. and *Orocrambus cultus*. Three giant ghost moths in the genus *Aoraia* are also a feature with their short-winged and flightless females. Another ghost moth present is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining. The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the damp areas at about 1000 m here too Additionally, among the beetles here the large carabid beetle *Mecodema chiltoni* and stout weevil *Lyperobius spedenii* are present in reasonable numbers in contrast to other places in western Otago where they have decreased in abundance dramatically. The large and rare land snail *Powelliphanta spedeni* was present at tree-line on the Mount Bee ridge in snow tussockland. Additionally, an undescribed species of scree wētā (*Pharmacus* n.sp.) is reasonably widespread here in the alpine zone of the highest peaks. The occurrence of six grasshopper species here underlines the high diversity of the Eyre Mountains.	Allen *et al.* 2003; Mark, Dickinson and Patrick 1987; 1987; Patrick 2016a; Peat and Patrick 1999; Patrick 1989c; Patrick 2004a; Hoare *et al*. 2017; Mark, Dickinson and Patrick 2003; Mark *et al.* 2003; Patrick 2012; Patrick 2018.
PISA ECOLOGICAL DISTRICT		
Cromwell Chafer Beetle Nature Reserve	Only known population of the Threatened-Nationally Endangered flightless Cromwell chafer beetle (*Prodontria lewisi*). Another scarab beetle *Pericoptus frontalis* also has its Type locality on the “Cromwell Sands” and although it has a slightly wider distribution, it is also a rare species. An undescribed and rare diurnal moth (*Dichromodes* n.sp.) also has a significant population on the reserve amongst a representative inland sand dune moth fauna.	Barratt & Patrick 1992; Grove 1995; Mark *et al.* 2003; Peat & Patrick 1999; Patrick 1990d.
Mount Iron (Scenic Reserve and RAP A1)	The mixed, low stature montane forest-shrubland, rocky areas and shrubland supports an insect fauna that is representative of such dry woody and rocky areas. Of note is the moth fauna associated with native broom *Carmichaelia petriei* and the small-leaved daisy shrub *Helichrysum lanceolatum*.	Allen *et al.* 2003; Grove 1995; Peat & Patrick 1999.
Pisa Flats (RAP A5)	This site supports the most representative specialist moth fauna of salty soils in the upper Clutha Valley including the saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict). An adjacent dryland cushionfield-herbfield also supports many uncommon insect species typical of the Central Otago valley floors.	Grove 1995; McIntosh, Beecroft & Patrick 1990 & 1991; Patrick 1989a; Patrick 1994c; Peat & Patrick 1999.
Luggate Creek (RAP A2)	Representative insect fauna of dry forest and shrublands of montane zone of Upper Clutha. Key foodplants for indigenous insects such as silver beech, kānuka, mountain ribbonwood, *Hebe subalpina*, *Corokia cotoneaster*, *Dracophyllum longifolium*, *Helichrysum lanceolatum* and several species of pōhuehue are present and support a rich specialist insect fauna, particularly butterflies and moths.	Grove 1995; Peat & Patrick 1999; Patrick 1994c.

SITE NAME	ATTRIBUTES	REFERENCES
Pisa (RAP A3 plus extension to eastern faces below and including Mount Dottrel and Column Rocks down to 700 m)	Representative, species rich and distinctive insect fauna occupying a range of habitats from montane to high alpine cirques. High alpine cushionfields, scree, large tors, snow grasslands and associated herbfield, shrublands and alpine seepages, wetlands and streams all support a distinctive and diverse assortment of indigenous insects from many Orders including beetles, cicadas, moths and butterflies, stoneflies, caddisflies, mayflies, bugs, cockroaches and grasshoppers. The Pisa Range is type locality for several insect species including stonefly and caddisfly species. Diurnal geometrid moths are a feature of the alpine areas and include the recently described *Notoreas elegans* whose caterpillars feed on *Pimelea* species here. The day-flying males of the large ghost moth *Aoraia senex* are a feature of high alpine snowbanks, and noteworthy for their short-winged flightless females.	Grove 1995; Mark *et al.* 2003; Peat & Patrick 1999; Patrick 1995b; Patrick and Hoare 2010; Patrick 2012; Patrick 2018.
Skeleton Stream & Lower Meg (RAPs A6 & 8)	By linking these two RAPs in the Roaring Meg, a highly representative insect fauna of aquatic insects, and insects of riparian silver beech forest and associated shrublands is encapsulated.	Grove 1995; Peat & Patrick 1999.
Double Rock (RAP A9)	A highly representative insect fauna of mixed shrublands on which many of the beetles and moths are specialist feeders. Of note here are the specialist moth larvae on the shrubs of a rare native broom *Carmichaelia compacta*, the extensive silver tussockland and the many rock faces where they feed on lichens. The rare and Threatened geometrid moth *Theoxena scissaria* (Nationally Vulnerable) is present in these shrublands associated with native brooms.	Grove 1995; Peat & Patrick 1999.
Poison Creek Flats (RAP B2)	A representative insect fauna, mostly moths and butterflies associated with dryland cushionfield, herbfield and low-growing shrubs such as *Pimelea oreophila*.	Grove 1995; Peat & Patrick 1999; Patrick 1989a; Patrick 1994c.
LINDIS ECOLOGICAL DISTRICT		
Lindis Pass Scenic Reserve & Double Peak extension (RAP A2)	A representative insect fauna of dry mixed grasslands and matagouri-dominated shrubland is found here. Of note in the extension is the daisy shrub *Olearia odorata* which is so rich in specialist moths including the noctuid moths *Meterana exquisita* and *M. grandiosa* (At Risk-Relict).	Grove 1995; Peat & Patrick 1999; Patrick 2000c; Hoare *et al*. 2017.
Lindis Head (RAP A1)	A representative insect fauna of dry montane mixed grassland - shrubland to high alpine cushionfield, grassland and snowbank communities.	Grove 1995; Peat & Patrick 1999.
Chain Hills (RAP A3)	This area contains a representative insect fauna from diverse upper montane to the high alpine zone with snow tussock and associated cushionfield and herbfield. Red tussock, pōhuehue, *Hebe subalpina*, *Melicytus alpinus* and *Olearia odorata* are noteworthy components of the montane zone here, and support specialist insects including a diverse assemblage of moths. The noctuid moths *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict) are found here.	Grove 1995; Peat & Patrick 1999; Patrick 2000c; Hoare *et al*. 2017.
Hospital Creek (RAP A8)	A representative insect fauna of montane shrublands and rock bluffs up to low alpine snow tussock and associated herbfield and woody species, all of which support specialist insects. The noctuid moths *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict) are found here.	Grove 1995; Patrick 2000c Peat & Patrick 1999; Hoare *et al*. 2017.

SITE NAME	ATTRIBUTES	REFERENCES
East Camp Creek (RAP A10)	This altitudinal sequence from the montane to low alpine zone contains kānuka and rock outcrop habitat at its lower part, through to snow tussock with associated herbfield, all of which support a representative insect fauna.	Grove 1995; Peat & Patrick 1999.
DUNSTAN ECOLOGICAL DISTRICT		
North Dunstan (RAP A1)	A highly representative insect fauna of montane to the high alpine zone of the North Dunstan Mountains including snowbank, snowgrass, cushionfield, herbfield, flush and shrubland communities with their diverse and mostly specialist insect species.	Grove 1995; Peat & Patrick 1999.
Dunstan Mountain tops down to 1100 m contour including Bendigo Tops - Scotts Creek - Fairfax Spur - Waikerikeri - Neds Creek - Dry Creek (RAPs A4, A5, A6, A7 & B9 & B10) and broadly Mounts Kinaki and Fulton.	A highly representative insect fauna of a large altitudinal sequence from montane shrubland, grasslands to high alpine cushionfield and impressive lichen-encrusted tors. The montane shrubland has a diverse flora that includes specialist insect-rich shrubs such as *Olearia odorata* and *Pimelea oreophila*. The recently described diurnal geometrid *Notoreas elegans* has its caterpillars feeding on the latter. The high alpine tops are home to a diverse and specialist insect fauna of cicadas, moths, beetles and grasshoppers including the large diurnal ghost moth *Aoraia senex* with its short-winged and flightless female living in snowbanks on the summit of the range.	Grove 1995; Mark *et al.* 2003; Peat & Patrick 1999; Patrick 2000c; Patrick 1995b; Patrick and Hoare 2010; Patrick 2012; Patrick 2018.
TAPANUI ECOLOGICAL DISTRICT		
Blue Mountains Conservation Area	Intact, diverse and extensive low alpine herbfield, grassland, shrubland and cushionfield, bordered by silver beech forest, with rich and distinctive insect fauna including local endemics - diurnal geometrid moth *Aponotoreas* n.sp., ghost moth *Aoraia oreobolae* and caddisfly *Tiphobiosis quadrifurca.* Another ghost moth present is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining. Other undescribed insects (cockroach and flightless stonefly) found here may also be endemic to the range.	Patrick *et al* 1985; Peat & Patrick 1999; Patrick 2018; Hoare *et al*. 2017.
OLD MAN ECOLOGICAL DISTRICT		
Butchers Dam (DoC)	Representative and significant saltpan habitat for specialist saline insects including the saltpan moths *Loxostege* n.sp. and *Paranotoreas fulva* (both At Risk-Relict).	Patrick 1989a; Peat & Patrick 1999; Hoare *et al*. 2017.
Earnscleugh Tailings Historic Reserve	Largest known populations of the grasshopper *Sigaus childi* (At Risk-Naturally Uncommon) and a significant population of an undescribed boulder copper butterfly - *Lycaena* new species.	Mark *et al* 2003; Patrick 1994c Trewick *et al*. 2016; Peat & Patrick 1999.
Garvie Mountains-Old Woman Range (linked RAPs 1/5, 1/6, 1/9, 1/10, 1/11,1/12, 2/5, 2/7 & 2/8)	Representative and very rich insect fauna of altitudinal sequence from montane to alpine to high alpine areas with high biodiversity particularly in snowbanks, alpine wetlands, grasslands, herbfields, shrublands, rock fields and on rock tor lichens. Special features include large-bodied flightless wētā and black scree butterfly. Three species of large ghost moths in the genus *Aoraia* are found here in snowbanks (*Aoraia senex*) and snowgrass (*Aoraia rufivena* and *A. macropis*). They are noteworthy not just for their large size, but they all have short-winged flightless females. Another ghost moth present is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining.	Brumley *et al.* 1986; Hoare *et al*. 2017; Mark *et al.* 2003; Patrick 1986c; Peat & Patrick 1999; Patrick 1985; Patrick 2018.
Old Man Range (linked RAPs 1/7, 1/8, 1/13, 2/3 & 2/4)	Representative and very rich insect fauna of altitudinal sequence from montane to alpine to high alpine area with high biodiversity and particularly rich biodiversity in snowbanks, alpine	Brumley et al. 1986; Hoare *et al*. 2017; Patrick 1986c; Mark *et al.* 2003; Patrick

SITE NAME	ATTRIBUTES	REFERENCES
	wetlands, shrublands and snowgrass communities. Special features include large-bodied flightless wētā and an abundance of diurnal geometrid moths such as *Notoreas elegans.* Another special feature is the number of Type Localities (13) for insects (beetles, cicada and cockroach) listed by Brumley *et al.* (1986) for the Old Man Range, including the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon). Several species of large ghost moths in the genus *Aoraia* are found here in snowbanks (*Aoraia senex*) and snowgrass (*Aoraia rufivena*). The former has its Type Locality here. Another ghost moth present is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining.	1991a; Peat & Patrick 1999; Brumley *et al.* 1986; Patrick and Hoare 2010; Patrick 2012; Patrick 2016a; Patrick 2018.
Barn Creek (RAP 1/4)	Representative insect community of montane to alpine grasslands with associated lichen-encrusted rock tors, and montane shrublands including specialist native broom and tree daisy (*Olearia odorata*) moth species. The distinctive noctuid *Meterana exquisita* (At Risk-Relict) is present. It is a specialist on *O. odorata*. An undescribed and rare new geometrid (*Dichromodes* n.sp.) with larvae feeding on lichens on tors is also present.	Brumley et al. 1986; Peat & Patrick 1999; Hoare *et al*. 2017; Patrick 2000c; Brumley *et al.* 1986.
Molyneux Faces (RAP 1/3)	Representative insect community of the dry shrublands and sunny rock faces of Central Otago with rich moth fauna associated with daisy shrub *Olearia odorata* including three specialists on *O. odorata* including the noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict) and geometrid *Declana nigrosparsa* (Threatened-Nationally Vulnerable). The rare, diurnal, rock face and lichen-feeding moth *Dichromodes ida* is also present.	Brumley et al. 1986; Peat & Patrick 1999; Hoare *et al*. 2017; Patrick 2000c; Brumley *et al.* 1986.
Long Gully Bluffs (RAP 1/2)	Representative insect community of dry shrublands and sunny rock faces of Central Otago with rich moth fauna associated with daisy shrub *Olearia odorata* including two specialists on *O. odorata*, the noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict).	Brumley et al. 1986; Peat & Patrick 1999; Hoare *et al*. 2017; Patrick 2000; Brumley *et al.* 1986.
Mount Difficulty (RAP 1/1) and significant extension to encompass all the lands down to Kawarau River to northeast and northwest of Mount Difficulty	Representative insect community of drylands of Central Otago with rich moth fauna associated with shrubs including *Olearia odorata* and *Pimelea aridula*. Populations of moths that are specialist feeding on *O. odorata* shrubs, including *Pasiphila* new species, *Protosynaema* new species, *Pseudocoremia cineracia* & *Declana nigrosparsa* (all Nationally Vulnerable), and two noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict), are present here. Additionally, the Threatened and rare geometrids *Theoxena scissaria* (Nationally Vulnerable) and *Xanthorhoe bulbulata* (Nationally Critical) have both been recorded in the Kawarau Gorge part of this area and for the latter species this is the only record of it anywhere over the past 75 years. The rare and flightless chafer beetle *Prodontria jenniferae*, has its Type locality here and a small distribution from the Kawarau Gorge up to 750 m on the surrounding slopes.	Brumley *et al.* 1986; Emerson and Barratt 1997; Patrick 1986c; Peat & Patrick 1999; Hoare *et al*. 2017; Patrick 2000b & c; Brumley *et al.* 1986.
WAIPORI ECOLOGICAL DISTRICT		
Te Papanui Conservation Park Lammerlaw - Lammermoor Tops (adjacent RAPs 2, 3 & 4)	High biodiversity of alpine insects in intact snow tussock, shrubland, wetland and snowbank communities are exemplified by the local endemic grassmoth *Orocrambus geminus*, and two other moths and six beetles. The range also has a high diversity of alpine dayflying geometrids (18), grassmoths in genus *Orocrambus* (25) including other dayflying moths such as *Notoreas elegans; O. thymiastes*, cicadas, grasshoppers, beetles, stoneflies and new undescribed caddisflies. The large-bodied alpine wētā *Hemideina maori* is also present, along with the large-bodied ghost moth *Aoraia orientalis* that it shares with the Rock & Pillar	Barratt & Patrick 1987; Grehan & Patrick 1984; Hoare *et al*. 2017; Mark *et al.* 2003; Patrick 1984; Peat & Patrick 1995; Patrick 1990, 1991a & 1991d; Patrick *et al*. 1993; Patrick 1993c; Carter 1994; Patrick and Hoare 2010; Patrick 2012.

SITE NAME	ATTRIBUTES	REFERENCES
	Range to the north. This species has a short-winged flightless female and a day-flying male, making for a spectacular mating event! Another ghost moth present is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining.	
Black Rock Scientific Reserve	Representative insect fauna of eastern Otago upland snowgrass, associated herbfield and diverse shrublands.	Patrick *et al*. 1993; Carter 1994.
Nardoo Scientific Reserve	Representative insect fauna of eastern Otago upland snowgrass and shrublands. Colourful day-flying moths such as *Dasyuris callicrena* are a feature of the *Hebe odora* shrublands, which are so extensive here.	Patrick *et al*. 1993; Carter 1994.
Stony Creek Scenic Reserve	Representative insect fauna of eastern Otago upland snowgrass, shrubland and silver beech forest, including moderate diversity of aquatic insect groups and specialist moths and beetles.	Patrick *et al*. 1993; Carter 1994.
Deep Stream Scenic Reserve	Representative insect fauna of eastern Otago upland snowgrass, shrubland and silver beech forest, including moderate diversity of specialist butterflies, moths, beetles and grasshoppers.	Patrick *et al*. 1993; Carter 1994.
Maungatua Scenic and Scientific Reserves	Representative insect fauna of eastern Otago upland snowgrass, herbfield, cushion bogs and shrublands. Patrick *et al*. (1993) list 48 invertebrates (spider, grasshopper, stonefly, moths and beetles) that have their Type Locality here. The *Hebe odora* and *Dracophyllum longifolium* shrublands here are particularly rich in specialist insects including beetles and moths. A ghost moth lives here in the summit wetlands. It is the sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining.	Hoare *et al*. 2017; Patrick *et al*. 1993; Patrick 1993c; Peat & Patrick 1985; Carter 1994.
Deep Creek Gorge (RAP 7)	Representative insect fauna of small-leaved shrubland, rock tors and flax land.	Patrick *et al*. 1993; Carter 1994.
Taieri Rapids (RAP 8)	Representative insect fauna of small-leaved shrubland and rock tors, including moderate diversity particularly of specialist moths and beetles.	Patrick *et al*. 1993; Carter 1994.
Black Rock (RAP 9)	Representative insect fauna of small-leaved shrubland and silver beech forest, including moderate diversity of beetles, bugs and moths.	Patrick *et al*. 1993; Carter 1994.
Lammerlaw Stream (RAP 10)	Representative insect fauna of small-leaved shrubland, rock outcrops, sphagnum moss wetlands and silver beech forest.	Patrick *et al*. 1993; Carter 1994.
Glendhu (RAP 13)	Representative insect fauna of grasslands, shrublands and forest.	Patrick *et al*. 1993; Carter 1994.
HAWKDUN ECOLOGICAL DISTRICT		
Mount Ida - Near Undaunted (DoC administered area and RAPs 12 & 13) - Oteake Conservation Park	Representative and highly diverse for insects from montane shrubland-grasslands to high alpine cushionfield-grassland-herbfield-rock tor area. Particularly rich in geometrid, noctuid and crambid moth species, giant weevils in genus *Lyperobius* in all ecosystems present.	Mark *et al.* 2003; Patrick 1994a; Peat & Patrick 1999; Hoare *et al*. 2017; Grove 1994a.
Hawkdun Range - entire summit ridge to 1876 m (includes RAPs 3, 5,6 & 9 and intervening high alpine	Representative and species-rich insect fauna of spectacular alpine and high alpine area containing abundant rock, scree, tors, grassland, herbfield, fellfield, tarns, seepages, wetlands and cushionfield, with altitudinal sequence down to valley-floor with shrublands, wetlands, herbfield and grasslands.	Mark *et al.* 2003; Patrick 1994a; Peat & Patrick 1999; Hoare *et al*. 2017; Grove 1994a; Patrick 2012.

SITE NAME	ATTRIBUTES	REFERENCES
grassland down to 1250m) with altitudinal sequences of Kirkwoods Creek RAP 6 and Berwen RAP 3. Oteake Conservation Park.		
TAHAKOPA ECOLOGICAL DISTRICT		
Ajax Bog - Mount Pye Conservation Area - Catlins Conservation Park (including all upland area from Catlins Cone & Tautuku to Beresford and McClennan Ranges)	Large and intact upland area of wetland, shrubland, forest and cushion bog with high biodiversity of representative upland insects including large population of At Risk-Declining ghost moth *Heloxycanus patricki.* Montane forest contains a rich biodiversity of insects also with many specialist moths present on a wide variety of tree, liane and shrub species.	Huryn *et al.* 2003; Patrick *et al.* 1984; Hoare *et al*. 2017.
Cannibal Bay - False Islet	Representative insect fauna of sand dune - rocky coast of the Catlins.	Barker *et al.* 2003; Patrick 1994d.
Glenomaru Valley Scenic Reserve	This forest supports a representative insect fauna of forest and understorey in eastern parts of the Catlins.	Allen *et al*. 2003.
Nugget Point Conservation Area	Impressive coastal herbfield on steep rock faces with shrubland and forest species present too, all supporting a rich insect fauna with many specialist moths and butterflies present. Diverse array of insects includes cockroaches, beetles and moths including four species of casemoths of biodiversity and conservation interest. Key plants supporting important diversity of specialist insects includes *Olearia fragrantissima*, kowhai and prostrate kowhai, *Celmisia lindsayi*, *Ileostylus micranthus*, five finger, pōhuehue, mahoe and *Hebe salicifolia*.	Barker *et al*. 2003; Patrick & Archibald 1988.
Papatowai Scenic Reserve	Coastal forest here supports a representative insect fauna with many specialist moth species on particular trees, laines and understorey shrubs and herbs.	Allen *et al*. 2003.
Pounawea Scenic Reserve	The forest and extensive saltmarsh, including Catlins Lake, support a representative insect fauna of the coastal Catlins.	Allen *et al*. 2003; Barker *et al.* 2003.
Tautuku Beach /Tautuku Bay Scenic Reserve/ Tautuku Peninsula	Representative insect fauna of sand dune, headlands, saltmarsh and coastal forest. The Threatened noctuid moth *Meterana* new species (aff. *M. meyricci*) has one of its few populations here where it's caterpillars feed on the sprawling shrub *Pimelea lyallii* in the dunes. The moth is classified as Nationally Endangered.	Barker *et al.* 2003; Hoare *et al*. 2017; Patrick 1986b.
Tahakopa Bay Scenic Reserve	A representative insect fauna of coastal forest, containing significant tall podocarp species, and sand dunes is present here. Specialist moths of rimu, kahikatea and matai are present here in the forests while pīngao moths are present in the dunes.	Barker *et al*. 2003.
Purakaunui Falls Scenic Reserve	This mixed and moist forest supports a representative insect fauna including a rich array of moth species, most of which are specialist on the various trees of the mixed beech - podocarp forest, and the associated shrubs, herbs and lianes.	Allen *et al*. 2003.
Waipati Beach Scenic Reserve	Coastal forest and shrubland supports a representative insect fauna with many specialist moths and butterflies present.	Barker *et al*. 2003.

SITE NAME	ATTRIBUTES	REFERENCES
BALCLUTHA ECOLOGICAL DISTRICT		
Otanomomo Scientific Reserve	The coastal broadleaf forest here supports a characteristic and representative insect fauna of mixed podocarp and hardwood forest in southern New Zealand. The specialist moths of the giants in the forest such as rimu, matai and kahikatea are present in good population numbers.	Allen *et al*. 2003.
GORE ECOLOGICAL DISTRICT		
Popotunoa Hill Scenic Reserve	This forested hill with remnant podocarps and light mixed forest, shrubland with abundant lianes supports a representative insect fauna.	Allen *et al*. 2003.
LAWRENCE ECOLOGICAL DISTRICT		
Birch Island in Clutha River	Representative insect fauna of near-natural beech forest with a local endemic, and un-named peripatus also. The tiny, jawed and day-flying moth *Sabatinca quadrijuga* is a feature of the forests here too, both on the island and in the forests on the bank of river opposite below the Blue Mountains.	Allen *et al.* 2003; Legge 1991; Patrick 2001a; Peat & Patrick 1999.
Rongahere Gorge	Representative insect fauna of beech and mixed beech-podocarp forest on steep slopes on both banks of the Clutha River. The site is significant too as it is the lower part of an unbroken sequence of natural vegetation and associated invertebrates from the Clutha Valley to the alpine tops of the Blue Mountains. The Threatened and diurnal moth *Cephalissa siria* (Nationally Vulnerable) is present along with its hostplant the liane *Fuchsia perscandens.* Significant features of the areas' invertebrates include an undescribed and local endemic peripatus (Onychophora), a surprisingly high diversity of 11 species of predatory carabid beetle and a rich leaf litter fauna across many different invertebrate groups.	Hoare *et al*. 2017; Patrick *et al*. 1996; Peat & Patrick 1999.
DANSEY ECOLOGICAL DISTRICT		
Dasher (RAP 5)	Representative and rich insect fauna of alpine snow tussock, wetlands and boulderfield shrublands of this part of the Kakanui Mountains on both schist and volcanic substrates. Particularly rich in diurnal moths, aquatic insects and large-bodied weevils in the genus *Lyperobius*.	Patrick 1991c; Peat & Patrick 1999; Comrie 1992.
Kakanui Peak (RAP 6)	Representative and rich insect fauna of montane shrublands and alpine grassland-shrubland, alpine rockfield and scree and wetlands including multiple flushes.	Mark *et al.* 2003; Patrick 1991c; Peat & Patrick 1999; Comrie 1992.
Pisgah (RAP 7)	Representative and rich montane to alpine grasslands and associated shrublands, scree and other rocky areas, and cushionfield. Significant for the number of diurnal butterflies and moths, particularly geometrid moths. Also significant for being habitat for the scree wētā, the large-bodied *Deinacrida connectens*.	Patrick 1991c; Peat & Patrick 1999; Comrie 1992; Patrick 2012.
Maerewhenua (RAP 8)	Representative insect fauna of forest, shrubland and grasslands of montane rocky gorge. Key habitat for the diurnal geometrids *Cephalissa siria* (Threatened-Nationally Vulnerable) and *Samana acutata* (At Risk-Relict).	Patrick 1991c; Peat & Patrick 1999; Comrie 1992; Hoare *et al*. 2017.

SITE NAME	ATTRIBUTES	REFERENCES
Benledi (RAP 9)	Representative and rich montane to alpine grasslands and associated shrublands, scree and other rocky areas, and cushionfield. Significant for the number of diurnal butterflies and moths, particularly geometrid moths.	Patrick 1991c; Peat & Patrick 1999; Comrie 1992.
Nobbler (RAP 10)	Representative and rich insect fauna of montane to alpine grassland, cushionfield, bluff, shrubland and wetland habitats. Of particular note is the diversity of indigenous moth, beetle, caddisfly and grasshopper species. The geometrid moth *Samana acutata* (At Risk-Relict) is present here.	Patrick 1991c; Peat & Patrick 1999; Comrie 1992; Hoare *et al*. 2017.
ARAWATA ECOLOICAL DISTRICT		
Mount Aspiring National Park	Representative insect fauna of the valley floor to high alpine tops, frequenting herbfields, cushionfields, rock face lichens and mosses, grasslands, shrublands through to beech forest on the steep slopes and valley-floors. Open areas in the valley-floors support a rich insect fauna too, on shrublands, grasslands and open areas of lichens and herbs.	Allen *et al.* 2003; Mark *et al.* 2003; Peat & Patrick 1999.
HUXLEY and OKURU ECOLOGICAL DISTRICTS		
Riverbeds to high alpine tops of entire EDs in ORC area	A diverse and representative insect fauna is found in the diverse habitats from riverbeds, through forest and shrubland to alpine grasslands and high alpine cushionfield, rocky areas and herbfield of a multitude of mountain ranges and intervening valley floors.	Allen *et al.* 2003; Mark *et al.* 2003; Peat & Patrick 1999.
DART and WANAKA ECOLOGICAL DISTRICTS		
Mou Waho, Mou Tapu and Stevensons Islands, Lake Wanaka	Representative insects of natural vegetation of mixed natural forests with abundant and diverse mistletoes, rocky areas, natural grassland with herbfield and shrublands. Mou Waho has large-bodied wētā *Hemideina maori* at surprisingly low altitude whereas Mou Tapu has cave wētā of significance.	Allen *et al.* 2003; Legge 1991; Peat & Patrick 1999.
Humboldt Mountains - Mount Earnslaw - Richardson - Harris Mountains (high alpine zone down to valley floors in Rees, Dart, Matukituki and Motutapu Rivers, and 700 m adjacent to Lake Wakatipu, and includes Dart Conservation Area and other areas linking to Mount Aspiring National Park)	The alpine to high alpine grasslands above 950 m, and associated herbfields, shrublands and areas of bare rock support a representative insect fauna of the mountains of western Otago. This insect fauna includes the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon). Many diurnal and conspicuous geometrid moth species are present in the alpine and high alpine zone such as in the genera *Notoreas*, *Dasyuris*, *Paranotoreas* and *Aponotoreas*. Valley-floor treeland and shrubland contains nationally important populations of the Threatened daisy tree *Olearia hectorii*, such an important host for a large diversity of rare and Threatened and At Risk moths such as the leaf roller *Pyrgotis* new species, *Pasiphila* new species, *Protosynaema* new species, *Pseudocoremia cineracia* & *Declana nigrosparsa* (all Nationally Vulnerable), and two noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict). The large wētā *Deinacrida pluvialis* was described from valley-floor here and is not known elsewhere.	Hoare *et al.* 2017; Huryn *et al.* 2003; Mark *et al.* 2003; Patrick 2000c; Patrick 2012; Patrick 2016a; Peat & Patrick 1999.
Mount Alta - broad montane alpine area westwards to Mount Aspiring National Park - down to 500 m in Matukituki Valley	Beech forest, upper montane grasslands, alpine to high alpine grasslands and herbfield, and high alpine rocky areas and cushionfield supports a rich and representative insect fauna which includes a new species of black butterfly in genus *Percnodaimon* and the rare alpine Butler's ringlet butterfly (*Erebiola butleri*). The Matukituki Valley shrublands and low forest contain the tree daisy species *Olearia lineata*, *O. fragrantissima* and *O. hectorii* and their suite of specialist rare and Threatened moths.	Allen *et al.* 2003; Hoare *et al.* 2017; Mark *et al.* 2003; Patrick 2000c; Peat & Patrick 1999.

SITE NAME	ATTRIBUTES	REFERENCES
Hawea Conservation Park	A large alpine area that supports a rich and representative insect fauna of high-altitude rocky areas with diverse cushionfield, herbfield and grasslands. Highlighting the high biodiversity here are twelve diurnal and brightly-coloured geometrid moths in the genera *Dasyuris*, *Aponotoreas* and *Notoreas* living here. Beech forests in the catchments around the Park are also important for indigenous insects.	Mark *et al.* 2003; Peat & Patrick 1999.
MACRAES ECOLOGICAL DISTRICT		
Lots Wife-Swampy Hill-Hummock	Representative and rich insect fauna of snowgrass, wetland including sphagnum areas, and shrublands of large and mostly intact low alpine-montane area. A feature of the fauna is the number of diurnal species. Threatened species present include the aniseed moth *Gingidiobora* new species (Nationally Critical) with caterpillars on the herbaceous *Gingidia montana*, the diurnal geometrid *Dasyuris partheniata* (At Risk-Declining) and the ghost moth *Heloxycanus patricki* (At Risk-Declining) with its caterpillars feeding on sphagnum moss. A population of New Zealand's sole mecopteran (*Nannochorista philpotti*) is also present here in streams.	Huryn *et al.* 2003; Patrick 1997; Peat & Patrick 1995; Hoare *et al.* 2017.
Emerald Stream	A diverse and representative insect fauna of grassland, shrubland and rocky areas.	Patrick 1997; Peat & Patrick 1995.
Flat Hill	A diverse and representative insect fauna of grassland, shrubland and rocky areas of the montane zone. A rich aquatic insect fauna is present too, particularly stoneflies, caddisflies, and mayflies.	Patrick 1997; Peat & Patrick 1995.
Taieri Ridge	Representative upper montane insect fauna of semi-natural grasslands and rock tor landscape.	Patrick 1997; Peat & Patrick 1995.
Taieri Gorge-Pukerangi	Representative insect fauna including cicadas and moths of rocky gorge area with diverse lichen and shrub flora with specialist insects particularly moths such as the large and local cicada *Amphipsalta strepitans*, moth *Horisme suppressaria* (caterpillars on corokia), and large diversity of case moths with larvae feeding on lichens.	Patrick 1997; Patrick 1992a; Peat & Patrick 1995.
Silver Peaks	Representative snowgrass, rock faces, shrublands and herbfield communities from the highest points down to 580 m. supporting a wide range of insect groups including grasshoppers, beetles, moths and butterflies. Diurnal moths and butterflies and grasshopper diversity are a feature of the rocky and grassland areas here including three species in the genus *Dichromodes* with larvae on lichens on the impressive rock faces here. Additionally, the diurnal moths *Cephalissa siria* (Nationally Vulnerable) and *Dasyuris partheniata* (At Risk-Declining) are present along with their hostplants, the liane *Fuchsia perscandens* and speargrass (*Aciphylla* species) respectively. This insect fauna includes the large ghost moth *Aoraia rufivena* with a male wingspan of about 7 cm and short-winged flightless females.	Patrick 1986a; Patrick 1987a; Patrick 1997; Peat & Patrick 1995.
Sutton Salt Lake Scenic Reserve	Representative dry grassland insects including grasshoppers, katydid, cricket and moths including the southern tiger moth *Metacrias strategica.* Does not support specialist saltpan insects on its salt flats flora. The reserve is the Type Locality for the casemoth *Scoriodyta suttonensis* which feeds lichens growing on tors within the reserve.	Patrick 1989; Peat & Patrick 1995; Patrick 1997.

SITE NAME	ATTRIBUTES	REFERENCES
REMARKABLES ECOLOGICAL DISTRICT		
Schoolhouse Flat	Representative insect fauna of dry, semi-natural short-tussock grassland in valley floor of the Nevis. The rare and Threatened crambid moth *Orocrambus sophistes* has its largest population here. It has a short-winged flightless female severely limiting its dispersal ability and is classified as "Nationally Vulnerable" in the threat ranking.	Hoare *et al*. 2017; Peat & Patrick 1999.
The Remarkables (includes Rastus Burn Recreational area, DoC stewardship lands and surrendered pastoral lands south to Staircase Creek). All lands from upper montane zone 850 to highest point at 2,324 m.	Representative alpine and high alpine habitat for a wide range of indigenous insects including conspicuous bugs, beetles, moths, butterflies, cicadas, grasshoppers and cockroaches. From montane beech forest, through diverse shrublands, grasslands, herbfield, rock bluffs, scree, cushionfield and snowbanks the insect fauna is diverse across many insect groups. A feature of the insect fauna here is the number of day active species in groups that are mostly nocturnal including ghost moths (*Aoraia senex*) and moths in the genera *Declana*, *Notoreas*, *Dasyuris*, *Aponotoreas*, *Paranotoreas* and *Orocrambus*. The rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon) is present in high alpine herbfields whereas the large and rare geometrid *Xanthorhoe frigida* with larvae on *Pachycladon* occurs here from 1640-1950 m and has a threat classification of Nationally Vulnerable. Other rare species found include the moths *Eudonia oreas*, *Scythris* n.sp.. noctuid *Aletia sollennis* and a tortricid *Eurythecta* n.sp.	Huryn *et al.* 2003; Mark *et al.* 2003; Patrick *et al*. 1992; Patrick 2016a; Peat & Patrick 1999; Hoare *et al*. 2017; Patrick 2012.
ROCK AND PILLAR ECOLOGICAL DISTRICT		
Rock and Pillar Range - summit plateaux (from south of McPhees Rock to far north of Summit Rock, and altitudinal sequences down Rock and Pillar Creek (Department of Lands & Survey area mapped with high conservation values)	Complete alpine plateaux of the Rock & Pillar Range contain representative montane, alpine and high alpine habitat for a wide range of indigenous insects including the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon), beetles, cicadas, wētā, grasshoppers, moths, butterflies, bugs, cockroach and aquatic insect groups. Of significance is large areas of impressive tors, wetlands, cushionfield, grasslands and associated herbfield. The five moths that are endemic to the range are listed in Peat & Patrick (1995). The large-bodied wētā *Hemideina maori*, growing to 65 mm in length, has a significant population on the summit crest of the Rock & Pillar Range where they inhabit rocky areas and hide under the largest slabs. It is joined in this high alpine habitat by a high-altitude cockroach and another wētā, this time a ground wētā - *Hemiandrus focalis.* The flightless chafer beetle *Prodontria montii* lives only in the cushionfields of the Rock & Pillar - Lammermoor Ranges, with the former range as it Type Locality. Two ghost moths are present here - the Threatened sphagnum ghost moth *Heloxycanus patricki* which is classified as At Risk-Declining, and the eastern alpine Otago endemic *Aoraia orientalis*, with its short-winged and flightless female.	Barratt & Patrick 1987; Mark *et al.* 2003; Department of Hoare *et a*l. 2017; Lands & Survey 1983; Mark *et al.* 2003; Peat & Patrick 1995; Patrick 2016a; Patrick 2012.
Great Moss Swamp	A large moss bog supports a representative insect fauna of moss bog, tall tussock and associated herbfield and shrubland. At Risk moths present include the diurnal geometrid *Dasyuris partheniata* (At Risk-Declining) and the ghost moth *Heloxycanus patricki* (At Risk-Declining) with its caterpillars feeding on sphagnum moss.	Barratt & Patrick 1987; Huryn *et al.* 2003; Peat & Patrick 1995; Hoare *et al.* 2017.

SITE NAME	ATTRIBUTES	REFERENCES
UMBRELLA ECOLOGICAL DISTRICT		
Whitcomb-Gem Lake-Argyle Burn (part RAP 1)	Representative alpine and high alpine habitat for a wide range of indigenous insects including the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon) and giant land snail *Powelliphanta spedenii*. The area encompasses tussock-shrubland, snowbank, herbfield and rock habitats. Emphasising its entomological richness, 73 of 83 beetle species were found in the Gem Lake catchment, while 92 moths and butterflies were found in the alpine zone.	Dickinson 1988; Patrick 1988; Patrick 2016; Mark *et al.* 2003; Peat & Patrick 1999; Patrick 2012.
Leithen Bush Scenic Reserve & Leithen Burn Headwaters (RAP 4)	Representative insect fauna of montane forest to low alpine grassland-shrubland-herbfield and rock bluff habitats with many diurnal low alpine crambids and geometrid moths are a feature.	Allen *et al.* 2003; Dickinson 1988; Patrick 1988; Peat & Patrick 1999.
Timber Creek Headwaters (RAP 5)	The sequence of vegetation from summit of Mount Benger down to montane grassland-shrubland of Timber Creek encompasses a highly representative and rich insect fauna including two species of large ghost moth with short-winged flightless females (*Aoraia senex* and *A. rufivena*). Diurnal moths in the *genera Dichromodes*, *Notoreas*, *Paranotoreas*, *Aponotoreas* and *Dasyuris* are also a feature in terms of diversity and population size.	Dickinson 1988; Patrick 1988; Peat & Patrick 1999.
Crown Rock - Stronach Hill (RAP 7)	The diverse shrublands, herbfield tussockland and rock bluffs support a highly representative insect fauna particularly in the Lepidoptera. The day-flying moths and butterflies are a standout feature.	Dickinson 1988; Patrick 1988; Peat & Patrick 1999.
Mckay Creek (RAP 20)	The mixed shrubland-silver beech forest containing dense tree daisy species here supports a rich specialist moth fauna including two noctuids *Meterana exquisita* and *M. grandiosa* (both At Risk-Relict) on *Olearia odorata* and its relatives. The spiny *Melicytus alpinus* also supports several specialist moths including the noctuid *Graphania lithias*.	Dickinson 1988; Patrick 1988; Patrick 2000; Peat & Patrick 1999.
DUNTROON ECOLOGICAL DISTRICT		
Earthquakes Reserve	Representative insect fauna of limestone bluffs and associated shrubland, herbfield and short-tussock grassland. Copper butterflies and other specialist Lepidoptera of pōhuehue (*Muehlenbeckia complexa* and *M. australis*), specialist moths of *Carmichaelia*, matagouri, *Dichondra repens* and *Melicytus alpinus* present too.	Peat & Patrick 2001.
OAMARU ECOLOGICAL DISTRICT		
Bushy Beach Scenic Reserve	The reserve supports a representative array of insect species of coastal forest, shrubland and herbfield with moths that are specialists on mahoe, ngaio, and *Hebe salicifolia*.	Barker *et al*. 2003; Peat & Patrick 2001.
WAIKOUAITI ECOLOGICAL DISTRICT		
Cornish Head	Steep cliffs and slopes support a rich flora and insect fauna that is representative of coastal herbfield and cliff refugia. Ancient and endemic moth family is represented here by small diurnal moth *Mnesarchaea paracosma*.	Allen *et al.* 2003; Patrick 2000a.
Goodwood Scenic Reserve	The mixed hardwood and podocarp forest present here with associated lianes support a representative insect fauna. A special feature is the presence of the deciduous small tree *Olearia fragrantissima* complete with its specialist moth fauna.	Allen *et al.* 2003; Patrick 2000c.

SITE NAME	ATTRIBUTES	REFERENCES
Karitane Beach	The red katipo spider (*Latrodectus katipo*) in present in sand dunes and is classified as At Risk-Declining.	Barker *et al.* 2003; Patrick 2002; Peat & Patrick 1995.
Waikouaiti Estuary	Representative insect fauna of estuarine habitat including saltmarsh, rushland habitat and associated saltmarsh ribbonwood community. The last-named shrub (*Plagianthus divaricatus*) is particularly rich in specialist moths feeding on foliage or leaf-mining the small leaves.	Barker *et al.* 2003; Patrick 2008.
Mount Watkin Scenic Reserve	Representative and intact insect fauna of volcanic plug and associated basalt screes, with shrublands and herbfields of this prominent mountain. The diurnal moths *Cephalissa siria* (Nationally Vulnerable), *Gingidiobora* new species (Nationally Critical) and *Dasyuris partheniata* (At Risk-Declining), are present along with their hostplants climbing fuchsia (*Fuchsia perscandens*) and speargrasses (*Aciphylla* species), respectively.	Hoare *et al*. 2017; Mark *et al.* 2003; Patrick 1997; Peat & Patrick 1995; Patrick 2007; Patrick 2017.
ST MARY ECOLOGICAL DISTRICT		
St Marys Range (broadly the highest peaks south to Danseys Pass at 900 m)	The alpine snowgrass areas through to high alpine screes and cushionfields support a rich and characteristic insect fauna with many species confined to these greywacke mountains of northern Otago. The large-bodied speargrass weevils *Lyperobius barbarae* and *L. patricki* - both specialist feeders of speargrass (*Aciphylla* species) are confined to the mountains of North Otago and South Canterbury where they are very local in distribution. The former found on alpine and high alpine speargrasses, while the latter is found lower down the range on larger speargrasses. Additionally, the flightless chafer beetle *Prodontria patricki* is a local endemic species found in the alpine grassland and herbfields down to 1000 m. Two large-bodied wētā species *Deinacrida connectens* and *Hemideina maori* live in areas of rock, both large boulders and scree, and the scree grasshopper *Brachaspis nivalis* is widespread on areas of bare rocky slopes. Three other grasshoppers live in adjacent grassland and herbfield.	Mark *et al.* 2003; Peat & Patrick 1999; Patrick 1982; Patrick 2012.
ST BATHANS ECOLOGICAL DISTRICT		
St Bathans Range - part Oteake Conservation Park	The sequence of alpine vegetation from snowgrass dominated slopes at 950 m, with a herbfield understorey through to areas of shrubland to the bare screes and rock outcrops of greywacke of the high alpine areas of the range with their patches of cushionfields and alpine tarns support a rich and characteristic insect fauna of the greywacke mountains that mark Central Otago northern ramparts. An undescribed black butterfly (*Percnodaimon* new species) is present here flying over screes as it is on adjacent greywacke mountains east to the Ida and St Marys Ranges. It is joined by the cryptic scree grasshopper *Brachaspis nivalis* and scree wētā *Deinacrida connectens*, both here at their southern distributional limit.	Mark *et al.* 2003; Peat & Patrick 1999; Patrick 2012.
Dunstan Range	The alpine slopes and high alpine tops here support a representative insect fauna of the greywacke mountains of northern Otago including two large-bodied and cryptic species, the scree grasshopper *Brachaspis nivalis* and scree wētā *Deinacrida connectens*.	Mark *et al.* 2003; Peat & Patrick 1999.

SITE NAME	ATTRIBUTES	REFERENCES
SHOTOVER ECOLOGICAL DISTRICT		
Coronet Peak Reserve	A representative insect fauna is present in the snowgrass, herbfield, cushionfield, shrubland and wetlands of the range down to 900 m. This fauna is of significance for its diversity of dragonflies and damselflies, scorpionfly and caddisflies, grasshoppers and moths and butterflies. Of note is the high biodiversity of grassmoths in the genus *Orocrambus* with 12 species present, some with short-winged flightless females such as *O. philpotti* and *O. crenaeus* and several that are diurnal over both tall and short grassland areas such as *O. scoparioides* and *O. aethonellus*. Additionally, the moth fauna is significant for the number of species and genera of diurnal geometrids present with six genera and 18 species present. A feature of the shrubland at about 1000 m is the daisy shrub *Olearia odorata*. Here it supports many specialist moths amongst them the At Risk-Relict noctuids, the appropriately named *Meterana exquisita* and *M. grandiosa*. New Zealand's only scorpionfly *Nannochorista philpotti* and the rarely recorded caddisfly *Tiphobiosis montana* are present in the wetlands including seepages.	Mark *et al.* 2003; Peat & Patrick 1999; Patrick 1992c; Patrick 2000c; Hoare *et al.* 2017.
Ben Lomond to Moke Lake	Alpine grasslands, shrublands down to wetland and short tussock grasslands support a rich and representative montane to high alpine insect fauna characteristic of western Otago. The moth fauna includes the rare and enigmatic geometrid moth *Asaphodes obarata* (Threatened-Nationally Critical) is present at one of its only known localities over the past 100 years. The insect fauna also includes the rare shield bug *Hypsithocus hudsonae* (At Risk-Naturally Uncommon) which lives in alpine cushionfield here.	Mark *et al.* 2003; Peat & Patrick 1999; Hoare *et al.* 2017.
Bobs Cove Scenic Reserve	The reserve supports a representative insect fauna of forest, forest under-storey and cliff face species. The large cryptic and undescribed geometrid moth *Gingidiobora* aff. *subobscurata* which is a specialist feeder on the large cliff-face herb *Gingidia montana*, has a population here. It is a Threatened species and classified as At Risk-Declining.	Patrick 2017; Peat & Patrick 1999; Hoare *et al.* 2017.
Skippers Canyon, Shotover River (McLeods Bluff to Skippers Point)	Steep rock faces with specialist herbs and shrubs support a distinctive insect fauna of this habitat type. The large cryptic and undescribed geometrid moth *Gingidiobora* aff. *subobscurata* which is a specialist feeder on the large cliff-face herb *Gingidia montana*, has a population here. It is classified as At Risk-Declining.	Patrick 2017; Peat & Patrick 1999; Hoare *et al.* 2017.
WAIANAKARUA ECOLOGICAL DISTRICT		
Shag Point - Matakaea Reserve- Shag River estuary	The reserve supports an intriguing array of insects reflecting its vegetation which includes many upland or alpine species at sea-level such as snowgrass (*Chionochloa rigida*), the sprawling sub-shrub *Pimelea oreophila* and the daisy *Celmisia hookerii.* The colourful diurnal moth *Notoreas elegans* has its only sea-level population here and is joined by several other unusual occurrences at sea-level such as the tussock butterfly *Argyrophenga antipodum*. A representative insect fauna of saltmarsh and coastal grassland-herbfield is present here. Rich insect fauna of beetle groups including tiger, click and chafer beetles, lacewings and rich moth fauna of shrubland, herbfield and mixed grasslands.	Barker *et al.* 2003; Patrick 1993a; Patrick & Hoare 2010; Peat and Patrick 2001.

SITE NAME	ATTRIBUTES	REFERENCES
South Peak, Horse Range (link broadly to Trotters Gorge SR from 100 - 280 m)	Slopes and rock bluffs of the Horse Range support a representative but distinctive insect fauna of grasslands, light forest, shrubland and herbfield of this extension of the Kakanui mountains with a Threatened geometrid moth. This moth is the large geometrid *Gingidiobora* new species aff. s*ubobscurata* which is listed as At Risk-Declining, and has its caterpillars feeding on the large herb *Gingidia grisea* which grows on steep rock faces here.	Hoare *et al.* 2017; Mark *et al.* 2003; Peat and Patrick 2001; Patrick 2017.
Trotters Gorge Scenic Reserve	This reserve supports a representative and rich insect fauna of northeastern Otago's open and mixed light forest. Many specialist moth and butterfly species are present including two species of copper butterfly (*Lycaena feredayi* and *Lycaena* new species) with their caterpillars feeding on pōhuehue vines, while kowhai here supports four specialist moths; the leaf-mining *Stigmella sophorae*, seed-feeding *Stathmopoda aposema*, and defoliators the kowhai moth (*Uresiphita maorialis*) and the noctuid *Meterana decorata*. Other rich hosts for specialist moths that are present here are small-leaved *Coprosma* species, *Hebe salicifolia*, *Haloragis erecta*, *Helichrysum lanceolatum*, ngaio and *Rubus* vines. Small trees of *Pseudopanax* are host to the South Island zebra moth (*Declana egregia*) that features on the New Zealand $100 banknote. Streams here support a rich aquatic insect fauna of mayflies, caddisflies and stoneflies. The colourful and Threatened geometrid moth *Asaphodes stinaria* (Nationally Vulnerable) has a population here with its caterpillars feeding on the herb *Ranunculus reflexus*. An undescribed and local endemic peripatus also occurs here in forest.	Allen *et al*. 2003; Peat and Patrick 2001; Hoare *et al.* 2017; Peat and Patrick 2001.

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Appendix 13: Wildlands Report (2020b)

MAPPING OF POTENTIAL NATURAL ECOSYSTEMS AND CURRENT ECOSYSTEMS IN OTAGO REGION

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R5015a

MAPPING OF POTENTIAL NATURAL ECOSYTEMS AND CURRENT ECOSYSTEMS IN OTAGO REGION

Contract Report No. 5015a

July 2020

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EXECUTIVE SUMMARY

Potential terrestrial ecosystems are those ecosystems that would have occurred in Otago prior to human settlement of New Zealand. Mapping of potential terrestrial ecosystems was undertaken across Otago, based on the Singers and Rogers (2004) classification of indigenous ecosystem types. Mapping was undertaken using a range of existing layers and database information, including spatial information on soil types, which was particularly useful in lowland and montane parts of Otago, and land cover spatial information which was particularly useful above treeline. Other spatial layers such as the Topo50 topographic layer, and the QMap geological layer, were also helpful. In addition, considerable new mapping was undertaken of wetland, valley floor, and lowland coastal ecosystems. Knowledge of current ecosystems was also informative, as mature examples of forest generally reflect the original pre-human forest, and many wetland ecosystem types can be identified by their current information. Information on climate and geology was also helpful.

Sixty-one potential terrestrial ecosystem types were mapped across Otago, which was largely covered by indigenous forest prior to human arrival, but with significant areas of tussock grassland and other alpine ecosystems above treeline.

Evidence from subfossil logs, pollen analysis, sub-fossilised plant fragments preserved in wetlands and in rock shelters, together with observations of exotic tree growth in different parts of Central Otago, indicates that forest cover extended across most of Central Otago, apart from in the driest and coldest areas. Almost none of these Central Otago forests remain today. On deeper soils on alluvial sites and basin floors, the forest canopy would have comprised manatū/lowland ribbonwood, narrow-leaved lacebark, kāpuka/broadleaf, kōhūhū, kōwhai, and fierce lancewood, with scattered emergent matai and Hall's tōtara. On the adjacent mountain slopes, and in areas with thinner soils, forest dominated by Hall's tōtara, mountain celery pine, and kāpuka/broadleaf would have been predominant.

While other studies have suggested that 40,000 hectares of saline vegetation was present in Central Otago, 14,366 hectares of this habitat was mapped, based on the distribution of the most highly saline Linnburn soils. It is also likely that saline vegetation did not occur fully across these soils, but was located in patches of locally higher salinity.

Fifteen wetland ecosystems, comprising 8,274 wetland polygons and 34,941 hectares, were mapped within Otago Region. This mapping built on wetlands mapped by the Land Cover Database, FENZ, and Topo50, but numerous additional wetlands were mapped. The most extensive ecosystem types mapped were WL16 red tussock, *Schoenus pauciflorus* tussockland (12,060 hectares), WL18 flaxland (6,037 hectares), and WL20 Coprosma, twiggy tree daisy scrub (5,935 hectares). As much of the mapping was based on the spatial distribution of current wetlands, this wetland mapping comprises a significant advance on wetland mapping in Otago Region, both in terms of spatial resolution and thematic resolution.

Current indigenous cover was predominantly undertaken by classifying land cover database cover types into Singers and Rogers (2004) ecosystems, but wetlands were added from the potential ecosystems layer where the mapping was based on current wetlands. A comparison of potential vs current ecosystem extent shows that approximately 200,000 hectares more tall tussock grassland currently occurs in Otago compared to the pre-settlement extent. Indigenous forest has experienced the opposite trend, being historically the ecosystem type of greatest extent in Otago, but now being reduced to approximately 10% of its original extent. A variety of scrub, shrubland, and fernland ecosystems that replaced the former forest also occur extensively across Otago.

CONTENTS

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1. INTRODUCTION

Regional Councils across New Zealand have agreed to map potential and actual natural terrestrial and wetland ecosystems, using the Singers and Rogers (2014) ecosystem classification, to add to the national picture of potential and actual terrestrial ecosystems by using a consistent methodology. Otago Regional Council commissioned Wildland Consultants to undertake this mapping across Otago Region.

In addition, Otago Regional Council commissioned mapping of the significant habitats of indigenous fauna across Otago Region, including the coastal marine part of the Region, and to map significant freshwater ecosystems.

The maps are intended to be used to

- Prioritise areas within Otago that would benefit most from active biodiversity management.
- Provide a baseline of the integrity and extent of indigenous biodiversity within Otago.
- Inform the upcoming reviews of the Regional Water Plan and the Regional Plan Coast.

The key outputs of the project are:

<u>Vegetation Mapping</u>

Three separate maps of:

- Actual vegetation (classified according to Singers and Rogers 2014).
- Potential vegetation (classified according to Singers and Rogers 2014).
- Terrestrial habitat of significant indigenous fauna.

<u>Freshwater Ecosystems and Habitat</u>

Two separate maps of:

- Fresh water ecosystem types
- Freshwater habitats of significant fauna

<u>Coastal/Marine Ecosystems and Habitat</u>

Two separate maps of:

- Ecosystem types.
- Coastal/marine habitats of significant indigenous fauna.

This report describes the methods that were used to map potential terrestrial ecosystems and current ecosystems, and describes the existing data layers that were used to map freshwater ecosystem types and coastal/marine ecosystem types. A companion report describes the mapping of significant habitats of indigenous fauna across Otago's terrestrial, freshwater, and marine ecosystems.

2. POTENTIAL ECOSYSTEM MAPPING

2.1 Overview

Potential ecosystem mapping across Otago Region used both existing layers and new mapping, informed by a wide range of resources including research articles and reports, species distribution data, aerial imagery, and Wildlands in-house knowledge. The mapping was based on the Singers and Rogers (2014) classification of indigenous ecosystem types, modified in some cases by adding new ecosystem types or sub-units of ecosystem types. The mapping approach is explained in more detail below.

2.2 Fundamental soils layer

Due to the generally strong relationships between soils and vegetation, soil mapping from the fundamental soils layer (FSL) was frequently used as the basis for mapping of potential vegetation in lowland and montane habitats, and in upland habitats in Central Otago and eastern Otago, especially where the former natural indigenous vegetation had been strongly modified or completely cleared. The limitations of FSL soil mapping are that it is at a broad scale, is relatively coarsely resolved, and transitions between soil polygons are necessarily sharp, and would not always correspond to broad ecological transitions along environmental gradients.

Therefore more resolved mapping was undertaken where soil mapping related less well to natural vegetation patterns. This is particularly the case in coastal habitats and around river mouths, and for mountain landscapes in western Otago. In these areas, more detailed mapping was undertaken by hand digitisation, based on evidence from existing vegetation, existing vegetation maps, staff knowledge, and descriptions of vegetation in books, reports, and other publications.

The Dunedin urban area is not covered by soil mapping, and the Dunedin waterfront sits on reclaimed land. For these reasons the potential ecosystems present in the Dunedin urban area were defined by topographical and ecological information, and an area roughly corresponding to the reclaimed land was classified as an estuarine wetland ecosystem, WL10 Oioi restiad rushland/reedland.

2.3 Establishment of treelines and mapping of alpine ecosystems

In western Otago, where beech forest is the dominant forest type, we used a different approach. Elevation thresholds were used to define the upper forest limit, and the lower limit was established either by defining a lower elevation threshold, or mapping all other low elevation ecosystems and then filling the remainder with beech forest. Upper forest limits varied in different parts of Otago, with the highest forest limit of 1,200 metres above sea level (asl) used for CDF3 mountain beech forest in the rainshadow of the Southern Alps where mountain beech charcoals are most abundant between 900-1,200 metres (Molloy *et al.* 1963). A treeline of 1,100 metres asl was used in western areas where CLF11 silver beech forest formed the treeline, but reduced to 900 metres asl in the uplands of the Garvie/Old Man/Old Woman Ranges, where wet upland soils may have limited the upper treeline.

The Land Cover Database Version 5 (LCDB) was then used to allocate ecosystems to cover classes above treeline (Table 1), in some cases using other layers such as QMAP to differentiate different ecosystem types. Hand digitisation was used to map the CL11 mountain tutu, *Hebe*, wharariki, *Chionochloa* shrubland/tussockland/rockland ecosystem above treeline in western areas such as in the Eyre Mts and the upper Matukituki catchment.

Table 1: Allocation of Singers and Rogers (2014) ecosystem types to LCDB land cover types above treeline

Ecosystem Type	Land Cover Class	Other Criteria
AH Alpine herbfields	Gravel or rock	AH1 on greywacke and in drier western areas.
	Gravel or rock	AH2 on schist in the Central Otago block mountains.
	Gravel or rock	AH3 in the higher rainfall western mountains.
IC1 Permanent snow and Ice	Permanent snow and ice	
AL7.1 Pungent snow tussock tussockland/ shrubland	Alpine grass/herbfield	Close to the Main Divide.
AL6 Mid-ribbed and narrow-leaved snow tussock tussockland/ shrubland	Tall tussock grassland	Close to the Main Divide, informed by distribution data for mid-ribbed snow tussock.
AL1 Narrow-leaved and slim snow tussock tussockland/shrubland	Tall tussock grassland, Low producing grassland	In eastern areas, based on the distribution limit of slim snow tussock. Also mapped on BAM soils.
CDF2 Dracophyllum, Phyllocladus, Olearia, Hebe scrub [subalpine scrub]	Subalpine shrubland	
SC1 scree	N/A	Mapped using topographic polygons and manual additions.

Like the FSL soils layer, LCDB does have limitations, including moderately coarse resolution and misclassification of polygons. Misclassifications were less common in the western parts of Otago, and in upland areas elsewhere where a more natural vegetation cover persists, so have probably not had a great effect on potential ecosystem mapping.

2.4 Other treelines

Tōtara logs have largely been found from 450-1,000 metres asl (Molloy *et al.* 1963), so the CLF1 Halls tōtara, mountain celery pine, broadleaf forest ecosystem was mapped up to 1,000 metres asl in Central Otago. The lowest upper forest limit of 900 metres asl was used in coastal Otago, based on the lack of forest remnants above this elevation in this coastally-influenced part of Otago. Cooler coastal weather is the likely cause of the lower elevation treeline in coastal Otago.

2.5 Lowland/montane podocarp/broadleaved ecosystems

Podocarp/broadleaved forest ecosystems other than CLF1 were mapped widely in coastal hill country and in the lower Clutha catchment, and as smaller examples in the lower Makarora and Matukituki valleys and on the Hawea plains. This mapping was generally based on the distribution of remnant examples of these forest types, and the landforms on which they occur outside Otago Region. The most widespread of these types was CLF4 kahikatea, tōtara, matai forest. The distribution of different podocarp/ broadleaved forest types on different landforms and areas is described in Table 2.

Table 2: Landform attributes used to map lowland podocarp/broadleaved forest types.

Ecosystem Type	Ecosystem Types
MF3 Matai, tōtara, kahikatea broadleaved forest	Mostly well-drained lowland recent alluvial sites.
MF4 Kahikatea forest	Poorly-drained lowland recent alluvial sites.
CLF1 Halls tōtara, mountain celery pine, broadleaf forest	Slopes of inland mountains, rocky soils in southern Macraes Ecological District.
CLF2 Halls tōtara forest	Coastal sand dunes.
CLF4 Kahikatea, tōtara, matai forest	Hill country and downlands, coastal and lower Clutha catchment.
CLF6 Kamahi, southern rata, podocarp forest	Higher rainfall areas, Catlins and Wisp Range.

2.6 Wetlands

Wetland ecosystems were mapped in a number of ways.

Soil maps were used to identify wetland ecosystems in valley floor and inland basin ecosystems, and as the initial basis for wetland mapping in coastal areas. These always required verification as in some cases wetland soils (Table 3) were mapped broadly and included significant areas of non-wetland habitat, e.g. dry hill slopes. Also, some wetland soil types had more than one potential ecosystem type on them (Table 3).

Table 3: The relationship between wetland soils and potential ecosystems.

FSL SOIL Type	Ecosystem Types
GOT, GOO Orthic soils	MF4 Kahikatea forest.
GRT, GRQ Recent soils	WL18 Flaxland, MF4 Kahikatea forest, WL10 Oioi restiad rushland/reedland, WL20 Coprosma, twiggy tree daisy scrub.
OFS Fibric soils	WL16 Red tussock, *Schoenus pauciflorus* tussockland, WL6 Lesser wire rush, tangle fern restiad rushland/fernland.
OMA, OMM Mesic soils	WL18 Flaxland,
PPF Perch-gley soils	MF4 Kahikatea forest.
ZPP Perch-gley soils	Identified some upland wetland complexes that were mapped using LCDB.

Where existing polygons, such as LCDB 'herbaceous freshwater vegetation' polygons, were mapped reasonably accurately, these were incorporated into the potential ecosystems layer and allocated ecosystem classifications based on knowledge of wetland types in those areas. The main areas where LCDB 'herbaceous freshwater vegetation' polygons were used in this way were on the uplands of the Lammermoor/Lammerlaw Ranges and Manorburn area, and in the uplands stretching from the Nokomai wetland complex around the Garvie Mountains and the Old Man Range, to wetlands on the Umbrella Range. These were mostly WL17, WL8, and/or

WL16 wetland ecosystems, with the former on flat to gently sloping landforms, and the latter on steeper slopes.

Wetlands were hand-digitised in other areas, especially where significant areas of wetland vegetation were not captured by any existing layer, for example on the Remarkables Range and Hector Mountains. Wetlands were also hand-digitised for greater accuracy after locating wetlands from wetland symbology on the NZ Topo layer and the FENZ wetland layer.

Wetlands were classified into ecosystems based on Wildlands staff knowledge of wetlands in different parts of Otago, and features of particular wetland types that could be determined in aerial imagery. For example WL17 *Schoenus pauciflorus* seepages/ flushes and WL8 herbfield/mossfield/sedgeland ecosystems often had similar dark coloration in aerial imagery, but were distinguished by WL8 ecosystems occurring on flat sites and often containing small pools, and WL17 occurring on steeper slopes and often having linear downhill striping.

Ephemeral wetlands were poorly mapped in existing layers such as LCDB and FENZ, as they generally occur at much smaller areas than the minimum mapping units of these classifications. However, ephemeral wetlands are in most cases easily distinguished in aerial imagery, and were mapped by hand digitisation across all parts of Otago where ephemeral wetlands occur. Almost 3,000 ephemeral wetlands were ultimately mapped. Very shallow ephemeral wetlands would be less easy to distinguish and are not likely to have been mapped, and other ephemeral wetlands where the wetland boundary is not sharp.

Sedge-dominant wetlands corresponding to WL22 *Carex*, *Schoenus pauciflorus* sedgeland were widely mapped in lower elevation sites, typically in gullies. These wetlands are generally swamps.

In upland parts of Otago, WL16 red tussock, *Schoenus pauciflorus* tussockland was widely mapped. Wetlands that were dominated by narrow-leaved snow tussock were included in this potential ecosystem type, and sphagnum moss (*Sphagnum cristatum*) is generally abundant in them.

Wood and Walker (2008) identified *Olearia* shrubland as occupying marsh and swamp wetlands in the upper Taieri catchment. *Olearia* shrubland has no analogue in the Singers & Rogers (2014) ecosystem classification. A new ecosystem type, WL23 *Olearia* shrubland, was therefore created to map the potential ecosystem in these basin-floor wetland habitats in the upper Taieri.

The end result of these wetland ecosystem mapping approaches is wetland mapping of significantly better spatial and thematic resolution than any other existing regional scale mapping of wetlands.

2.7 Thermally-induced ecosystems

Thermally-induced ecosystems are typically found in frost hollows and on plains, but also occur in upland plateaux (Singers and Rogers 2014). The TI1 bog pine, mountain celery pine scrub/forest ecosystem was mapped extensively in the colder basins of

Central Otago, and also in mountain valleys such as the Greenstone. T12 kānuka, *Olearia* scrub/treeland was mapped in Central Otago, mostly in the upper Clutha River catchment, where it was mapped on recent alluvial soils and on the drier parts of outwash terraces. Some of the land that would have supported this ecosystem is now occupied by Lake Dunstan. TI2 was also mapped on north-facing rocky slopes at Bendigo and near Luggate, where makahikatoa (*Kunzea serotina*) woodland remains extensive today, and near the junction of the Kawarau River and Clutha River where a smaller existing stand of makahikatoa remains. TI6 red tussock tussockland was mapped on volcanic uplands centred on Mt Siberia in the Kakanui mountains, where impeded drainage on the volcanic plateau has favoured establishment of copper tussock (*Chionochloa rubra* subsp. *cuprea*) grassland. This unit was also mapped in the upper Greenstone Valley.

2.8 Central Otago potential ecosystems

Central Otago presented a challenge for potential ecosystem mapping due to the scarcity of intact indigenous vegetation in lowland and montane habitats, and its unique climate and soils. As McGlone (2001) stated: "Eight hundred years of fire and 150 years of pastoral development have obscured the original vegetation patterns of the south-eastern South Island. Over large stretches of country no vegetation associations corresponding to those of the pre-human situation remain." Mapping of Central Otago habitats therefore took account of recent research and modelling on the paleoecology of the area.

McGlone (2001) suggested that low forest-scrub-grassland vegetation was originally present in Central Otago and that matai (*Prumnopitys taxifolia*) was highly unlikely to have been present in the semi-arid Central Otago area, apart from immediately east of the axial mountains. However matai is abundant in the pollen diagram for the Idaburn Valley site described in this paper, along with tōtara (*Podocarpus* spp.), mountain celery pine (*Phyllocladus alpinus*) and *Olearia*. At Earnscleugh Cave, matai and/or tōtara pollen were abundant, along with abundant *Myrsine* and *Coprosma*. At Teviot Swamp, abundant matai pollen, along with with *Halocarpus*, *Phyllocladus*, and beeches, was deposited in pre-human times.

Matai charcoal and seed cases have been recorded from Tekapo moraines (Molloy *et al.* 1963), illustrating its occurrence in inland basins, while Holloway (1954) observed matai/tōtara/kahikatea stands in the lower reaches of the Makarora Valley. He noted that matai stumps were present near Lake Hawea. Matai is currently still present in the lower Matukituki Valley (Peter Johnson, Landcare Research, pers.comm.). Singers (2018) developed an additional cool forest ecosystem, CLF13 Matai, broadleaf forest, to accommodate the matai forests that were believed to have dominated the Awatere valley floor and been historically more extensive in southern Marlborough, inland North Canterbury, and possibly Central Otago. As evidence of matai is mostly from alluvial landforms, CLF13 was mapped on alluvial flats and terraces in the inland valley floors. The presence of a wide range of exotic trees on these landforms today is evidence that there are few limitations to the growth of taller forest in these habitats, apart from where landforms are too cold, too dry, or too wet to support tall forest. Besides matai and broadleaf, it is likely that the CLF13 ecosystem type would also have included trees such as kōwhai, lowland ribbonwood (*Plagianthus regius*), narrow-leaved lacebark (*Hoheria angustifolia*), and fierce lancewood (*Pseudopanax ferox*). As no indigenous forest remains in the areas where CLF13 has been mapped, there is more uncertainty relating to the occurrence and extent of this ecosystem type than for most other ecosystem types.

Molloy *et al.* (1963) concluded that forest would have covered almost all areas of the South Island below treeline, apart from sites that were too dry or subject to frequent natural disturbance. Wardle (2001) noted widespread subfossil logs and charcoal on slopes in Central Otago, predominantly from beech, but also including matai, Hall's tōtara (*Podocarpus laetus*), mountain toatoa, bog pine (*Halocarpus bidwillii*), and kānuka (*Kunzea* spp.). Tōtara logs were found between 590 metres asl and 1,040 metres asl. On Mou Waho Island (Lake Wanaka), charred tōtara and matai logs were found in a small lake. Logs were widespread, but none were found on the western slopes of the Pisa Range, or on the Dunstan Mountains, although they occur on the eastern slopes. Park (1908) noted tōtara logs on the Dunstan, Pisa, Remarkable, and Carrick Ranges. Holloway (1954) noted that tōtara was common in the Nevis Valley. Buchanan (1875) noted that mountain celery pine was common on the central mountains and on Dunedin hilltops. Based on the widespread evidence of Hall's tōtara and mountain celery pine on the inland range slopes, the CLF1 Halls tōtara, mountain celery pine, broadleaf forest ecosystem was mapped widely in these habitats.

Walker *et al.* (2003) mapped 12 woody ecosystem types across Central Otago, noting the main gradient is an elevation gradient caused by climate. These ecosystems don't neatly fall into Singers and Rogers (2004) ecosystems, possibly because they relate to only woody species. Walker *et al.* (2003) concluded that a suite of frost- and drought-tolerant but fire-sensitive tall woody species were eliminated from the valley floors, leaving only fire-resistant species. They suggest that Central Otago valley floors are likely to have supported woodlands of mountain toatoa (*Phyllocladus alpinus*) and bog pine (*Halocarpus bidwillii*) which survive in fire refugia on basin floors elsewhere in the eastern South Island. These associations are typically found in frost-prone habitats, and some of the best remaining examples in Otago occur in the Greenstone Valley (Johnson and Lee 1993). Accordingly, we mapped this vegetation as a thermally-induced ecosystem (TI1 Bog pine, mountain celery pine scrub/forest) in the most frosty parts of the Central Otago, including the Nevis Valley, upper Manuherikia Valley, southern part of the Idaburn Valley and upper Taieri Plains.

Walker *et al.* (2003) also concluded that the widespread matagouri (*Discaria toumatou*)-mingimingi (*Coprosma propinqua*) associations in Central Otago are derived from invasion of more disturbance-tolerant shrubs following destruction of the forests that used to grow in these locations. They also concluded that the broad Otago range tops supported woody vegetation as well as snow tussocks. The Singers and Rogers (2014) classification is consistent with this, as its alpine tussock ecosystems always include shrubs.

Wood and Walker (2008) identified broadleaved-scrub forest with scattered tōtara as occupying rocky gorges in Central Otago, and a likely widespread distribution of lowland ribbonwood on valley floors. In contrast, kānuka and matagouri (*Discaria toumatou*) were not recorded in the sites sampled by Wood and Walker (2008), suggesting the current abundance of these species in Central Otago is due to increased fire frequency and vegetation clearance following the arrival of humans. This does not support the modelling of Walker *et al.* (2003), which suggested kānuka-dominant woodland occurred in these gorges. However, kānuka was mapped more widely on recent landforms as described above.

2.9 Saline ecosystems

Saline and alkaline soils are located at about 200-600 metres elevation in the main basins of Otago, and were thought by Allen *et al.* (1997) to have occupied at least 40,000 hectares in Otago at the time of European settlement.

Soils are not saline where rainfall is greater than 18 inches (Cossens and Rickard 1968), but are present on brown-grey earths where rainfall is less than 18 inches. Apart from shallow or stony soils, brown-grey earths accumulate soluble salts. In the southern part of the Ida Valley, salty soils occurred to a minor extent on downlands on the toes of some fans, but the main salty area was associated with Linnburn soils on the intermediate terrace, where saline soils were present on ridges between shallow depressions (Cossens and Rickard 1968). Raeside *et al.* (1966) noted that, in general, salt concentrations were not particularly high on the Maniototo Plains, but that localised, highly saline soils did occur, scattered through the areas with lower salt concentrations. Linnburn soils had the greatest salt concentrations, with the most saline of these on the valley floors of the streams draining Rough Ridge, south of Waitoi Creek.

Rogers *et al.* (2000) noted that 40,000 hectares of saline soils had been mapped, and considered that this would all have supported saline-adapted indigenous vegetation. Given the patchy distribution of highly saline soils across the Maniototo (Raeside *et al.* 1966), it is likely that a lower proportion of the 40,000 hectares would have supported indigenous saline vegetation. Based on evidence that Linnburn soils had the highest salinity, 14,366 hectares of Linnburn soils in Central Otago were therefore mapped as the inland saline ecosystem (SA11 Kirk’s scurvy grass herbfield/loamfield) corresponding to the salt meanders, pans, and plains that have suffered the greatest loss of saline ecosystems (Rogers *et al.* 2000). This extent, which would have had varying salinity, and likely over-represents the original extent of saline vegetation, was supplemented by additional areas of hand-digitised salt knolls and salt aprons based on currently known highly saline sites.

2.10 Cliff and rockland ecosystems

As described above, CL11 Mountain tutu, Hebe, wharariki, *Chionochloa* shrubland/tussockland/rockland was applied to cliffs and rockland in upland western areas. The other two cliff ecosystems mapped were CL5 Harakeke, *Hebe elliptica* flaxland/rockland on coastal cliffs and slopes, and CL8 *Helichrysum*, *Melicytus* shrubland/tussockland/rockland on limestone cliffs in North Otago and on terrace risers in the upper Clutha basin. Limestone cliffs were located using topographical cliff symbols, but were digitised by hand as the topographic symbols were not amenable to conversion to cliff areas.

2.11 Successional ecosystems

Successional ecosystems would have been widespread in the pre-settlement natural vegetation of New Zealand, but as dynamic ecosystems, would not necessarily occur in the same places they would currently occupy if human settlement of New Zealand had not occurred. Successional ecosystems are denoted VS in the Singers & Rogers (2014) ecosystem classification. We mapped two of these in Otago: VS6 Matagouri, *Coprosma propinqua*, kōwhai scrub (grey scrub) was mapped on recent river flats and along montane stream corridors, while VS11 Short tussock grassland was mapped in western mountain valley floors alongside braided rivers where more frequent disturbance occurs, and in the coastal delta of the Waikouaiti River.

2.12 Higher-resolution ecosystem definitions

In potential ecosystem mapping in Southland Region, subunits of the Singers and Rogers (2014) classification were used in some cases. We were able to apply subunits to some ecosystem types based on their geographic distributions or elevation ranges (Table 4). Boundaries between alpine tall tussock grassland ecosystems in Fiordland had not previously been defined, but we were able to map AL7, pungent snow tussock tussockland/shrubland, into three different subunits using Wildlands staff knowledge and previous research (Lloyd 2000). The relevant unit in Otago is AL7.1, dominated by *Chionochloa crassiuscula* subsp. *torta*. Silver beech forest (CLF11) was divided into low elevation and upland subunits, based on variants 2 and 3 of Singers and Rogers (2014), while Rockland (EP1) was mapped as either siliceous rockland (EP1.1) or calcareous rockland (EP1.2). CLF6 kamahi, southern rata, podocarp forest comprises at least five sub-units (N. Singers pers. comm.) across New Zealand, with two of those used in Otago (Table 4). Finally, we created an additional subunit of CLF4, with CLF4.3 applying to rimu-dominant podocarp/broadleaved forest ecosystems on the Dunedin hills.

Table 4: Singers & Rogers (2014) ecosystem types that were divided into subunits.

Code	Ecosystem Type	Subunits
AL7	Pungent snow tussock tussockland/shrubland	AL7.1 is dominated by *Chionochloa crassiuscula* subsp. *torta*, *C. rigida* subsp. *amara*, and *C. pallens* subsp. *cadens*. and was mapped on higher mountain ranges, north of the Middle Arm of Lake Te Anau and mostly east of the Main Divide.
		AL7.2 has prominent *Chionochloa acicularis*, and was mapped in western Fiordland, west of Lake Poteriteri and the Main Divide.
		AL7.3 has prominent Chionochloa *teretifolia*, which is often co-dominant, and is mapped in south-eastern Fiordland
CLF4	Kahikatea, tōtara, matai forest	CLF4.2 occurs on better-drained hill country sites and rimu is less prominent
		CLF4.3 was mapped over the volcanic hills of Dunedin, where a wetter climate results in rimu-dominance in this forest type
CLF6	Kamahi, southern rata, podocarp forest	CLF6.1 has emergent rimu, miro and locally Hall's tōtara over a canopy of kamahi and southern rata. Occurring in humid climates typically with acidic soils (e.g. BMA) and podzols on shallow to moderate hillslopes. It was mapped in the southern and western Catlins.
		CLF6.5 comprises emergent rimu, matai, tōtara, miro and locally kahikatea over a sub-canopy kamahi, and southern rata. Occurring in sub-humid climates on brown soils on shallow to moderate hillslopes. This subunit was mapped in the eastern Catlins on the Wisp Range, and in the Kaitangata area.
CLF11	Silver beech forest	CLF11.2 was mapped above 600 m elevation, and corresponds to 'variant 2', upland silver beech forest, as described by Singers & Rogers (2014)

		CLF11.3 was mapped below 600 m elevation and corresponds to 'variant 3', southern lower elevation silver beech forest as described by Singers & Rogers (2014)
EP1	Rockland	EP1.1 'siliceous rockland', was mapped in coastal Otago
		EP1.2 'calcareous rockland' was mapped in North Otago

2.13 Non-vegetated ecosystems below treeline

Polygons for rivers and lakes were obtained from the Freshwater Environments of New Zealand (FENZ) layer. Some additional mapping was undertaken along river corridors and around lakes that the FENZ layer did not include. Some large FENZ lakes were reclassified as ephemeral wetlands in the Middlemarch area.

Beaches were mapped manually when delimiting the coastal environment.

2.14 Uncertainties in the mapping

A key issue with potential ecosystem mapping is that the outcome necessarily results in lines determining boundaries between different ecosystem types, whereas ecological boundaries between different ecosystems are sometimes diffuse or have significant inter-fingering. In addition, the certainty relating to the identification of an ecosystem is generally weaker at the boundary compared with the centre of a polygon. These considerations are particularly relevant to woody non-wetland ecosystem types such as forest, scrub, and shrubland. The consequences of these issues are that if a site is close to a boundary between different potential forest, scrub, and/or shrubland ecosystem types, then either ecosystem (on different sides of the boundary) may have been present.

Ecosystem types that are very small in extent are potentially under-represented or not accurately represented in the mapping. For example, the mapping of inland saline ecosystems (SA11) likely over-represents the extent of inland saline vegetation because it relied on soil mapping, and salinity is not uniform in those soils. Whereas mapping of WL11 Machaerina sedgeland, which would have occurred in small-scale zonations around estuarine wetlands and in some inland wetlands, will have been under-estimated in the mapping due to the lack of evidence to discriminate these small examples. Ephemeral wetlands (WL14) were one class of ecosystem that could be mapped at very small scale, as often there was a sharp outline to the natural boundaries of these ecosystems.

Other ecosystems were mapped widely, but are associated with greater uncertainty because little direct evidence of them being present in an area remains. This is particularly the case in the inland Otago basin floors, where CLF13 Matai, broadleaf forest and TI1 Bog pine, mountain celery pine scrub/forest were widely mapped. In the case of these two ecosystem types, TI1 was mapped across the very cold parts of these basins, and CLF13 in the slightly milder areas.

3. FRESHWATER AND MARINE ECOSYSTEM MAPPING

New mapping for freshwater ecosystems was not undertaken because the existing FENZ classification and mapping of freshwater ecosystems is comprehensive. The FENZ database is a recently-developed set of spatial layers that provide consistent national coverage of information about freshwater ecosystems, including their geographical distribution, their physical and biological attributes, and their current condition (Leathwick *et al.* 2010). The FENZ data sets can be accessed by sending an email to fenz@doc.govt.nz.

An existing coastal ecosystem classification and mapping scheme developed by the Ministry of Fisheries and Department of Conservation is suitable for the classification of the coastal marine environment in the Otago Region. Fourteen broad coastal marine biogeographic regions have been mapped across the New Zealand coastline, one of which (Southern South Island) occurs in Otago Region. There are four additional sub-levels based on environment type (estuarine or marine), depth (intertidal, subtidal, shallow subtidal, deep subtidal), exposure (low-medium-high) and habitat type (relating to substrate type). The coastal habitat layer is available at:

https://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/marine-protected-areas/coastal-marine-habitats-and-marine-protected-areas-in-the-new-zealand-territorial-sea-a-broad-scale-gap-analysis/

4. CURRENT ECOSYSTEM MAPPING

LCDB was used as the basis for current indigenous ecosystem mapping. It should be noted that LCDB contains widespread thematic and spatial inaccuracies so that while general patterns may be reliable, the outcomes at a particular site may be misleading.

The classification of LCDB classes into indigenous and exotic cover types is shown in Table 5. The LCDB cover types 'low producing grassland' and 'depleted grassland' LCDB types were not classified as indigenous when assessing the amount of indigenous cover remaining with an ecological district, though these cover types often contain indigenous species at low density. However, if these cover types had been included as indigenous, this would over-estimate indigenous cover. The LCDB cover type 'high producing exotic grassland' also contains many areas of indigenous vegetation, as the resolution of the mapping is poor in places like the Waipori Ecological District where incised gullies are not differentiated in LCDB. These issues mean that the actual extent of indigenous cover will be under-estimated in this report.

Table 5: Classification of LCDB cover classes into indigenous and exotic categories.

Land Cover Classes (LCDB5)	
Indigenous Cover Types	**Exotic Cover Types**
Alpine Grass Herbfield	Deciduous Hardwoods
Broadleaved Indigenous Hardwoods	Depleted Grassland
Estuarine open water	Exotic Forest
Fernland	Forest - Harvested
Flaxland	Gorse and Broom
Herbaceous freshwater vegetation	High Producing Exotic Grassland
Herbaceous saline vegetation	Low Producing Grassland
Gravel or Rock	Mixed Exotic Shrub
Indigenous Forest	Orchard, vineyard, or other perennial crop
Landslide	Short-rotation cropland
Lake or pond	Surface mine or dump

Manuka and Kānuka	Transport infrastructure
Matagouri or Grey Scrub	Urban parkland/open space
Permanent snow and ice	
River	
Sand or Gravel	
Sub Alpine Shrubland	
Tall Tussock Grassland	

Indigenous LCDB cover types were better defined by classifying them into Singers and Rogers (2004) ecosystems. Due to the extensive modification of indigenous ecosystems below treeline, many indigenous cover types no longer support their original vegetation. This means that a straightforward intersect of potential ecosystems and indigenous cover would produce misleading results. We therefore restricted the allocation of potential ecosystems to current cover as outlined in Table 6. In some cases, the choice of potential ecosystem was constrained (e.g. 'tall tussock grassland' can only be allocated to an AL ecosystem above treeline), in others whatever potential ecosystem that intersected with the LCDB polygon was allocated. Indigenous LCDB polygons retained the LCDB cover name where they were not allocated a potential ecosystem, or when there were additional mapped ecosystems within an LCDB polygon to the constrained ones.

Table 6: Classification of indigenous LCDB cover classes into Singers and Rogers (2014) ecosystem types.

Land Cover Classes (LCDB5) and Ecosystems	
Indigenous Cover Types	**S&R Ecosystem Allocation**
Alpine Grass Herbfield	The relevant potential ecosystem
Broadleaved Indigenous Hardwoods	VS5 Broadleaved species scrub/forest
Estuarine open water	Estuary
Fernland	VS10 Bracken fernland
Flaxland	WL18 flaxland
Herbaceous freshwater vegetation	The relevant WL ecosystem
Herbaceous saline vegetation	SA3 Glasswort herbfield
Gravel or Rock	Gravel or rock <400m, the relevant potential ecosystem >400m
Indigenous Forest	The relevant MF, CLF, or CDF ecosystem
Landslide	The relevant potential ecosystem
Lake or pond	Lake or Pond
Manuka and Kānuka	Differentiated using geographic and elevation limits
Matagouri or Grey Scrub	VS6 Matagouri, Coprosma propinqua, kowhai shrubland
Permanent snow and ice	Permanent snow and ice
River	River
Sand or Gravel	Sand or Gravel
Sub Alpine Shrubland	CDF2 Dracophyllum, mountain celery pine etc scrub
Tall Tussock Grassland	The relevant AL ecosystem

LCDB 'Mānuka or kānuka' polygons were differentiated into three possible units, corresponding to makahikatoa (*Kuzea serotina*) scrub and shrubland (corresponding to the TI2 ecosystem) in most inland areas, kānuka (*Kunzea robusta*) scrub/forest in coastal areas, the lower Clutha Valley, and the southern and northern slopes of the

Dunstan Mountains (de Lange 2014), and manuka (*Leptospermum scoparium*) scrub/forest allocated to LCDB 'mānuka or kānuka' polygons above 600 metres asl where kānuka was present, and above 900 metres asl where makahikatoa was present.

In the Catlins, where kānuka is absent (de Lange 2014), all LCDB 'mānuka or kānuka' polygons were allocated to mānuka scrub/forest.

5. POTENTIAL ECOSYSTEM MAPPING OUTCOMES

5.1 Wetland ecosystems

Fifteen wetland ecosystems, comprising 8,274 wetland polygons, with an average polygon size of 5.6 hectares, totalling 34,941 hectares in area, were mapped within Otago Region (Table 7). The most extensive ecosystem types mapped were WL16 red tussock, *Schoenus pauciflorus* tussockland (12,060 hectares), WL18 flaxland (6,037 hectares), and WL20 Coprosma, twiggy tree daisy shrubland (5,935 hectares).

Wetland ecosystems that were mapped as being historically uncommon in Otago included WL9 cushionfield, WL11 *Machaerina* sedgeland, WL13 sphagnum mossfield, WL15 herbfield (lakeshore turf), and WL19 raupo reedland. While Otago has abundant upland cushionfield, most of this is not wetland vegetation, and wetland vegetation comprising cushion vegetation was mostly mapped within WL8 herbfield, mossfield, sedgeland. WL11 *Machaerina* sedgeland was likely more widespread in Otago than we mapped, but is likely to have occurred in relatively small patches that were below our mapping resolution. Singers and Rogers (2004) define WL13 sphagnum mossfield as riverine/lacustrine ecosystem, rare in both the North Island and South Island. While wetlands containing *Sphagnum* are widespread and extensive in the Otago uplands, most of these comprise other wetland types, commonly WL6 lesser wire rush, tangle fern, restiad rushland/fernland and WL16 red tussock, *Schoenus pauciflorus* tussockland. In Otago, WL13 sphagnum mossfield was mapped only on the margins of two small lakes in the lower Dart River. Lakeshore turf is present on the margins of the larger Otago lakes, but was difficult to map, because of its occurrence in narrow bands along lake shores, and because lake polygons from the FENZ layer incorporate most lakeshores. Similarly, WL19 raupo reedland would have been more common than the mapping suggests, because it would also have occurred in areas mapped as lake.

Table 7: Wetland ecosystem types historically present in Otago.

S&R Ecosystem	Zone	Total Area (ha)	Number of Polygons	Mean Polygon Size (ha)
WL6 Lesser wire rush, tangle fern restiad rushland/fernland	High rainfall areas	712	40	18
WL8 Herbfield, mossfield, sedgeland	Upland and alpine areas	3,587	1,035	3
WL9 Cushionfield	Upland and alpine areas	91	72	1
WL10 Oioi restiad rushland	Lowland estuarine	388	38	10

S&R Ecosystem	Zone	Total Area (ha)	Number of Polygons	Mean Polygon Size (ha)
WL11 Machaerina sedgeland	Montane swamp	17	2	9
WL12 Mānuka, tangle fern scrub/fernland	High rainfall areas	129	15	9
WL13 Sphagnum mossfield	Montane lake margins	10	2	5
WL14 Herbfield (ephemeral wetland)	Montane basins	294	2,927	0.10
WL15 Herbfield (lakeshore turf)	Inland lake shores	2	2	1
WL16 Red tussock, Schoenus pauciflorus tussockland	Montane uplands	12,060	2,009	6
WL17 Schoenus pauciflorus sedgeland (alpine seepages/flushes)	Upland and alpine areas	3,819	1,594	2
WL18 Flaxland	Lowland swamps	6,037	98	62
WL19 Raupo reedland	Lowland and coastal lakes and inland basins	76	11	7
WL20 Coprosma, twiggy tree daisy scrub	Lowland swamps	5,935	37	48
WL22 Carex, Schoenus pauciflorus sedgeland	Lowland swamps	1,784	392	4
TOTAL		**34,941**	**8,274**	**5.6**

As noted above, the wetland mapping approach we used is a significant advance in both spatial and thematic resolution than any previous wetland mapping layer covering Otago, though numerous small (<0.5 hectares) wetlands remain un-mapped in the Lammermoor/Lammerlaw uplands. Wetland types whose current distribution and extent closely matches their potential distribution and extent are WL8 Herbfield, mossfield, sedgeland, WL13 *Sphagnum* mossfield, WL14 herbfield (ephemeral wetland), WL16 red tussock, *Schoenus pauciflorus* tussockland, WL17 *Schoenus pauciflorus* sedgeland (alpine seepages/flushes), and WL22 *Carex*, *Schoenus pauciflorus* sedgeland. These current wetland ecosystems comprise approximately two thirds of the historic extent of wetlands mapped across Otago.

5.2 Forest and scrub ecosystems

Forest historically covered most of Otago, including the inland basins that are currently devoid of indigenous forest.

CDF3 Mountain beech forest, CLF1 Hall's tōtara, mountain celery pine, broadleaf forest, CLF4 Kahikatea, tōtara, matai forest, CLF11 Silver beech forest, CLF6 Kamahi, southern rata, podocarp forest, and CLF13 matai, broadleaf forest were the predominant forest types in Otago (Table 8). These forest types were generally not mixed together and occurred in different parts of Otago. CLF4 Kahikatea, tōtara, matai forest dominated the relatively dry eastern lowland hill country within the region, while CLF1 Hall's tōtara, mountain celery pine, broadleaf forest and CLF13 matai, broadleaf forest occupied the inland basins of Central Otago. CDF3 Mountain beech forest occurred in the rainshadow mountains east of the Main Divide, while CLF11 Silver beech forest occupied mountain valleys along and close to the Main Divide, and also higher-rainfall uplands further east. CLF6 Kamahi, southern rata, podocarp forest dominated hill slopes in South Otago and in the Catlins.

Table 8: Forest ecosystem types historically present in Otago.

S&R Ecosystem	Zone	Total Area (ha)	Number of Polygons	Mean Polygon Size (ha)
CDF1 Pahautea, Hall's tōtara, mountain celery pine, broadleaf forest	East Matukituki, upper Shotover	3,678	14	263
CDF2 Dracophyllum, Phyllocladus, Olearia, Hebe scrub (subalpine scrub)	Mountain valleys above treeline	29,931	1,924	16
CDF3 Mountain beech forest	Otago lakes area	334,418	123	2,719
CDF6 Olearia, Pseudopanax, Dracophyllum scrub (subalpine scrub)	Catlins, margin of Ajax Plateau	35	1	35
CLF1 Hall's tōtara, mountain celery pine, broadleaf forest	Central Otago uplands	417,690	130	3,213
CLF2 Hall's tōtara forest (dune forest)	Old dunes	2,530	30	84
CLF4.2 Kahikatea, tōtara, matai forest		631,622	135	4,679
CLF4.3 Kahikatea, tōtara matai forest	Dunedin hills	27,965	8	3,496
CLF6.1 Kamahi, southern rata, podocarp forest	Southern Catlins, Kaitangata	54,931	185	297
CLF6.5 Kamahi, southern rata, podocarp forest	Northern Catlins	73,175	25	2,927
CLF9 Red beech, podocarp forest	Western lakes	4,425	13	340
CLF10 Red beech, silver beech forest	Western and south-western valleys	55,854	54	1,034
CLF11.2 Silver beech forest	Above 600m	141,564	514	275
CLF11.3 Silver beech forest	Below 600m	277,361	321	864
CLF12 Silver beech, mountain beech forest	Western lakes	38,593	68	568
CLF13 Matai, broadleaf forest	Inland basins	101,827	100	1,018
MF3 Matai, tōtara, kahikatea, broadleaved forest	Lowland plains	81,672	186	439
MF4 Kahikatea forest	Lowland plains	35,138	96	366
TOTAL		**2,312,409**	**3,927**	**589**

5.3 Alpine ecosystems

Nine ecosystems were historically present above treeline in Otago (Table 9), and all remain present, though some with their extent changed. For example there is less AL1 narrow-leaved and slim snow tussock tussockland/shrubland currently above treeline, due to the widespread loss of slim snow tussock due to historic fire and grazing. AL1 narrow-leaved and slim snow tussock tussockland/shrubland was historically by far the most extensive alpine ecosystem in Otago, due to its presence on all the eastern ranges and most of the western ranges. AL6 mid-ribbed and narrow-leaved snow tussock grassland was mapped in the westernmost alpine areas within Otago Region, with AL7.1 at higher elevation in these same areas. Alpine herbfield ecosystems were largely differentiated by geology and climate, with AH1 gravelfield, stonefield present on the drier, steeper mountains in the north and southwest of Otago Region, AH2 *Dracophyllum muscoides* cushionfield on the Central Otago block mountains, and AH3 gravelfield/stonefield/mixed species cushionfield in the western high-rainfall mountains. CL2 mountain tutu, *Hebe*, wharariki, *Chionochloa* shrubland/tussockland/ rockland was mostly mapped in the Eyre Mountains.

Table 9: Alpine ecosystem types historically present in Otago.

S&R or Non-Vegetated Ecosystem	Total Area (ha)	Number of Polygons	Mean Polygon Size (ha)
AH1 Gravelfield, stonefield	25,612	2,269	11
AH2 Dracophyllum muscoides cushionfield	41,095	330	134
AH3 Gravelfield/stonefield/mixed species cushionfield	45,352	1,687	27
AL1 Narrow-leaved and slim snow tussock tussockland/shrubland	448,651	1,181	380
AL6 Mid-ribbed and narrow-leaved snow tussock tussockland/shrubland	49,995	272	184
AL7.1 Pungent snow tussock tussockland/shrubland	8,347	166	50
CL11 Mountain tutu, Hebe, wharariki, Chionochloa shrubland/tussockland/rockland	500	17	29
IC1 Permanent snow and ice	14,636	510	29
SC1 Gravelfield (screes and boulderfields)	17,348	1,114	16
TOTAL	**651,536**	**7,546**	**86**

6. CURRENT INDIGENOUS ECOSYSTEM MAPPING OUTCOMES

Current indigenous ecosystems in Otago are dominated by AL1 narrow-leaved and slim snow tussock tussockland/shrubland, which remains extensive (414,328 hectares) in alpine areas, and has an additional 328,509 hectares of LCDB ‘tall tussock grassland’ below treeline, where most of it would not have historically occurred (Table 10). In total therefore there are currently 742,837 hectares of tall tussock grassland in Otago, which is approximately 300,000 hectares more than would have historically occurred. In contrast, only 212,643 hectares of broadleaved, podocarp/broadleaved, and/or beech forest remains, which is approximately 10% of the original extent of indigenous forest across Otago. At least 90,016 hectares of scrub and shrubland below treeline, and 28,447 hectares of bracken fernland have partially replaced this indigenous forest. Some coastal ecosystems, such as SA7 Ice plant, glasswort herbfield/loamfield and SA9 *Olearia, Brachyglottis, Dracophyllum* scrub/herbfield/loamfield are still present, but they are not captured as an indigenous cover type by LCDB, thus have no area or only minimal area in Table 10. Wetlands have fared differently depending on whether they are lowland or upland ecosystems, as shown by the trends for WL16 red tussock, *Schoenus pauciflorus* tussockland and WL18 flaxland. Both occurred extensively (>6,000 hectares of each) in Otago prior to human settlement, but while WL16 red tussock, *Schoenus pauciflorus* tussockland remains extensive on Otago's upland plateaux, the lowland WL18 flaxland has been reduced to 25% of its original extent.

Table 10: Current indigenous ecosystem types in Otago Region. Not all LCDB cover types could be resolved as Singers and Rogers (2014) ecosystems.

Singers and Rogers or LCDB current ecosystem	**Total Area (ha)**	**Number of Polygons**	**Mean Polygon Size (ha)**
AH1 Gravelfield, stonefield	25,591	2,268	11
AH2 Dracophyllum muscoides cushionfield	10,290	410	25
AH3 Gravelfield/stonefield/mixed species cushionfield	45,286	1,685	27
AL1 Narrow-leaved and slim snow tussock tussockland/shrubland	414,328	1,382	300
AL6 Mid-ribbed and narrow-leaved snow tussock tussockland/shrubland	49,041	264	186
AL7.1 Pungent snow tussock tussockland/shrubland	8,301	161	50
BR1 Hard tussock, scabweed gravelfield/stonefield	1,534	161	10
BR2 Scabweed gravelfield/stonefield	942	173	5
CDF1 Pahautea, Hall's tōtara, mountain celery pine, broadleaf forest	942	29	32
CDF2 Dracophyllum, Phyllocladus, Olearia, Hebe scrub (subalpine scrub)	45,657	1,902	24
CDF3 Mountain beech forest	36,231	1,219	30
CDF6 Olearia, Pseudopanax, Dracophyllum scrub (subalpine scrub)	8	8	1
CL11 Mountain tutu, Hebe, wharariki, Chionochloa shrubland/tussockland/rockland	87	11	8
CL5 Harakeke, Hebe elliptica flaxland/rockland	465	90	5
CL8 Helichrysum, Melicytus shrubland/tussockland/rockland	12	5	2
CLF1 Hall's tōtara, mountain celery pine, broadleaf forest	957	201	5
CLF10 Red beech, silver beech forest	18,053	418	43
CLF11.2 Silver beech forest	36,108	536	67
CLF11.3 Silver beech forest	37,358	534	70
CLF12 Silver beech, mountain beech forest	17,192	418	41
CLF13 Matai, broadleaf forest	144	40	4
CLF2 Hall's tōtara forest (dune forest)	26	18	1
CLF4.2 Kahikatea, tōtara, matai forest	2,597	443	6
CLF4.3 Kahikatea, tōtara matai forest	3,226	154	21
CLF6.1 Kamahi, southern rata, podocarp forest	24,746	226	109
CLF6.5 Kamahi, southern rata, podocarp forest	5,395	298	18
CLF9 Red beech, podocarp forest	884	37	24
DN3 Pingao sedgeland	315	34	9.2
DN5 Oioi, knobby clubrush sedgeland	138	9	15
EP1.1 Siliceous rockland	170	78	2
EP1.2 Calcareous rockland	0	0	0
MF3 Matai, tōtara, kahikatea, broadleaved forest	440	112	4
MF4 Kahikatea forest	199	55	3
SA11 Kirk's scurvy grass herbfield/loamfield	0.3	2	0.2
SA3 Glasswort herbfield	600	214	2.8

Singers and Rogers or LCDB current ecosystem	**Total Area (ha)**	**Number of Polygons**	**Mean Polygon Size (ha)**
SA5 Herbfield (coastal turf)	19	9	2
SA7 Ice plant, glasswort herbfield/loamfield	0	0	0
SA9 Olearia, Brachyglottis, Dracophyllum scrub/ herbfield/loam field (mutton bird scrub)	0	0	0
SC1 Gravelfield (screes and boulderfields)	13,885	1,309	11
TI1 Bog pine, mountain celery pine scrub/forest	93	38	2
TI2 Kānuka, Olearia scrub/treeland	36	21	2
TI4 Coprosma, Olearia, matagouri scrub (grey scrub)	26	34	1
TI6 Red tussock tussockland	17	20	1
VS10 Bracken fernland	28,477	683	41
VS11 Short tussock grassland	0.2	1	0.2
VS5 Broadleaved species forest	27,684	2,300	12
VS6 Matagouri, Coprosma propinqua, kōwhai scrub (grey scrub)	32,145	3,212	10
WL10 Oioi restiad rushland	269	28	10
WL11 Machaerina sedgeland	17	2	8
WL12 Mānuka, tangle fern scrub/fernland	131	15	9
WL13 Sphagnum mossfield	11	7	2
WL14 Herbfield (ephemeral wetland)	345	3,032	0.1
WL15 Herbfield (lakeshore turf)	0	0	0
WL16 Red tussock, Schoenus pauciflorus tussockland	12,297	2,044	6
WL17 Schoenus pauciflorus sedgeland (alpine seepages/flushes)	3,840	1,594	2
WL18 Flaxland	1,564	109	14
WL19 Raupo reedland	76	13	6
WL20 Coprosma, twiggy tree daisy scrub	4,167	49	85
WL22 Carex, Schoenus pauciflorus sedgeland	2,238	639	4
WL6 Lesser wire rush, tangle fern restiad rushland/fernland	750	34	22
WL8 Herbfield, mossfield, sedgeland	3,645	1,045	3
WL9 Cushionfield	95	73	1
LCDB cover types not differentiated into S&R types			
Estuary	112	359	0.3
Gravel or Rock	8,233	777	11
Herbaceous freshwater vegetation	3	1	3
Indigenous forest	461	736	1
Kānuka scrub/forest	33,342	1,789	19
Lake or pond	77,808	1,241	63
Makahikatoa scrub and shrubland	12,292	908	14
Mānuka scrub/forest	12,840	1,309	10
Permanent ice or snow	14,671	519	28
River	8,484	265	32
Sand or gravel	51	54	1
Tall tussock grassland	328,509	5751	58

ACKNOWLEDGMENTS

Rachael Brown of Otago Regional Council is thanked for providing project liaison. John Leathwick is thanked for discussion on potential ecosystems from inland Otago. John Barkla is thanked for undertaking a peer review of the mapping.

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Appendix 14: Wildlands Report (2021b)

AN OVERVIEW OF THE STATE OF INDIGENOUS BIODIVERSITY IN THE OTAGO REGION

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AN OVERVIEW OF THE STATE OF INDIGENOUS BIODIVERSITY IN THE OTAGO REGION

Contract Report No. 5704a

March 2021

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EXECUTIVE SUMMARY

A review was undertaken on the current state and trend of indigenous biodiversity in Otago, including positive trends and actions, and current pressures and issues affecting indigenous biodiversity.

Otago has an important role to play in the maintenance of Aotearoa/New Zealand's indigenous biodiversity, because key features are only located in Otago. Nationally-significant indigenous biodiversity features in Otago include inland saline habitats, a large assemblage of ephemeral wetlands, endemic and threatened inland galaxiid fish and lizard populations, western forest habitats, and coastal fauna such as New Zealand sea lion which have recently re-colonised the Otago coast. Fenced sanctuaries and numerous community groups are playing a significant role by working with agencies to maintain and enhance indigenous biodiversity across Otago, particularly in western Otago and coastal Otago. Significant investment in mapping and surveys has resulted in a better understanding of the distribution of indigenous biodiversity in Otago, and generated new tools to help manage Otago's indigenous biodiversity.

On the negative side, the widespread loss and modification of indigenous vegetation and habitats in lowland and montane areas has profoundly affected populations of indigenous fauna, and those that are sensitive to predation have been additionally affected and have retreated to refuge habitats. Coastal forest has been significantly depleted along much of the Otago coast, and coastal treelands are experiencing attrition and will not persist in the long term if current management continues. There are few remaining options to protect outwash plain herbfield and grassland in Otago, and the limited remaining extent of this ecosystem that remains has diminished ecological functioning. Montane tussock grassland has experienced considerable recent loss of extent. Lowland wetlands remain subject to a range of Marine ecosystems are not currently managed for the indigenous biodiversity values, and there is no network of marine protected areas off the Otago coast. Estuaries are vulnerable to infilling, drainage, and the influences of upstream land use activities. There are also significant information deficiencies, e.g. identification by councils of significant indigenous vegetation and significant habitats of indigenous fauna has been patchy, and relatively few sites have been scheduled in district plans to date

CONTENTS

1. INTRODUCTION

Otago Regional Council (ORC) are currently undertaking a legal review of the draft Otago Regional Policy Statement, and are working to finalise the Indigenous Biodiversity Chapter. As such, ORC requires a succinct report on the 'state of play' for indigenous biodiversity in the Region, and Wildland Consultants were commissioned to provide this assessment.

2. METHODS

A review was undertaken of information on the current state and trend of indigenous biodiversity in Otago Region, drawing on recent relevant Otago-wide assessments such as mapping of potential and current ecosystems (Wildland Consultants 2020a) and habitats of indigenous fauna (Wildland Consultants 2020b), and summaries of issues relating to indigenous biodiversity in Otago (Wildland Consultants 2017) These Otago-wide reports are based on numerous sources of information including spatial layers of soils, geology, and land cover, information from databases containing records of indigenous fauna, and many articles and reports. The Otago component of national scale trends in vegetation cover was assessed from the most recent version of the Threatened Environment Classification (Cieraad *et al.* 2015). A range of other reports and articles providing information on specific sites in Otago were also reviewed and are cited elsewhere in this report. Wildlands staff knowledge and observations of the state and issues relating to indigenous biodiversity were also used. Territorial local authority plans were briefly reviewed to assess policies on recognition and protection of significant areas of indigenous vegetation and significant habitats of indigenous fauna.

3. INDIGENOUS BIODIVERSITY VALUES

3.1 Indigenous forest and scrub

Otago retains a diverse range of forest, scrub, and shrubland types (Wildland Consultants 2020a), spanning climatic and soil gradients, including:

- A very extensive tract of western indigenous forest, on the lower and mid-slopes of mountain ranges in the catchments of Lake Whakatipu, Wanaka, and Hawea:
  - Mixed beech forests in the higher-rainfall western valleys.
  - Red beech (*Fuscospora fusca*) forest in tributary valleys at the head of Lake Wakatipu, a keystone forest type for cavity-nesting and cavity-roosting indigenous fauna.
- Mountain beech (*Fuscospora cliffortioides*) forest in the drier valleys east of the Main Divide.
- Significant remnants of silver beech (*Lophozonia menziesii*) forest in south-eastern Otago.
- Remnants of rare eastern matai-totara forest from the Clutha catchment north to the Waianakarua catchment.
- Rimu-miro dominant forest is present on the Dunedin hills.

- Indigenous forest on lowland alluvial sites has become extremely scarce in Otago
- Rata-kamahi forest south of the Taieri River and in the Catlins uplands.
- Cedar forest on the upper slopes of the Dunedin hills, on elevated sites in the Catlins, and in the East Matukituki and upper Shotover Valleys.
- Kānuka (*Kunzea robusta*) forest is widespread on coastal hill country, and comprises an important habitat for indigenous forest birds such as tītitipounamu (rifleman; *Acanthissita chloris*) but tends to be under-appreciated by landholders, and thus frequently subject to clearance.
- Makahikatoa (*Kunzea serotina*) scrub in inland areas, notably at Bendigo, in the upper Clutha terraces and foothills, and at Mānuka Stream Scenic Reserve in the Macraes Ecological District.
- Two types of subalpine scrub, one in the Catlins and one in the western mountains.
- Coprosma-matagouri scrub is widespread in Otago, and is present in areas formerly occupied by indigenous forest.

The western forest tract provides important habitat for kea (*Nestor notabilis*), kaka (*N. meridionalis*), mohua (*Mohoua ochrocephala*), and long-tailed bat (*Chalinolobus tuberculatus*), with the Catlins forest also being important for the latter two species (Wildland Consultants 2020b). The larger forested areas associated with the western lakes, Catlins, upper Pomahaka River, Blue Mountains, Dunedin area, and Waianakarua catchment provide significant habitat for forest birds, with kānuka-dominant forest often comprising this significant habitat in eastern and central Otago. Forest in the Catlins provides significant habitat for Tautuku gecko (*Mokopirirakau* 'southern forest'), while forest in the Waianakarua catchment provides important habitat for jewelled gecko (*Nautilinus gemmeus*).

3.2 Tussock grassland and herbfield

3.2.1 Montane tall tussock grassland

Montane tussock grassland habitat remains extensive in Otago, and occupies areas where indigenous forest has been displaced (Wildland Consultants 2020a). While montane tall tussock grassland does not represent the original natural vegetation, it has value as a successional stage that will increasingly develop into indigenous woody vegetation, provides habitat connectivity between rock outcrops and shrubland (Berry *et al.* 2005; Gebauer *et al.* 2013), and contains habitats such as rock outcrops and ephemeral wetlands that are important habitats for indigenous biodiversity (Wildland Consultants 2017). For example, montane tall tussock grassland and its embedded rock outcrops provide significant habitat for indigenous lizards, most notably for Otago skink (*Oliogosma otagense*) and grand skink (*Oligosoma grande*) in the Macraes Ecological District and in western Otago, but also for jewelled gecko in other areas.

3.2.2 Outwash plain herbfield and grassland

Uncultivated outwash plain habitats generally support low-stature short tussock grassland and herbfield, providing habitat for At Risk plant species such as *Pimelia sericeovillosa* subsp. *pulvinaris* and *Raoulia australis*, and formerly providing important breeding habitat for braided river birds such as banded dotterel (*Charadrius bicinctus bicinctus*; Threatened-Nationally Endangered).

3.2.3 Alpine grassland and herbfield

The alpine zone in Otago ranges from relatively intact alpine grassland, herbfield, and gravefield habitats in the western mountains, to more modified alpine habitats on the Central Otago block mountains which none the less retain extensive and distinctive indigenous herbfield and grassland. The following alpine vegetation and habitat types are represented in Otago (Wildland Consultants 2020a):

- Three alpine tussock grassland ecosystem types, two of which are restricted to the western mountains.
- Three alpine herbfield ecosystems types, including distinctive *Dracophyllum muscoides* cushionfield on the higher Central Otago block mountains, which may be unique to Otago.
- Screes and boulderfields.
- Permanent ice and snow

Alpine habitats remain dominated by indigenous vegetation, however the natural extent of tussock grassland has been reduced in the eastern block mountains, with the extent of herbfield increasing in response.

Alpine and subalpine habitats provide significant habitat for a wide range of indigenous lizard species in Otago, including Burgan skink (*Oligosoma burganae*), Nevis skink (*Oligosoma toka*), orange-spotted gecko (*Mokopirirakau* 'Roys Peak'), North Otago black-eyed gecko (*Mokopirirakau* aff. *kahutarae* 'North Otago'), Oteake skink (*Oligosoma* aff. *inconspicuum* 'North Otago'), scree skink (*Oligosoma waimatense*), rockhopper skink (*Oligosoma* sp.), lakes skink (*Oligosoma* aff. *chloronoton* 'West Otago'), and alpine rock skink (*Oligosoma* sp.). The Hawkdun Range and Ida Range provide significant alpine and subalpine habitat for a number of these species (Wildland Consultants 2020b). Alpine habitat in the western lakes area provides significant habitat for rock wren (*Xenicus gilviventrus*)

3.3 Limestone ecosystems

The Shag/Waihemo Valley and North Otago contain cliffs and scarps of calcareous rocks, an originally rare ecosystem type (Williams *et al.* 2007) classified as Nationally Vulnerable (Holdaway *et al.* 2012). Limestone outcrops are key habitats for Threatened and At Risk plant species, but are relatively poorly-known in Otago Region, and a number are affected by quarrying.

3.4 Inland saline ecosystems

Otago Region contains nationally significant inland saline habitats, including areas of saline/sodic soils (salt pans) in the Maniototo and in the upper Clutha basin, and New Zealand's only confirmed inland salt lake at Sutton. A number of rare plant species are specialised to these habitats, including the rare indigenous cress *Lepidium kirkii* (Threatened-Nationally Critical) and the rare geometrid moth *Paranotoreas fulva* (At

Risk-Relict; Stringer *et al.* 2012). Most salt pans are threatened by land use intensification involving cultivation and irrigation, and by invasion of exotic weeds (Wildland Consultants 2011).

3.5 River and lake ecosystems

Otago Region contains rare lake and river systems, on a national basis. For example the Lake Waihola-Waipori complex is nationally rare, and the Tautuku River is the only example of an east coast South Island river that has a catchment with over 95% indigenous cover. Sutton salt lake near Middlemarch is New Zealand's only confirmed example of a salt lake, and its bed supports distinctive indigenous turf vegetation when dry. Many rivers and streams in Otago support diverse populations of indigenous fish and invertebrates. Thirteen of these indigenous fish species are classified as Threatened or At Risk, which is the most of any region of New Zealand. Most of these Threatened and At Risk species are galaxiid fish of inland areas.

Many of Otago's rivers provide important breeding habitat for avifauna, including Threatened species such as black-billed gull (*Larus bulleri*) and black-fronted tern (*Chlidonias albostriatus*). Important bird areas for seabirds, including the above two species, have been mapped in the Hunter River, Makarora River, Wilkin River, Matukituki River, Dart River, Rees River, Caples River, Greenstone River, Nevis River, upper Manuherikia River, and upper and lower Clutha River (Wildland Consultants 2020b). Mountain rivers provide important habitat for whio/blue duck (*Hymenolaimus malacorhynchos*).

The western lakes (Lake Wakatipu, Lake Wanaka, Lake Hawea, and Lake Dunstan) provide important habitat for southern crested grebe (*Podiceps cristatus australis*) (Wildland Consultants 2020b).

3.6 Freshwater wetlands

3.6.1 Lowland and montane wetlands

Examples of lowland harakeke (*Phormium tenax*) wetlands remain in the Lakes Waipori-Waihola wetland complex, and in gullies in south Otago. The most common freshwater wetlands in the hill country are *Carex*-dominant swamps in gullies, which often persist in more modified landscapes, and copper tussock swamp and marsh wetlands in montane areas, the latter often adversely affected by drainage.

Lowland and montane wetlands provide important habitat for Australasian bittern (*Botaurus poiciloptilus*) and mātātā/South Island fernbird (*Bowdleria punctata punctata*), with important fernbird habitats mainly present in wetlands in eastern Otago, and Australasian bittern having important habitat these eastern wetlands as well as in the upper Taieri River, upper Manuherikia River, lower Dart River, and Matukituki River.

Ephemeral wetlands are numerous in the dry montane basins of inland Otago, with approximately 3,000 ephemeral wetlands mapped by Wildland Consultants (2020a). Ephemeral wetlands are a Critically Endangered (Holdaway *et al.* 2012), historically rare (Williams *et al.* 2007) ecosystem type. They are key habitats for Threatened and

At Risk plant species, and larger examples can provide important habitat for wading birds such as pied stilt (*Himantopus himantopus leucocephalus*) and banded dotterel.

3.6.2 Upland wetlands

Upland wetlands include widespread peat bogs in gullies, seepages on steep hillsides, and low stature wetlands dominated by cushionfield and herbfield/mossfield/sedgeland on the summits of the inland block mountains (Wildland Consultants 2020a). Distinctive scroll plains occur in the upper Taieri River and as smaller examples in the larger inflow streams of the Loganburn Reservoir and Lake Onslow (Wildland Consultants 2020f). The less-modified scroll plains provide important habitat for rare plant species.

3.7 Coastal margins

3.7.1 Dune systems

Dune systems occur in various locations south of the Waihemo/Shag River, with small sand spits protecting the estuaries of the Waihemo/Shag River and Pleasant River, and more extensive sand spits at the mouth of the Waikouaiti River mouth and the Blueskin Bay estuary. Dune systems also occur at Purakaunui and Aramoana, and are extensive on the Otago Peninsula at Okia Flat, Allans Beach, and Sandfly Bay, but apart from Okia Flat, these dune systems are largely dominated by exotic vegetation. The same is true of smaller dune systems further down the Otago coast until the Catlins, where old dune systems at Tahakopa Bay, Tautuku Bay, and Waipati Beach are largely covered in indigenous vegetation, including forest and wetlands.

3.7.2 Marine mammal breeding habitats

New Zealand sea lion (*Phocarctos hookeri*) were historically distributed around the entire length of the New Zealand coast, and bred around the South Island coast, but were entirely extirpated from mainland New Zealand by historic sealing activity. They have since recolonised Rakiura and the Otago coast from the subantarctic islands where breeding populations persisted. In coastal Otago, the first pup born in 1993 marked the resumption of mainland breeding, and around 10-20 pups are currently born in coastal Otago annually[1]. The extension of New Zealand sea lion's range by recolonisation of the mainland is considered essential to the long term survival of the species[2].

New Zealand fur seal (*Arctocephalus forsteri*) breeding colonies have also re-colonised the Otago coast, with breeding being recorded in 1978 after a long absence, and there are now numerous breeding colonies on Otago Peninsula, with a significant increase in pup production since 1983 (Bradshaw *et al.* 2000).

3.7.3 Coastal bird habitats

[1] https://www.sealiontrust.org.nz/
[2] https://www.doc.govt.nz/nature/native-animals/marine-mammals/seals/new-zealand-sea-lion/species/biology/

Important coastal bird habitats have been mapped in Oamaru harbour, at points and headlands along the North Otago coast, at Aramoana and along both sides of the mouth of Otago Harbour, along much of the outer coast of the Otago Peninsula, Tunnel Beach, Green Island, and along many parts of the Catlins coast from Nugget Point to Waipati Beach. Key bird species that utilise these habitats include hoiho (*Megadyptes antipodes*), northern royal albatross (*Diomedea sanfordi*), black-fronted tern, white-fronted tern (*Sterna striata striata*), red-billed gull (*Larus novaehollandiae scopulinus*), spotted shag (*Stictocarbo punctatus punctatus*), and Otago shag (*Leucocarbo chalconotus*).

3.7.4 Estuaries

Large estuaries are concentrated at two locations in Otago Region: at northern group including the mouth of the Pleasant River, Karitane, Blueskin Bay, Purakaunui Bay, Aramoana, Papanui Inlet, Hoopers Inlet, and Kaikorai Stream, and another cluster in the Catlins, comprising estuarine systems at the mouths of the Catlins, Papatowai, Fleming, and Waipati Rivers. Smaller estuaries and coastal lagoons are associated with many smaller rivers and streams in coastal Otago.

A number of estuarine tidal sandflats and mudflats supporting saltmarsh vegetation, seagrass beds, shellfish beds and aquatic birdlife provide significant habitat for biodiversity. Estuaries provide nursery habitat for many types of fish, particularly flatfish and galaxiids, and are an important part of the migration pathways and feeding and staging areas for a range of species, such as wading birds (godwits, herons), seabirds, and diadromous fish.

Two Catlins estuaries are largely intact and warrant special attention:

- *Tahakopa Estuary*

  The Tahakopa Estuary comprises modified mud flats with a small area of salt marsh turf and an extensive area of oioi (*Apodasmia similis*). This intricate area of wetland is of special significance for wading birds and galaxiid breeding; flatfish are also a feature of the estuary's biodiversity. This relatively pristine estuary has significant ecological values.

- *Tautuku Estuary*

  The Tautuku Estuary is a largely unmodified estuary with a catchment largely comprising indigenous forest and protected wetlands. The estuary contains pristine saltmarsh and estuarine communities, and is an important breeding ground for black flounder (*Rhombosolea retiaria*) and yellow-belly flounder (*Rhombosolea leporina*). The estuary is also an important habitat for mātata.

3.8 Marine ecosystems

The Otago coastline can be broadly categorised into five distinct environments (Wildland Consultants 2017):

- Lower extent of the Canterbury Bight, a coastline dominated by mixed sand and gravel beaches and braided rivers with lagoons/hapua at their outlets to the sea.

- Northern Otago coast, a sedimentary rock coast with shallow subtidal reefs supporting forests of giant kelp.

- Otago Peninsula, a prominent volcanic landform that strongly influences coastal currents, bordered to the east by a narrow shelf and deep-water canyons that are found relatively close inshore.

- Clutha coastline, strongly influenced by fresh water input and sediment from the Clutha River, the biggest river by volume in New Zealand, which has a major effect on the chemistry and productivity of the coastal shelf waters.

- The Catlins, a cliffed and embayed coastline with old erosion-resistant sedimentary rocks that is strongly influenced by tidal currents and the outflow from Foveaux Strait/Te Ara a Kewa.

This stretch of coastline is recognised as distinct due to the mixing of sub-Antarctic and sub-tropical waters along the coast. In particular, the Southland Current is a special and major influence on the marine ecology of the area. Where the current heads north past the Otago Peninsula, the headland and offshore deep canyons narrow the current, creating periods where nutrients from deeper waters are pushed up and become available in coastal waters. The information below is summarised from Wildland Consultants (2017)

3.8.1 River influences

The Waitaki River and Clutha River influence marine biodiversity, both in terms of freshwater input to the marine environment and the sediment that is transported to the sea. The area surrounding the Waitaki River is known to be an important foraging area for seabirds (including southern blue penguin - *Eudyptula minor minor*) and Hector's dolphin (*Cephalorhynchus hectori hectori*). Rhodolith beds, often associated with high biodiversity value, are also likely to be associated with cobble habitat in this area, as well as known kelp beds that are important for juvenile fish species. In addition, some of the densest areas of squat lobster (*Munida gregaria*) have historically been found around the Waitaki River mouth.

3.8.2 Shallow intertidal and subtidal habitats

Subtidal habitats include forests of giant bladder kelp (*Macrocystis pyrifera*) and bull kelp (*Durvillaea antarctica*), with other dominant brown kelp species below depths of three metres. Giant bladder kelp is a habitat-forming indigenous kelp that provides important habitat for fisheries, and is long-lived but recovers slowly after damage. It forms the base of complex food webs which provide for both coastal and pelagic species, such as rock lobster (*Jasus edwardsii*). Kelp understoreys also consist of a diverse assemblage of small red seaweeds, and a variety of sponges, bryozoans and solitary ascidians.

Beaches and subtidal sediments across coastal Otago contain shellfish species - such as cockle/tuaki (*Austrovenus stutchburyi*), tuatua (*Paphies subtriangulata*), and horse mussel (*Atrina zelandica*) - that create extensive shellfish beds, as well as containing marine worms and crustacea.

3.8.3 Biogenic habitats

Biogenic reefs are found throughout the Otago marine environment. Bryozoan beds enhance local biodiversity by providing attachment surfaces for invertebrates such as anemones, and places for other animals to hide from predators. Juvenile tarakihi (*Nemadactlyus macropterus*) are associated with tube worm habitats along the East Coast of the South Island, while blue cod (*Parapercis colias*) are associated with Otago bryozoan beds.

Seagrass beds have been identified in the Otago Harbour, Papanui Inlet, Blueskin Bay, Waikouaiti River and at Moeraki. New Zealand has only one species of seagrass, *Zostera muelleri*, which provides a range of ecosystem services, including provision of habitat, refuge, shelter and nursery grounds; they are identified as "hotspots" of biodiversity and productivity, involving macroinvertebrate and fish assemblages.

Biogenic habitat in Otago Region includes dense assemblages of sponges, tulips and tubeworms which occur offshore from north of Oamaru to the Waianakarua River; these provide habitats for a multitude of invertebrate species, and nurseries for fish including blue cod, rock lobster and tarakihi.

3.8.4 Deep subtidal habitats

Relatively little is known regarding the biology of the deep subtidal shelf area in Otago; the main research focus has been on an extensive area of bryozoan beds on the mid and outer shelf directly east of Otago Peninsula. The heads of several canyons (Karitane Canyon, Papanui Canyon, and Saunders Canyon) are located within the 12 nautical mile limit of the Otago marine area. These habitats are important deep slope environments, with diverse fauna including brittle stars, sea stars, gastropods, bivalves, shrimps, hermit crabs, bryozoans, sponges and quill worms. They are known hotspots for whales and for seabird activity. Shephard's beaked whale (*Tasmacetus shepherdii*), one of the world's least known cetaceans, was recently sighted for the first time in New Zealand waters in the vicinity of the Saunders and Taiaroa Canyons. Deep offshore reefs and gravels (such as one offshore of Akatore, with areas of ice-age relict shoreline gravel) are likely suitable habitat for bryozoans. These areas also provide offshore feeding habitats for yellow-eyed penguins from Otago Peninsula. Also likely to be feeding in the area are New Zealand fur seal, sooty shearwater (*Puffinus griseus*), Buller's albatross (*Thalassarche bulleri*), and white-capped albatross (*Thalassarche cauta*).

3.8.5 Marine fauna

The Otago marine environment is an important foraging area for marine mammals and seabirds. There are a number of important bird areas located within the Otago marine environment, comprising important feeding habitat for seabirds such as hoiho and pelagic birds (Wildland Consultants 2020b)

The endangered great white shark (*Carcharodon carcharias*) and basking shark (*Cetorhinus maximus*) occur seasonally off the Otago coast but there is currently limited data available on their movement and habitat requirements.

The Otago Region was previously an important calving ground for southern right whale (*Eubalaena australis*) in New Zealand; this recovering population is now frequently sighted off the Otago coast, particularly during the winter months.

Hector's dolphin inhabits coastal waters around Otago peninsula, north of Moeraki, and the southern Catlins near Waikawa Harbour.

Two other marine mammals, in addition to New Zealand sea lion and New Zealand fur seal, are occasionally present on Otago beaches.

Leopard seals (*Hydrurga leptonyx*) are a regular seasonal occurrence in winter. Sightings of leopard seals between Aramoana and Karitane have been reported to or observed by the Department of Conservation in most years since 1999.

Southern elephant seal (*Mirounga leonina*; Threatened-Nationally Critical) are less frequently seen, although dead seals are often washed ashore by the Otago Peninsula eddy. A yearling elephant seal has previously been recorded on Warrington Beach for a short period.

4. POSITIVE TRENDS AND ACTIONS

A number of positive trends and actions have occurred in recent decades, relating to natural processes, direct actions by people to restore and enhance indigenous biodiversity, and generation of new information and tools.

4.1 Natural regeneration

In the absence of fire, woody indigenous vegetation is slowly increasing in extent, structure, and composition in protected areas where indigenous woody seed sources remain, and outside these areas where woody weeds are scarce.

For example, in the Silver Peaks and Silver Stream catchment north-west of Dunedin, extensive areas of former tussock grassland and mānuka (*Leptospermum scoparium*) shrubland have undergone transitions into more complex kānuka (*Kunzea robusta*) forest and kānuka-broadleaved forest, and these transitions are ongoing.

Another example of this is in Central Otago where makahikatoa (*Kunzea serotina*) scrub has increased in density in recent decades, and is providing more habitat for indigenous forest birds and invertebrates. The traits that have allowed makahikatoa to increase are its relative unpalatability to mammalian browsing animals, and its resilience to fire.

4.2 Fenced sanctuaries

Fenced sanctuaries in Otago include the 307 hectare Orokonui Ecosanctuary, which protects forest habitat near Dunedin, two small (18 hectare and 10 hectare) fenced sanctuaries for Otago skink and grand skink at Macraes, and the 14 hectare Mokomoko Dryland Sanctuary near Alexandra. These ecosanctuaries have all been developed in the last two decades, with the two inland sanctuaries playing a critical role in conservation of Otago skink and grand skink, and Orokonui Ecosanctuary showcasing a highly-functioning forest ecosystem and core protected habitat for forest birds.

4.3 Planting projects

Community groups and private landholders are actively implementing planting projects in many parts of Otago (Wildland Consultants 2017). Particularly important planting projects are being undertaken in coastal and near-coastal habitats north of Dunedin, where coastal forest is significantly reduced and fragmented. This includes small planting projects undertaken on the margins of the lower Waikouaiti River, on riverbed land and Māori reserve land, by the River-Estuary Care: Waikouaiti-Karitane community group and Kati Huirapa ki Pukeraki, and plantings on Potato Point above Purakaunui, by private landholders. More extensive planting has been undertaken on the southern margins of the Pleasant River estuary, as part of a resource consent enabling clustered coastal housing (Wildland Consultants 2007). These projects are relatively small but, collectively, help to reverse the ongoing loss and attrition of coastal forest in North Otago. These projects show that planting sites can be generated by a range of processes.

4.4 Pest plant control

Significant funding has been directed toward wilding conifer control in Otago (Wildland Consultants 2017), following prioritisation and reprioritisation of wilding conifer control (Wildland Consultants 2016; 2018a) which is mainly undertaken by trusts. This is reducing the extent of wilding conifer infestations in Otago.

4.5 Pest animal control

Landscape-scale predator control is being implemented in a number of locations in the Queenstown Lakes area, including four main trapping hubs:

- Makarora catchment
- Matukituki catchment
- Dart-Rees catchment
- Queenstown-Arrowtown

There are currently 7,300 traps deployed across these areas: 2,000 by the Department of Conservation and 5,300 by community groups (Wildland Consultants 2020d). Additional drops of 1080 poison are also undertaken as part of the Department of Conservation 'Battle for the Birds. The Department of Conservation is principally operating in national parks and conservation estate in the Southern Alps and on islands in Lakes Wakatipu and Wanaka. Community-based trapping occurs in a diverse range of locations, including national parks, on braided rivers, lake edges, pastoral grasslands, and peri-urban areas. Much of the community group activities support and buffer Department of Conservation initiatives. These trapping initiatives help to protect forest birds, braided river birds, pekapeka/long-tailed bat, whio/blue duck, rock wren, kea, southern crested grebe, and Australasian bittern (Wildland Consultants 2020d). As such, these programmes are important for the maintenance of these nationally Threatened species (Robertson *et al* 2017) in Otago.

4.6 Information gains

Recent mapping of potential ecosystems across Otago (Wildland Consultants 2020a) is a key resource for ecological restoration projects, as it provides information on the ecosystems that ecological restoration should strive to restore. Another important mapping project was mapping of significant habitats of indigenous fauna (including birds, bats, lizards, fish, terrestrial habitats of invertebrates, seabirds, and marine mammals, and marine habitats including seabird feeding sites, benthic habitats, and (Wildland Consultants 2020b). Dunedin City Council recently commissioned detailed mapping of both indigenous and exotic cover across Dunedin City District (Wildland Consultants 2020e). This mapping goes some way toward mapping the extent of existing wetlands in Otago, as is required under the National Policy Statement for Freshwater Management.

The Department of Conservation has invested resources to better understand Data-Deficient lizard taxa and other rare lizards. This has resulted in information that significantly improved knowledge of the distributions of species such as the Tautuku gecko (Wildland Consultants 2018b) and Burgan skink (Wildland Consultants 2019) and also developed effective monitoring methodologies for these taxa.

5. PRESSURES AND ISSUES

5.1 Threatened and At Risk environments

The Threatened Environment Classification (Cieraad *et al.* 2012) illustrates the extent of human modification of Otago. The classification shows a significant loss of vegetation cover from lowland areas including lowland plains, basins, and river valleys, most of which retain less than 20% of their original cover, while upland areas retain more indigenous vegetation cover. Many montane slopes east of the Main Divide have land environments that have retained more than 30% of their original indigenous cover, but lack legal protection of this habitat, particularly in the Knobby Range-Rough Ridge area.

5.2 Lowland forest

In terms of extent, Otago has experienced very significant loss of forest cover, with an estimated 10% of the original forest cover remaining (Wildland Consultants 2020a). Additionally, while Otago retains a reasonable diversity of its original forest types, no representative examples remain of the forest types that once covered the Central Otago basins and mountain slopes.

On coastal landforms, there is evidence of recent clearance of what little indigenous forest and treeland remains. In addition, treelands present in the drier coastal environment from Otago Harbour north to the Waihemo/Shag River are experiencing gradual attrition and are not likely to persist in the long term if current management persists.

5.3 Outwash plain habitat

Indigenous habitats on the outwash plains in the Hawea-Wanaka basin have become very scarce following the expansion of pivot irrigation in recent years. These habitats have generally not been perceived as important by land managers, and until recently, were not protected by indigenous vegetation clearance rules, leading to their widespread transformation through pastoral intensification. Only small examples now remain on the margins of the Hawea outwash plain, where parts of the outwash plain edge and terrace risers are protected by QEII covenants.

5.4 Limestone habitat

Limestone ecosystems generally have little indigenous cover remaining, and are subject to invasion of exotic weeds that threaten to overwhelm any rare plants remaining on these limestone habitats. Restoration of indigenous forest around limestone outcrops could potentially help to maintain partially shaded limestone habitats, that provide habitat for rare plant species. This has been suggested in management plans for the Wai o Toura/Gards Road and Waipata/Earthquakes limestone ecosystems (Wildland Consultants 2016a; 2020c) now protected as public conservation land, just outside Otago Region in the Waitaki Valley.

5.5 Lowland wetlands

Lowland and montane wetlands remain vulnerable to clearance and drainage, with recent examples of wetland drainage and vegetation clearance resulting in compliance action from the Council. Lowland harakeke wetlands have been significantly reduced from their historic extent (Wildland Consultants 2020a).

Ephemeral wetlands are common in dry parts of Otago, but most are highly modified by invasion of exotic grasses and herbs. They are very poorly protected, with only about 6% of ephemeral wetland area occurring in legally protected areas, and are vulnerable to activities such as open-cast mining and pastoral intensification. Some ephemeral wetlands have been assessed for their ecological significance in Waitaki District (e.g. Wildland Consultants 2018c), but in general the values and condition of Otago’s ephemeral wetlands are not well documented.

5.6 Upland wetlands

Otago’s upland wetlands are extensive and relatively intact above 800 metres elevation, but only 16% of these wetlands occur in protected areas. They are therefore more vulnerable to modification and clearance from activities such as intensification of farming, and large developments such as the proposed Lake Onslow pumped storage system.

5.7 Marine ecosystems

Marine ecosystems and indigenous biodiversity are not managed for their indigenous biodiversity values. A network of marine protected areas has yet to be established off the Otago coast, despite several rounds of consultation. Marine fauna that use terrestrial habitats during their life cycles receive better conservation management. Marine mammals are monitored by the Department of Conservation who also advocates on their behalf. Penguins are managed by NGOs and nature-based tourism operators. Smaller sea birds such as fairy prion and sooty shearwater are managed primarily by NGOs and have tenuous hold on the mainland.

5.8 Estuaries

Otago's estuaries are threatened by infilling and drainage to create pasture, invasion by exotic plants such as spartina (*Spartina ×anglica*), and effects on water quality due to upstream land uses. Estuaries receive little management but seven estuaries (the Kakanui, Shag, Waikouaiti, Kaikorai, Taieri, Tokomairiro, and Catlins Lake) are monitored by the Council. An estuary state of the environment report (ORC 2009) showed that all had elevated levels of nutrients.

5.9 Montane tall tussock grassland

Montane tall tussock grassland has been significantly reduced in some areas, such as in the area between Maungatua and the Lammermoor Range, and in the Macraes Ecological District (Cieraad *et al.* 2012). Much of the remaining montane snow tussock grassland is unprotected and un-managed. Tall tussock stature and the condition of tall tussock grassland vegetation will be declining in the majority of unprotected areas of montane tall tussock grassland habitat, due to the ongoing effects of grazing and burning. Wilding conifer control will benefit these habitats by reducing one significant pressure, but the other pressures remain.

5.10 Terrestrial indigenous fauna habitats

The widespread loss and modification of lowland and montane habitats has had profound effects on the distribution and abundance of indigenous fauna, with only resilient species remaining in lowland/montane areas where habitats have been extensively cleared, other species remaining so long as sufficient habitat is preserved, and others being vulnerable to mammalian predation and thus found only in refuges from predation or where mammalian predator densities are low.

For example, indigenous species such as grey warbler (*Gerygone igata*) and fantail (*Rhipidura fuliginosa*), McCann's skink (*Oligosoma maccannii*) and southern grass skink (*Oligosoma polychroma* Clade 5) are more resilient and adaptable, so have been able to maintain populations in lowland and montane habitats where indigenous habitat has been extensively cleared. Other species such as jewelled gecko, and Burgan skink, or kōparapara/bellbird (*Anthornis melanura*) and pipirihika/brown creeper (*Mohoua novaeseelandiae*), can remain in lowland and montane habitat so long as their habitats are protected, and thus are much more secure on protected land than on unprotected land. Other species are now only present in alpine areas or western areas (e.g. kea and orange-spotted gecko), presumably because mammalian predation is less intense in these areas, or depend on fenced sanctuaries for persistence in lowland and montane habitats, e.g. Otago skink and grand skink. Similarly, many of Otago’s inland galaxiid fish are dependent on stream reaches that are free of introduced salmonid fish.

5.11 Information deficiencies

Queenstown Lakes District Council, Dunedin City Council, and Waitaki District Council have all commissioned recent surveys to identify areas of significant indigenous vegetation and habitat. However none of these surveys comprehensively identify significant natural areas, for a range of reasons including resourcing constraints, council caution, and landholder resistance. The situation is even worse in Central Otago District and in Clutha District, where these councils have no proactive programmes to identify and protect areas of significant indigenous vegetation and habitats of indigenous fauna on private land.

Limestone ecosystems are poorly understood in Otago Region, compared with limestone ecosystems in Canterbury, which have been shown to be key sites for the maintenance of indigenous biodiversity, providing habitat for numerous endemic plant taxa.

6. CONCLUSIONS

Otago has a range of nationally significant biodiversity features and values, and a significant responsibility for maintaining biodiversity nationally with respect to these values:

- A very extensive tract of indigenous vegetation and habitats on the Main Divide ranges in the catchments of Lakes Whakatipu, Wanaka, and Hawea.
- Alpine grassland and herbfield habitats on the Central Otago block mountains that are key habitat for indigenous lizards.
- An extensive network of freshwater lakes, wetlands, rivers, and streams.
- Nationally significant inland saline habitats, an originally rare ecosystem (Williams *et al.* 2007) classified as Critically Endangered, with only 10-100 hectares remaining (Holdaway *et al.* 2012). These saline habitats support populations of Threatened indigenous halophytic plant species and include New Zealand's only salt lake, Sutton Salt Lake near Middlemarch.
- A nationally-significant assemblage of ephemeral wetlands, comprising approximately 3,000 wetlands (Wildland Consultants 2020a), which are also originally rare, Critically Endangered ecosystems that provide habitat for numerous Threatened and At Risk plant species.
- Nationally significant populations of Threatened and At Risk (Dunn *et al.* 2018) freshwater fish, including Clutha flathead galaxias (*Galaxias* 'species D'; Threatened-Nationally Critical) in the vicinity of Lawrence, Central Otago roundhead galaxias (*G. anomalus*; Threatened-Nationally Endangered) in the Maniatoto, Teviot flathead galaxias (*G.* 'Teviot'; Threatened-Nationally Critical) in tributaries of Lake Onslow, and Eldon's galaxias (*G. eldonii*) and Dusky galaxias (*G. pullus*) in east Otago (both Threatened-Nationally Endangered).
- Nationally significant lizard populations, including grand skink (*Oligosoma grande*) and Otago skink (*Oligosoma otagense*), both classified as Threatened-Nationally Endangered (Hitchmough *et al.* 2016), and both unique to Otago Region. Many other Threatened and At Risk lizard taxa are also present.
- Nationally significant forest habitats for species such as mohua, kea, kaka, Tautuku gecko, and long-tailed bat.
- Nationally-significant populations of coastal indigenous fauna including marine mammals, pelagic seabirds, and penguins.

Otago has an important role to play in the maintenance of Aotearoa/New Zealand's indigenous biodiversity, because key features are only located in Otago. Nationally-significant indigenous biodiversity features in Otago include inland saline habitats, a large assemblage of ephemeral wetlands, endemic and threatened inland galaxiid fish and lizard populations, western forest habitats, and coastal fauna such as New Zealand sea lion which have recently re-colonised the Otago coast. Fenced sanctuaries and numerous community groups are playing a significant role by working with agencies to maintain and enhance indigenous biodiversity across Otago, particularly in western Otago and coastal Otago. Significant investment in mapping and surveys has resulted in a better understanding of the distribution of indigenous biodiversity in Otago, and generated new tools to help manage Otago's indigenous biodiversity.

On the negative side, the widespread loss and modification of indigenous vegetation and habitats in lowland and montane areas has profoundly affected populations of indigenous fauna, and those that are sensitive to predation have been additionally affected and have retreated to refuge habitats. Coastal forest has been significantly depleted along much of the Otago coast, and coastal treelands are experiencing attrition and will not persist in the long term if current management continues. There are few remaining options to protect outwash plain herbfield and grassland in Otago, and the limited remaining extent of this ecosystem that remains has diminished ecological functioning. Montane tussock grassland has experienced considerable recent loss of extent. Marine ecosystems are not currently managed for the indigenous biodiversity values, and there is no network of marine protected areas off the Otago coast. Estuaries are vulnerable to infilling, drainage, and the influences of upstream land use activities. There are also significant information deficiencies, e.g. identification by councils of significant indigenous vegetation and significant habitats of indigenous fauna has been patchy, and relatively few sites have been scheduled in district plans to date

ACKNOWLEDGMENTS

Anita Dawe and Lisa Hawkins of Otago Regional Council provided helpful project liaison.

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ECOLOGY RESTORATION BIODIVERSITY SUSTAINABILITY

Appendix 15: Analysis of wilding conifer species

Supporting analysis for wilding confer spread

4th May 2021

The following resources were reviewed to form a list of species that are found in the Otago region that are prone to wilding spread:

- South Island wilding conifer strategy – Department of Conservation[i]
- Wilding conifers – Otago Regional Council[ii]
- Wakatipu Wilding Conifer Strategy 2008-2012[iii]
- Wakatipu Wilding Conifer Strategy 2013-2017[iv]
- Otago Pest Management Plan 2019-2029[v]
- Ministry for Primary Industries website [vi]
- New Zealand Wilding Conifer Management Strategy 2015-2030[vii]
- Wilding Conifer in New Zealand: Status Report[viii]
- Aotearoa New Zealand New Zealand Biodiversity Strategy 2020[ix]
- Methods for the prioritisation of wilding conifer sites across New Zealand (Wildlands report)[x]

Species in Otago prone to wilding conifer spread

Common name	Botanical name	Biological success rating (BSR)	Notes
Bishops pine	*Pinus muricata*	11	
Contorta (lodgepole) pine	*Pinus contorta*	12	• Is now an unwanted organism under the Biosecurity Act 1993[xi]. • Prominent in the Otago high country and is one of the most widespread species in Otago[xii].
Corsican pine	*Pinus nigra*	12	• One of the most widespread species in Otago[xiii]
Douglas fir	*Pseudotsuga menziesii*	11	• Is one of the most dominant wilding species and poses a threat to beech forest and tussock lands in the Queenstown area[xiv]. • The second most common commercial timber species, but can spread rapidly in montane areas[xv] • One of the most widespread species in Otago[xvi]
Dwarf mountain pine	*P.uncinata*	12	

Larch	*Larix decidua*	12	• Prominent in the high country and is one of the most widespread species in Otago[xvii].
Lawson's cypress	*Chamaecyparis lawsoniana*	10	• Found in Wye Creek, Wanaka[xviii]
Maritime pine	*Pinus pinaster*	11	
Macrocarpa	*Cupressus macrocarpa*	10	• Very common species but infestations are relatively small[xix].
Mountain pine	*Pinus mugo*	12	
Norway spruce	*Picea abies*	10	• Possibly in Mount Aspiring National Park[xx]
Ponderosa pine	*Pinus ponderosa*	10	
Radiata pine	*Pinus radiata*	11	• Very common species but infestations are relatively small[xxi] • The most common commercial timber species, but can spread in lowland situations and affect native bush[xxii]
Scots pine	*Pinus sylvestris*	12	
Western red cedar	*Thuja plicata*	10	Rare only seen in Moonlight Creek, Wakatipu[xxiii].

The extent of the invasiveness of wilding conifer species can, to some degree, be predicted by their biological success rating of a wilding conifer vigorous spreading Biological Success Rating (BSR). This rating measures the biological capacity of a species based on criteria such as age of seeding, quantity of seed produced, viability of seed dispersal, seedling establishment and growth rates. Wilding conifer species have been given BSR scores of 12 (highest) to 10 (lowest)[xxiv]

The spreading vigour of wilding conifer species is based on a species competitiveness, palatability, seed production, and seed weight. However, the spreading vigour of a species can differ from region to region due to regional variations e.g. site conditions, especially altitude and climate.

List of species prone to wilding conifer spread:

1. Big cone pine *(Pinus coulteri)*
2. Bishops pine *(Pinus muricata)*
3. Contorta (lodgepole) pine *(Pinus contorta)*
4. Corsican pine *(Pinus nigra)*
5. Douglas fir *(Pseudotsuga menziesii)*
6. Dwarf mountain pine *(P.uncinata)*
7. Japanese cedar *(Cryptomeria japonica)*
8. Japanese Larch *(Larix kaempferi)*
9. Larch *(Larix decidua)*
10. Lawson's cypress *(Chamaecyparis lawsoniana)*
11. Macrocarpa *(Cupressus macrocarpa)*

12. Maritime pine *(Pinus pinaster)*
13. Mountain pine *(Pinus mugo)*
14. Norfolk Island pine *(Araucaria heterophylla)*
15. Norway spruce *(Picea abies)*
16. Patula pine *(Pinus patula)*
17. Pine (*Pinus sp./pine*)
18. Ponderosa pine *(Pinus ponderosa)*
19. Radiata pine *(Pinus radiata)*
20. Scots pine (*Pinus sylvestris*)
21. Sitka spruce (*Picea sylvestris)*
22. Slash pine (*Pinus elliottii)*
23. Spruce *(Picea sp.)*
24. Strobus pine (*Pinus strobus*)
25. Western red cedar (*Thuja plicata)*
26. Western white pine *(Pinus monticola)*

Other species that are prone to wilding spread but are not found in the Otago region, include[xxv]:

- Austrian pine (*Pinus nigra* ssp. *Nigra*)
- Big cone pine (*Pinus coulteri*)
- Sitka spruce (*Picea sitchensis*)

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[xxv] 2.1 Wilding conifers in the South Island (doc.govt.nz)

Appendix 16: Prioritised areas for ECO significance assessments

Prioritised areas for ECO significance assessments

Area / habitat	Explanation / Reasons for prioritising	Reference (report and page number)
Intermontane basins	<u>Ecological importance of intermontane basins</u> • Of all the reports reviewed none mentioned intermontane basins. In an email correspondence with Kelvin Lloyd from Wildland Consultants, he said the following about the status of intermontane basins in Central Otago, and whether there is merit in including them in method ECO-M2: *"I assume this feedback (Clause 3 feedback) relates to 'indigenous vegetation and habitats' in these basins. These basins are largely cultivated, irrigated, and farmed, but areas of value that remain include:* *Wetlands* *Ponds* *Uncultivated, non-irrigated 'low producing grassland' (often habitat of rare plant species)* *Kānuka shrubland* *It would probably pay to provide more specificity on what should be mapped in these areas."* <u>Prioritisation of intermontane basins</u> • In the same email Kelvin said the following regarding prioritisation: *"I would agree that 'indigenous vegetation and habitats on intermontane basins and dryland shrubs are a higher priority*	Email correspondence with Kelvin Lloyd.

	for mapping than tussock grassland. I would prioritise them in that order". <u>Consider changing to</u> (a) Intermontane basins that contain indigenous vegetation and habitats.	
Dryland shrubs	• Of the reports reviewed, none mentioned dryland shrubs. In an email from Kelvin Lloyd of Wildland Consultants, he said the following regarding dryland shrubs in the Otago region: *"Mingimingi (Coprosma-propinqua), matagouri (Discaria toumatou), porcupine shrub (Melicytus alpinus) are common and widespread components of dryland shrublands. In riparian areas, other species of Coprosma, and indigenous broom (Carmichaelia spp.) often occur in addition. Remnants of broadleaved forest and tī kōuka/cabbage tree can also be found in such shrublands. They are habitat for indigenous and exotic fauna and represent areas that would formerly have been forested.* *The Land Cover Database maps these as 'matagouri or grey shrubland' to a certain extent, but many examples are not mapped.* *These shrubs also occur in varying levels of density, so mapping is generally just of the relatively dense stands."* <u>Prioritisation of dryland shrubs</u> • In the same email Kelvin said that,	Email correspondence with Kelvin Lloyd.

	"the mapping of dryland shrubs should be a higher priority than tall tussock grasslands."	
Braided rivers, including the Makarora, Mātukituki and Lower Waitaki River	<u>Ecological importance of braided rivers</u> • Braided rivers are characterised by wide gravel riverbeds containing several migratory channels which fluctuate in flow. Their dynamism is one of their key features and is fundamental to supporting an abundant ecosystem rich in biodiversity (Gray et al, 2018). • These vast river systems are regarded for their ecological significance (O'Donnell & Moore 1983; O'Donnell 2000a, as cited in Department of Conservation, 2016) and recognised endangered (Holdaway et al., 2012 as cited in Department of Conservation, 2016). While found only in a few places around the world, New Zealand is a hotspot for these natural features. O'Donnell et al (2016) suggest over 300 rivers in New Zealand are braided and 7% of these are in Otago. • However, braided rivers remain inadequately protected within New Zealand's planning system, unless provided for by National Parks or local reserves, or other means such as Water Conservation Orders (O'Donnell et al, 2016). • Increasing pressures from human and natural factors continue to threaten the natural character and ecological values of these natural; resources. Factors include, low flows caused by natural climatic cycles, flood harvesting and diversion, changing land uses, organic and chemical pollution, recreation, and invasive plants (Department of Conservation, 2007, pp.31-35). <u>Ecological importance of Matukituki and Makarora River</u> • Mātukituki and Makarora Rivers are important bird areas for seabirds, including Threatened species such as black-billed gull (*Larus bulleri)* and black-fronted tern (*Chlidonias albostriatus*) (Wildland Consultants, 2021a, p.4). 'Seabird' IBAs (Important Bird Areas) have been identified on inland braided riverbeds in various parts of Aotearoa/New Zealand	Gray, D., Grove, P., Surman, M. & Keeling, C. (2018). *Braided rivers: natural characteristics, threats and approaches to more effective management.* Report No. R17/13. Christchurch, New Zealand: Environment Canterbury. O'Donnell, C. F. J., Sanders, M., Woolmore, C. & Maloney, R. F. (2016). *Management and research priorities for conserving biodiversity on New Zealand's braided rivers.* Wellington, New Zealand: Department of Conservation. Gray, D. & Harding, J. S. (2007). *Braided river ecology: a literature review of physical habitats and aquatic invertebrate communities.* Science for Conservation 279. Wellington, New Zealand: Department of Conservation. Wildland Consultants. (2021a). *An overview of the state of indigenous biodiversity in the Otago region (Final)*. Wildland Consultants. (2020b). *Mapping of significant habitats for indigenous fauna in terrestrial, freshwater, and marine ecosystems in Otago region*. Wildland Consultants. (2017). *Strategic analysis of options to improve management of ecosystems and biodiversity for Otago Region*.

	(Wildland Consultant, 2020b, p.5). The upper Manuherikia River adjacent to Falls Dam provides spring breeding habitat for vulnerable threatened braided river birds (Wildland Consultants, 2017, p.51). Ecological importance of the Waitaki River • The Waitaki River influence marine biodiversity, both in terms of freshwater input to the marine environment and the sediment that is transported to the sea. The area surrounding the Waitaki River is known to be an important foraging area for seabirds (including southern blue penguin) and Hector's dolphin. Some of the densest areas of squat lobster have historically been found around the Waitaki River mouth (Wildland Consultants, 2021a, p.7).	
Tall tussock grassland (indigenous cover type)	Ecological importance of montane tall tussock grasslands • Montane tall tussock grassland are species rich and comprise of an environment in which other habitats such as rock outcrops, shrublands, and gully and ephemeral wetlands are prominent. These habitats provide shelter and feeding habitat for a range of indigenous lizards, birds and invertebrates (Wildland Consultants, 2017, p. 17 & Wildland Consultant, 2021a, p.2). • Montane tall tussock provides a 'placeholder' for future development of indigenous woody vegetation, helps to buffer wetlands, and provides important connectivity between rock outcrops for threatened indigenous lizards that inhabit these montane environments (Wildland Consultants, 2021b, p.10). • While montane tall tussock grassland does not represent the original natural vegetation, it has value as a successional stage that will increasingly develop into indigenous woody vegetation, provides habitat connectivity between rock outcrops and shrubland (Wildlands, 2021a, p. 2).	Wildlands Consultants. (2021b). *Ecological advice on indigenous biodiversity provisions in the proposed Otago Regional Policy Statement*. Wildland Consultants. (2017). *Strategic analysis of options to improve management of ecosystems and biodiversity for Otago Region*. Wildland Consultants. (2021a). *An overview of the state of indigenous biodiversity in the Otago region (Final)*.

	<u>The decline of tall tussock grassland and montane tall tussock grassland</u> • Tall tussock grassland has been extensively fragmented in agricultural landscapes, and may also have a patchy representation in subalpine, and alpine areas (Wildland Consultants, 2021b, p.10). • Tall tussock grassland on the montane ranges of Central Otago (e.g. Rough Ridge), the foothills of taller ranges, and uplands in the Macraes area and Eastern Hill Country zone has been reduced over the last few decades (Wildland Consultants, 2017, p. 17). • Many stakeholders, both from coastal Otago and inland Otago, were concerned about loss of tussock grassland habitat, particularly tussock in grassland montane habitats. It was suggested to improve the protection of tussock grassland, that the identification and mapping of these vulnerable tussock grassland habitats is needed (Wildland Consultants, 2017, p.49-50). • Montane tall tussock grassland has been significantly reduced in some areas, such as in the area between Maungatua and the Lammermoor Range, and in the Macraea Ecological District. Much of the remaining montane snow tussock grassland is unprotected and un-managed (Wildland Consultants, 2021a, p. 13). <u>Prioritisation of tall tussock grassland</u> • Tall tussock grassland is generally considered to be of greater ecological importance than short tussock grassland (Wildland Consultants, 2021b, p.9).	
Short tussock grassland	<u>Ecological importance of short tussock grassland, include:</u> • Habitat for insect fauna (Wildland Consultants, 2020b, p.65) • Short tussock grasslands hold ecological value in the inland basins and valleys (Wildland Consultants, 2021b, p.9) <u>Prioritisation of short tussock grassland</u>	Wildland Consultants. (2021b). *Ecological advice on indigenous biodiversity provisions in the proposed Otago Regional Policy Statement*. Wildland Consultants. (2021a). *An overview of the state of indigenous biodiversity in the Otago region (Final)*.

	• Short tussock grasslands generally occur in a mosaic of exotic pasture, and in these cases are of relatively low ecological importance, but short tussock grasslands in the inland basins and valley floors can have greater value. If mapping of short tussock grassland is contemplated, this should be restricted to these areas (Wildland Consultants, 2021b, p. 9). • Tall tussock grassland is generally of greater ecological importance that short tussock grassland (Wildland Consultants, 2021b, p.9). • Therefore, short tussock grassland should be prioritised after tall tussock grassland if it is included in ECO-M2. <u>Justification for including</u> • Currently, tall tussock grassland is the only tussock grassland listed in ECO-M2, despite short tussock grassland having ecological importance, particularly in inland basins. It could be worth considering including short tussock grassland to ECO-M2 but assign it as a lower priority habitat as there is limited evidence contained within the reports reviewed that this habitat is facing pressure or loss.	Wildland Consultants. (2020b). *Mapping of significant habitats for indigenous fauna in terrestrial, freshwater, and marine ecosystems in Otago region*.
Limestone habitat	<u>Ecological importance of limestone habitat</u> • Limestone outcrops are key habitats for threatened and at-risk plant species (Wildland Consultants, 2012a, p.3). <u>Justification for including</u> • Limestone habitats are relatively poorly known in Otago Region and a number are affected by quarrying (Wildland Consultants, 2021a, p.3). They have little indigenous cover remaining and are subject to invasion of exotic weeds that threaten to overwhelm any rare plants remaining on these limestone habitats. Restoration of indigenous forest around limestone outcrops could potentially help to maintain partially shaded	

	limestone habitats, that provide habitat for rare plant species (Wildland Consultants, 2021a, p.12). • Limestone ecosystems are poorly understood in Otago Region, compared with limestone ecosystems in Canterbury, which have been shown to be key sites for the maintenance of indigenous biodiversity, providing habitat for numerous endemic plant taxa (Wildland Consultants, 2021a, p. 14). <u>Prioritisation of Limestone habitats</u> • Given the decline of limestone habitats and the lack of knowledge about them it would be suitable to suggest that they are classed as high priority for mapping, as part of ECO-M2.	

References

Gray, D., Grove, P., Surman, M. & Keeling, C. (2018). *Braided rivers: natural characteristics, threats and approaches to more effective management.* Report No. R17/13. Christchurch, New Zealand: Environment Canterbury.

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Wildland Consultants. (2020a). *Mapping of potential natural ecosystems and current ecosystems in Otago Region*.

Wildland Consultants. (2020b). *Mapping of significant habitats for indigenous fauna in terrestrial, freshwater, and marine ecosystems in Otago region*.

Wildlands Consultants. (2021a). *An overview of the state of indigenous biodiversity in the Otago region (Final)*.

Wildlands Consultants. (2021b). *Ecological advice on indigenous biodiversity provisions in the proposed Otago Regional Policy Statement*.

Appendix 17: Wildlands Report (2021a)

ECOLOGICAL ADVICE ON INDIGENOUS BIODIVERSITY PROVISIONS IN THE PROPOSED OTAGO REGIONAL POLICY STATEMENT

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R5704

ECOLOGICAL ADVICE ON INDIGENOUS BIODIVERSITY PROVISIONS IN THE PROPOSED OTAGO REGIONAL POLICY STATEMENT

Contract Report No. 5704

February 2021

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CONTENTS

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1. INTRODUCTION

Otago Regional Council are currently undertaking a legal review of the draft Otago Regional Policy Statement (RPS), and are working to finalise the indigenous biodiversity chapter. A particular concern is whether proposed bottom lines for Otago Region have been set at too high a bar, or will pose challenges for assessment. Otago Regional Council therefore requires an expert review of the indigenous biodiversity chapter, with particular regard to the policies containing bottom lines. Wildland Consultants were commissioned to provide this expert review, as set out in this report.

Headings in this report relate to the specific RPS objectives and policies that have been commented on, in a legal review. Less attention has been paid to methods, except where specific ecological matters require attention. In compiling this review particular attention has been given to comments in the legal review that relate to ecological issues.

2. OBJECTIVES

2.1 ECO-01 Ecosystems and indigenous biodiversity

Otago's ecosystems and indigenous biodiversity are healthy, abundant and thriving, previous decline in their quality, quantity and diversity has halted, and restoration is resulting in a net increase in the extent of Otago's indigenous biodiversity, the range of species present and the improved condition of areas that were previously degraded.

The legal review has raised concerns about the length of this objective, tautology within it, and ambiguity.

2.2 Comments

The terms 'ecosystems' and 'indigenous biodiversity' are both used in the objective, possibly to emphasise that both ecosystems and individual species and their assemblages are important. If this is the case, it would be better to refer to 'indigenous species' in addition to 'ecosystems'. It would, however, be more concise to refer to 'indigenous biodiversity' alone, as that term encompassess both ecosystems and species.

Use of the term 'range of species' is somewhat vague and potentially ambiguous because it could refer to the extent or the number of species. What it is probably intended to mean is the occupancy of species, i.e., that the species that are naturally present in Otago occupy a greater number of sites and/or larger population numbers are present. This is different from the extent of species, which only assesses their outer geographic extent. Occupancy accounts for both increases in extent, and 'filling in' of existing extent, i.e. increased numbers and densities.

The final part of the objective relates to ecological restoration resulting in "the improved condition of areas that were previously degraded". The legal review has identified that this cannot be taken literally as many degraded areas (e.g. farmland, housing, and infrastructure) are not likely to have their indigenous biodiversity condition improved. This text is therefore probably not necessary. If Otago's indigenous biodiversity is healthy, abundant, and thriving, and the previous declines in its quality, quantity, and diversity have been halted, and restoration is leading to net increase in species occupancy, then this implies that the condition of degraded areas has been subject to meaningful improvement.

2.3 Suggested text for ECO-01

<u>Option 1</u>

ECO-01 Indigenous biodiversity

Otago's indigenous biodiversity is healthy, abundant and thriving, previous decline in its quality, quantity, and diversity has halted, and restoration is resulting in a net increase in its extent and occupancy.

<u>Option 2</u>

ECO-01 Indigenous biodiversity

Otago's indigenous ecosystems and populations of indigenous species are healthy and thriving, previous declines in quality, quantity, and diversity have been halted, and restoration is resulting in net increases in extent and occupancy.

3. POLICIES

3.1 ECO-P1 Significant indigenous vegetation and significant habitats of indigenous fauna

3.1.1 Current Policy

Protect areas of significant indigenous vegetation and significant habitats of indigenous fauna by:

(1) identifying them in accordance with BIO-SCHED1, and

(2) avoiding the adverse effects of activities that result in:

- *(a) loss of ecosystem representation or extent,*
- *(b) disruption to sequences, mosaics or ecosystem function,*
- *(c) fragmentation or loss of buffering or connectivity within the identified area and between other indigenous habitats and ecosystems, or*
- *(d) loss of Kāi Tahu values.*

The legal review suggested minor wording changes, but more significantly also noted that the policy appears to set bottom lines that should not be breached, with very broad coverage. The policy would therefore preclude most activities in significant indigenous vegetation and habitats, which could be contentious (and potentially also not warranted or necessary).

3.1.2 Comments

The legal review suggested that enhancement should be included along with protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna, however the sub-paragraphs focus on prevention of adverse effects rather than enhancement of these areas. It is appropriate that more specificity is provided in sub-paragraph (1).

Policy ECO-P1 relates to Policy 3.9(a) of the draft National Policy Statement for Indigenous Biodiversity (draft NPSIB), which requires that adverse effects on the values of High ranked significant natural areas (SNAs) are avoided. Draft NPSIB Policy 3.9(a) provides exceptions relating to specified activities for SNAs classified as Medium, for adverse effects generated by protection, restoration, and enhancement activities, for adverse effects relating to the addressing of severe and immediate risks to public safety, and for SNAs based solely on the threats posed by myrtle rust (*Austropuccinia psidii*) to mānuka (*Leptospermum scoparium*), or kānuka (*Kunzea* spp.). ECO-P1, however, provides no such exemptions, and creates bottom lines preventing adverse effects on the specified attributes of SNAs.

The key requirement for SNAs is maintenance of the significant values which resulted in them being defined as significant. SNAs can have a variable cover of significant areas and often include areas that have been included in SNAs but are important only for buffering, and may include areas of low value early successional indigenous regeneration and/or exotic vegetation. In these cases, effects generated within the SNA but on the lower value indigenous regeneration or exotic habitats or within buffer areas may not result in any reduction of the significant values. Use of the term 'reduction' is preferred to 'loss', as the latter may imply complete loss as being what needs to be avoided, whereas the former requires that any reduction is avoided.

It is suggested that if the policy requires no reduction in the significant values for which the area was defined, then the sub-paragraphs relating to loss of ecosystem representation or extent, and disruption to sequences or mosaics, may not be required, as any such losses could only be of non-significant values.

The legal review raises a good point about bottom lines for areas outside of SNAs because, currently, avoiding adverse effects on SNAs would not be sufficient to avoid loss of ecosystem representation and extent, disruption to sequences, mosaics, and ecosystem function, fragmentation and loss of buffering, and reduction in population sizes and occupancy of threatened species.

Bottom lines for areas outside SNAs could be created around the extent and occupancy of more reduced ecosystem types and around significant habitats of indigenous fauna. For example, Wildland Consultants (2020a) mapped Otago's potential natural ecosystems and current natural ecosystems, and that mapping could be used to help identify significantly reduced (e.g. <20% remaining) ecosystems. Similarly, Wildland Consultants (2020b) mapped significant habitats of indigenous fauna across terrestrial, freshwater, and marine ecosystems in Otago, although these areas have yet to be adopted in district or regional plans.

Maintenance of ecosystem function, and avoiding fragmentation or loss of buffering or connectivity outside an identified SNA, may be problematic as bottom lines, as there may not be reliable baselines for these values, or there may be insufficient information to determine appropriate bottom line thresholds.

A new policy would be needed to specify bottom lines for areas outside of SNAs. Such a policy could also address disruption of ecosystem functions and adverse effects caused by fragmentation and loss of buffering or connectivity, but probably should only capture significant examples of these, given the uncertainty about appropriate thresholds. A new policy should also address important fauna habitats since these are currently not well captured in statutory plans.

3.1.3 Possible text for a modified policy

Protect areas of significant indigenous vegetation and significant habitats of indigenous fauna by:

- *(1) identifying these areas in accordance with BIO-SCHED1, and*
- *(2) avoiding the adverse effects of activities that result in:*
    - *(a) reduction of the significant values for which the area was defined, or*
    - *(b) loss of Kāi Tahu values.*

3.1.4 Possible text for a new policy

Protect areas of indigenous vegetation and habitats of indigenous fauna throughout Otago by:

- *(1) avoiding the adverse effects of activities that result in:*
    - *(a) significant disruption to sequences, mosaics, and ecosystem functions, including disruption caused by the effects of fragmentation and loss of connectivity,*
    - *(b) significant adverse effects on important indigenous fauna habitats, or*
    - *(c) further loss of ecosystem extent for indigenous ecosystems that have been reduced to less than 20% of their original extent.*

Note that only (c) provides an objectively-determined bottom line.

3.2 ECO-P2 Coastal indigenous biodiversity

3.2.1 Current Policy

Protect indigenous biodiversity in the coastal environment by:

- *(1) avoiding the adverse effects of activities on species and areas listed in Policy 11(a) of the New Zealand Coastal Policy Statement, and*
- *(2) in areas of indigenous biodiversity in the coastal environment that are not identified under ECO-P1(1) or listed in Policy 11(a) of the New Zealand Coastal Policy Statement:*
    - *(a) identify these areas in accordance with Policy 11(b) of the New Zealand Coastal Policy Statement, and*

(b) protect those areas by avoiding significant adverse effects in those areas.

The legal review also queried whether enhancement should be referred to in this policy, suggested other minor wording changes, and notes that the policy appears to simplify the requirements of Policy 11 of the New Zealand Coastal Policy Statement (NZCPS).

3.2.2 Comments

Not all of the values specified in NZCPS Policy 11(a) relate to species or areas; for example, NZCPS Policy 11(a) (iii) refers to indigenous ecosystems and vegetation types, which also need to be captured in ECO-P2.

ECO-P2 is silent about effects that don't have significant adverse effects on matters addressed in NZCPS Policy 11(b).

Furthermore, ECO-P2(2)(b) refers to the protection of areas, but may be better to refer to the protection of the indigenous biodiversity values within those areas.

3.2.3 Suggested text for ECO-P2

Protect indigenous biodiversity in the coastal environment by:

- *(1) avoiding the adverse effects of activities on species, ecosystems, vegetation types, and areas listed in Policy 11(a) of the New Zealand Coastal Policy Statement, and*
- *(2) in areas of indigenous biodiversity in the coastal environment that are not identified under ECO-P1(1) or described in Policy 11(a) of the New Zealand Coastal Policy Statement:*
  - *(a) identify these areas in accordance with Policy 11(b) of the New Zealand Coastal Policy Statement, and*
  - *(b) protect the indigenous biodiversity values within those areas by avoiding significant adverse effects on those values and avoiding, remedying, or mitigating other adverse effects on those values.*

3.3 ECO-P3 Maintaining ecosystems and indigenous biodiversity

3.3.1 Current Policy

Achieve a healthy functioning state and maintain the full range of Otago's indigenous habitats and ecosystems by applying the following prioritisation in decision-making on plans and resource consent applications:

- *(1) comply with ECO-P1 and ECO-P2 if relevant, then*
- *(2) avoid adverse effects as a first priority,*
- *(3) where adverse effects cannot be avoided, they are mitigated,*
- *(4) where adverse effects cannot be avoided or mitigated, they are remedied,*
- *(5) where more than minor residual adverse effects cannot be avoided, mitigated, or remedied, biodiversity offsetting is provided in accordance with ECO-SCHED2,*

(6) if biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided in accordance with ECO-SCHED3, and

(7) if biodiversity compensation is not demonstrably achievable, the activity itself is avoided.

The legal review raised a range of concerns about the drafting of this policy, and whether the sub-paragraphs were consistent with the maintenance of Otago's biodiversity.

3.3.2 Comments

The legal review suggestion is appropriate, suggesting that simplification of the initial text is required as the current text, while wordy, is limiting in that it does not address species. It is also appropraite that remediation comes before mitigation in the mitigation hierarchy.

3.3.3 Suggested text for ECO-P3

Maintain the full range of Otago's indigenous biodiversity by applying the following prioritisation in decision-making:

(1) comply with ECO-P1 and ECO-P2, then
(2) avoid adverse effects as a first priority,
(3) where adverse effects cannot be avoided, they are remedied,
(4) where adverse effects cannot be avoided or remedied, they are mitigated,
(5) where more than minor residual adverse effects cannot be avoided, remedied, or mitigated, biodiversity offsetting is provided in accordance with ECO-SCHED2,
(6) if biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided in accordance with ECO-SCHED3, and
(7) if biodiversity compensation is not demonstrably achievable, avoid the activity.

3.4 ECO-P4 Enhancement

3.4.1 Current policy

Through decision-making on plans and resource consent applications, and non-regulatory actions, the spatial extent of Otago's indigenous biodiversity and range of species is increased by:

(1) restoring habitat for indigenous species,

(2) improving the health and resilience of ecosystems supporting indigenous biodiversity and important ecosystem services, including pollination, and

(3) buffering or linking ecosystems, habitats and areas that contribute to ecological corridors.

The legal review raised issues about redundant wording, the need to refer to intrinsic values, and the relationship between ecosystems and indigenous biodiversity.

3.4.2 Comments

As described above, it is suggested that the occupancy of Otago's indigenous biodiversity is referred to, as well as its extent. The reference to 'range of species' is not required, as species are a component of indigenous biodiversity. In addition to increasing the spatial extent and occupancy, the policy should also promote enhancement of the condition of existing indigenous biodiversity, for example through the control of pest plants and pest animals in an indigenous forest remnant. If condition is included, the word 'spatial' can be omitted. It is generally clear that extent and occupancy are spatial concepts.

The legal review also identified that 'enhancing' should be specifically referred to in sub-paragraph (1). Ecosystem services are referred to but generally relate only to the regulating functions of ecosystems. Referring to 'ecosystem functions' would provide wider coverage. It is not clear why pollination is singled out in subparagraph (2).

Ecosystems are part of indigenous biodiversity, as noted in the legal review, so the policy could refer to the intrinsic values of ecosystems as well as those that support other indigenous biodiversity. However, it would be simpler to refer only to indigenous biodiversity, but perhaps highlight particular aspects such as ecosystems, species, and intrinsic values.

Sub-paragraph (3) can be simplified as it currently refers to both 'linking' and 'corridors'. Connectivity could be a better term to use as it is less limiting as to the specific type of connection. Species could possibly also be referred to, as in some cases buffering or connectivity will specifically relate to species rather than habitats or ecosystems.

3.4.3 Suggested text for ECO-P4

The extent, occupancy, and condition of Otago's indigenous biodiversity is increased by:

(1) restoring and enhancing habitat for indigenous species,

(2) improving the health and resilience of indigenous biodiversity, including ecosystems, species, and important ecosystem function, and intrinsic values;

(3) buffering or connecting ecosystems, habitats, and species.

The text highlighted in subparagraph (2) may not be necessary.

3.5 ECO-P5 Wilding conifers

3.5.1 Current policy

The impact of wilding conifers on areas of significant indigenous vegetation and significant habitats of indigenous fauna is reduced by:

(1) preventing the planting of commercial wood species that are prone to wilding confider spread within areas identified as significant areas of indigenous vegetation or significant habitats of indigenous fauna, and
(2) supporting initiatives to control existing wilding conifers and limit their further spread.

The legal review does not provide any comment on the text of this policy, but does note that RPS provisions on wilding conifers can potentially duplicate or conflict with regional pest management plan provisions.

3.5.2 Comments

This policy relates only to the impacts of wilding conifers on significant indigenous vegetation and significant habitats of indigenous fauna. Wilding conifers also affect other indigenous biodiversity and ecosystem functions outside of significant natural areas. The scope of this policy could be widened to 'indigenous biodiversity', to capture these additional effects.

3.5.3 Suggested text for ECO-P5

The impact of wilding conifers on areas on indigenous biodiversity is reduced by:

(1) preventing the planting of commercial wood species that are prone to wilding confider spread within areas of indigenous biodiversity, and
(2) supporting initiatives to control existing wilding conifers and limit their further spread.

4. METHODS - ECO-M2 IDENTIFICATION

4.1 Current provisions

In this section comments are only provided on the practicalities of implementation of the methods that relate to the ecological issues raised in the method ECO-M2 Identification.

Local authorities will:

(1) outside public conservation land, identify the areas specified in ECO-P1 in accordance with the statement of responsibilities in ECO-M1,

(2) recognise that indigenous biodiversity spans jurisdictional boundaries by:
  (a) the identification process across that boundary in order to ensure the areas identified are not artificially fragmented when an area has been identified under ECO-P1 or ECO-P2 and spans a jurisdictional boundary, and
  (b) ensuring that management frameworks are no less stringent than adjacent districts,

(3) map the areas identified under (1) in the relevant regional and district plans,

(4) in the following areas, undertake identification under (1) and mapping under (3) no later than 2025:
  (a) Otago Peninsula,
  (b) Moeraki Peninsula,
  (c) Catlins coastline,
  (d) Braided rivers, including the Makarora, Mātukituki and Lower Waitaki Rivers, and
  (e) Tussock grasslands.

4.1.1 Comments

Most of the territorial authorities in Otago have undertaken projects to identify and protect areas of significant indigenous vegetation and significant habitats of indigenous fauna, but none of these assessments have comprehensively identified SNAs, due to resourcing and access issues. Detailed mapping of indigenous vegetation and habitats has been undertaken in Dunedin City District (Wildland Consultants 2020c), and this could be used to facilitate more comprehensive assessment of significant areas, but that exercise has not been undertaken to date. Potential natural ecosystem and current ecosystem mapping undertaken for Otago Regional Council by Wildland Consultants (2020a) includes a considerable amount of mapping of current vegetation, particularly of wetlands. It also includes mapping of the current gravel river beds of the Matukituki and Makarora Rivers, but only small parts of the lower Waitaki River as not much of this river is located in Otago Region. Current ecosystem mapping was mostly based on Land Cover Database version 4.1 (LCDB) polygons, which are known to have issues with from spatial the thematic resolution. The thematic resolution of this mapping was improved by Wildland Consultants (2020a), but approximately 500,000 hectares of current vegetation was nevertheless still mapped using its LCDB classification.

Mapping of tussock grasslands can be technically-challenging and resource-intensive, and warrants further consideration, as addressed below:

- The term 'tussock grassland' can be used to refer to both tall tussock (dominated by species of *Chionochloa*) and short tussock (dominated by *Festuca* spp. or silver tussock (*Poa cita*). Tall tussock grassland is generally considered to be of greater ecological importance than short tussock grassland. Short tussock grasslands generally occur in a mosaic of exotic pasture, and in these cases are of relatively low ecological importance, but short tussock grasslands in the inland basin and valley floors can have greater value. If mapping of short tussock grassland is contemplated, this should be restricted to these areas.
- Tall tussock grassland occurs at varying density, but dense stands have greater ecological importance.

- Tall tussock grassland has been extensively fragmented in agricultural landscapes, and may also have a patchy representation in subalpine, and alpine areas. This high degree of fragmentation and patchiness are key factors in what makes mapping of tall tussock grassland more resource-intensive and technically-challenging.
- Tall tussock grassland now occupies a much greater area in Otago than it would have naturally, due to its invasion into montane landscapes following anthropogenic deforestation. There are currently approximately 300,000 hectares more tall tussock grassland in Otago due to human colonisation and modification of Aotearoa/New Zealand.
- While montane tall tussock grassland may be perceived as being related less natural, it nevertheless provides a 'placeholder' for future development of indigenous woody vegetation, helps to buffer wetlands, and provides important connectivity between rock outcrops for threatened indigenous lizards that inhabit these montane environments; e.g. Gebauer *et al.* 2013; Berry *et al.* 2005.
- The pattern of tall tussock grassland depletion is not even across Otago. Tall tussock grassland on higher elevation ranges is more intact and protected than tall tussock grassland on the drier montane ranges of Central Otago (e.g. Rough Ridge), on the foothills of taller ranges, and in uplands of the the Macraes area and eastern hill country. Tall tussock grassland has been reduced significantly in extent in these areas over the last few decades, with the rate of reduction increasing more recently, particularly in Macraes Ecological District and in the Lee Stream area (Cieraad *et al.* 2015). This suggests that the focus of this method should be on tall tussock grassland in the areas where further depletion is most likely to occur, *i.e.* montane environments below *c.*800 metres above sea level.

5. ECO-SCHED1 SIGNIFICANCE CRITERIA

5.1 Current provisions

An area of indigenous vegetation or habitat of indigenous fauna is significant if it meets any one or more of the criteria set out below:

Representativeness	(a) An area that is an example of an indigenous vegetation type or habitat that is typical or characteristic of the natural diversity of the relevant ecological district or coastal marine biogeographic region. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas. (b) An indigenous marine ecosystem (including both intertidal and sub-tidal habitats, and including both faunal and floral components) that makes up part of at least 10% of the natural extent of each of Otago's original marine ecosystem types and reflecting the environmental gradients of the *region*. (c) An indigenous marine ecosystem, or habitat of indigenous marine fauna (including both intertidal and sub-tidal habitats, and including both faunal and floral

	components), that is characteristic or typical of the natural marine ecosystem diversity of Otago.
	(d) A habitat that is important to indigenous species of Otago, either seasonally or permanently, including for migratory species and species at different stages of their life cycle (and including refuges from predation, or key habitat for feeding, breeding, spawning, roosting, resting, or haul out areas for marine mammals).
	(e) The area contains biological features (habitat species, community) that represent a good example within the relevant coastal marine biogeographic region.
Rarity	(f) An area that supports:
	(i) An indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district or coastal marine biogeographic region, or
	(ii) Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant *land environment*, ecological district, coastal marine biogeographic region or *freshwater environment* including wetlands.
	(iii) Indigenous vegetation and habitats within originally rare ecosystems.
	(iv) The site contains indigenous vegetation or an indigenous species that is endemic to Otago or that are at distributional limits within Otago.
Diversity	(g) An area that supports a high diversity of indigenous ecosystem types, indigenous taxa or has changes in species composition reflecting the existence of diverse natural features or gradients.
Distinctiveness	(h) An area that supports or provides habitat for:
	(i) Indigenous species at their distributional limit within Otago or nationally, or
	(ii) Indigenous species that are endemic to the Otago *region, or*
	(iii) Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors or occurs within an originally rare ecosystem.
Ecological Context	(i) The relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including:
	(i) An area that has important connectivity value allowing dispersal of indigenous vegetation and fauna between different areas;

	(ii) An important buffering function that helps to protect the values of an adjacent area or feature; (iii) An area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, nesting, breeding, or refuges from predation. (iv) A *wetland* which plays an important hydrological, biological or ecological role in the natural functioning of a *river* or coastal ecosystem.
Interactions	(j) The site or area has indigenous biodiversity of significance to Kai Tahu. (k) The site or area is important for human interactions with, and appreciation of, indigenous biodiversity.
Sustainability	(l) The site is ecologically resilient, i.e. its natural ecological integrity and processes (functioning) are largely self-sustaining.

5.2 Comments

5.2.1 Representativeness

The Representativeness criterion has five subcriteria, a-e, and comments are provided below on each of these.

<u>Subcriterion (a)</u>

Sub-criterion (a) is similar to the various versions of the Representativeness criterion defined in current regional and district plans elsewhere in New Zealand. As written, it does not contain a standard or baseline against which the assessment of typical or characteristic can be made. Many plans previously used an historic baseline, for example a pre-human baseline, or an 1840 baseline. The latter was used because there were at least some early descriptions of the vegetation present at that time and indications of extent. Pre-human baselines were more problematic due to a lack of suitably resolved information on the pre-human vegetation pattern. This has now changed, with potential natural ecosystem mapping now undertaken widely across Aotearoa/New Zealand, using a consistent classification of indigenous vegetation (Singers and Rogers 2014). As this has now been done for Otago (Wildland Consultants 2020a), the potential natural ecosystem map for Otago constitutes the best historic baseline available for the natural vegetation of Otago.

Representativeness addresses the natural diversity of an area. Some experts suggest that Representativeness should be based on current indigenous vegetation patterns. Much of the current vegetation across Otago and other regions is often strongly modified or secondary in nature and, while it is indigenous and has been established through 'natural' processes, does not constitute the original vegetation cover of an area. As noted above, some 300,000 hectares of tussock grassland occurs below treeline in Otago, where indigenous forest is the natural vegetation cover. This snow tussock grassland may be significant for other reasons, but not necessarily for Representativeness of the original natural vegetation cover.

A Representativeness criterion utilising an historic baseline targets those ecosystem types that are the most consistent in structure and composition with the historic state. For example, broadleaved forest with emergent podocarps, or harakeke (*Phormium tenax*)-dominant wetlands in lowland valleys. These ecosystem types, which have a high representativeness rating based on an historic baseline, may no longer be typical or characteristic in the present day.

To make the need for an historic baseline clear, the word ‘original’ could be inserted before ‘natural diversity’

<u>Subcriterion (b)</u>

Subcriterion (b) relates to the marine environment and captures ecosystems that *“make up part of at least 10% of the natural extent of each of Otago’s original marine ecosystem types and reflecting the environmental gradients of the region”.*

More extensive marine ecosystem types would be captured by this criterion, *i.e.* those that make up part of 10% or more of the natural extent of Otago’s original marine ecosystem types. The only ecosystems that would not be captured are those that make up less than 10% of their original natural extent. Generally, where percentage thresholds are used for ecosystems, they are part of the Rarity criterion, and are stated in a way that captures examples of ecosystems that are reduced in extent below the threshold. The intent of subcriterion (b) is not entirely clear, and it could be restated under Rarity.

It is not clear how the final part of the sub-criterion, - “… *reflecting the environmental gradients of the region”* - would be interpreted. It could be interpreted as a qualifier to limit the assessment only to marine ecosystems that are part of marine gradients. It appears to be an attempt to address a different value - environmental gradients - under the representativeness criterion, and should be omitted, since this is already addressed under the Diversity criterion.

Subcriterion (b) has wide scope, including both intertidal and subtidal areas, and both fauna’ and flora’ assemblages. This is particularly important in the marine environment, where benthic fauna can form marine ecosystems, and is also reflected in subcriterion (c).

Subcriterion (d) would be best addressed under Ecological Context, where it is partially duplicated in any case.

Subcriterion (e) refers to “good examples” and is likely to be subject to variable interpretation. It duplicates subcriterion (b) in that characteristic or typical examples of the original marine ecosystem diversity are also likely to be ‘good examples.

5.2.2 Rarity

The Rarity criterion has four subcriteria, which are typical of those included under Rarity in ecological significance criteria sets in other regional and district plans.

Subcriterion (i)

Under subcriterion (i), any area that supports a species that is classified as threatened, at risk, or uncommon could be captured as significant. It requires expert judgement to assess an area(s) as being not significant when they contain low numbers of at risk or uncommon species, or where a species that is at risk nationally, is very common regionally, e.g. matagouri (*Discaria toumatou*) has a current threat classification of At Risk-Declining. One solution to this is to require a higher threshold for the capture of at risk and uncommon species, for example by restricting ecological significance to important populations of such species.

Subcriterion (ii)

Subcriterion (ii) refers to indigenous vegetation and habitats of indigenous fauna that have been reduced to less than 20% of their original extent, at a variety of scales. Mapping of potential natural ecosystems for Otago (Wildland Consultants 2020a) provides a useful basis for assessment of the extent and the level of reduction of terrestrial and wetland ecosystem types.

Subcriterion (iii)

Subcriterion (iii) refers to 'Originally rare ecosystems'. It should be noted that these were originally defined as 'historically rare ecosystems' (Williams *et al.* 2007) and more recently as 'naturally uncommon ecosystems' (Holdaway *et al.* 2012), and these terms are synonymous for the same thing.

Subcriterion (iv)

Subcriterion (iv) does not need to refer to endemic taxa or distribution limits of taxa, as these are covered and better-expressed under Distinctiveness.

5.2.3 Diversity

The Diversity criterion is appropriate and does not require any modification.

5.2.4 Distinctiveness

Distinctiveness subcriterion (iii) does not need to refer to originally rare ecosystems as these are covered under the Rarity criterion.

5.2.5 Ecological context

The Ecological Context criterion is important for the capture of significant habitats of indigenous fauna.

Subcriterion (ii) needs to refer to an area.

Subcriterion (iii) should include an attribute which would cover aspects such as staging areas for seasonal migrations, high tide roosts for wading birds, and haul-out sites for marine mammals. A ‘spawning’ attribute may also be warranted to make this explicit, but would be captured under ‘breeding’.

5.2.6 Interactions

Ecological significance criteria generally refer to RMA Section 6(c) and relate to significant indigenous vegetation and significant habitats of indigenous fauna. The proposed Interactions criterion captures sites and areas of indigenous biodiversity of significance to Kai Tahu, and areas that are important for human interaction with and appreciation of indigenous biodiversity. As neither of these are Section 6(c) matters, they should be dealt with in other parts of the Proposed RPS.

5.2.7 Sustainability

Sustainability criteria were promoted in the 1980s through to the early 2000s (*e.g.* Norton and Roper-Lindsay 2004), but were subsequently have not been supported as resilience often relates strongly to management of sites, and is not an intrinsic feature of an area of indigenous vegetation or habitat. For example, an area of indigenous forest may not be very resilient if it is open to stock browsing, but if fenced to exclude stock, can regain its ecological integrity and processes, and be very resilient and sustainable.

5.3 Suggested significance criteria

Suggested changes to the draft criteria set are made in the table below using underlining for text that has been added, and ~~strikethrough~~ for text that has been deleted.

Representativeness	(a) An area that is an example of an indigenous vegetation type or habitat that is typical or characteristic of the original natural diversity of the relevant ecological district or coastal marine biogeographic region. This may include degraded examples of their type or represent all that remains of indigenous vegetation and habitats of indigenous fauna in some areas. (b) An indigenous marine ecosystem, or habitat of indigenous marine fauna (including both intertidal and sub-tidal habitats, and including both faunal and floral assemblages ~~components~~), that is characteristic or typical of the original natural marine ecosystem diversity of Otago. ~~(d) A habitat that is important to indigenous species of Otago, either seasonally or permanently, including for migratory species and species at different stages of their life cycle (and including refuges from predation, or key habitat for feeding, breeding, spawning, roosting, resting, or haul out areas for marine mammals).~~ ~~(e) The area contains biological features (habitat species, community) that represent a good example~~

~~within the relevant coastal marine biogeographic region.~~

Rarity	(c) An area that supports: (i) An indigenous species that is threatened, at risk, or uncommon, nationally or within an ecological district or coastal marine biogeographic region, or (ii) Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent nationally, regionally or within a relevant land environment, ecological district, coastal marine biogeographic region or freshwater environment including wetlands. (iii) Indigenous vegetation and habitats within originally rare ecosystems. ~~(iv) The site contains indigenous vegetation or an indigenous species that is endemic to Otago or that are at distribution limits within Otago.~~
Diversity	(d) An area that supports a high diversity of indigenous ecosystem types, indigenous taxa or has changes in species composition reflecting the existence of diverse natural features or gradients.
Distinctiveness	(e) An area that supports or provides habitat for: (i) Indigenous species at their distributional limit within Otago or nationally, or (ii) Indigenous species that are endemic to the Otago region, or (iii) Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, or has developed as a result of an unusual environmental factor or combinations of factors~~ or occurs within an originally rare ecosystem~~.
Ecological Context	(i) The relationship of the area with its surroundings (both within Otago and between Otago and the adjoining regions), including: (i) An area that has important connectivity value allowing dispersal of indigenous ~~vegetation~~ flora and fauna between different areas; (ii) An area that has an important buffering function that helps to protect the values of an adjacent area or feature; (iii) An area that is important for indigenous fauna during some part of their life cycle, either regularly or on an irregular basis, e.g. for feeding, resting,

	nesting, breeding, spawning, or refuges from predation. (v) A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem.
~~**Interactions**~~	~~(j) The site or area has indigenous biodiversity of significance to Kai Tahu.~~ ~~(k) The site or area is important for human interactions with, and appreciation of, indigenous biodiversity.~~
~~**Sustainability**~~	~~(l) The site is ecologically resilient, i.e. its natural ecological integrity and processes (functioning) are largely self-sustaining.~~

6. CONCLUSIONS

Comments have been provided primarily in relation to the proposed objectives, policies, and significance criteria in the indigenous biodiversity chapter of the Proposed RPS, along with, discussion of mapping information and mapping issues relevant to evaluation methods. Recent advances in mapping of current ecosystems and potential natural ecosystems in Otago and in Dunedin City District are potentially very useful for identification and mapping of areas of significant indigenous vegetation and significant habitats of indigenous fauna, and provide a basis for assessment of criteria for Representativeness and Rarity. The currently proposed significance criteria set contains some duplication and includes two criteria that do not relate to Section 6(c) of the RMA, and seem out of place in this chapter. Suggestions have been provided to improve the other significance criteria by removing duplication and tightening of the scope for each criterion, to ensure that they are more appropriate.

ACKNOWLEDGMENTS

Anita Dawe and Lisa Hawkins of Otago Regional Council provided helpful project liaison.

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Appendix 18: EIT – Option 2 provisions

Appendix 18

Energy, infrastructure, and transport – Option 2 Alternative Provisions

Part 1 – Energy

Alternative provisions for Option 2: PORPS 2019 approach with some efficiency and effectiveness improvements

Policies

EIT-EN-P1 Renewable electricity generation activities

Provide for the development of renewable electricity generation activities by:

(1) recognising the national, regional and local benefits of renewable electricity generation activities, including:

 (a) maintaining or increasing security of renewable electricity supply by diversifying the type or location of electricity generation;
 (b) maintaining or increasing renewable electricity generation capacity while avoiding or reducing greenhouse gas emissions; and
 (c) for economic, social or cultural wellbeing; and

(2) as a first priority, avoid locating infrastructure in:

 (a) areas of significant indigenous vegetation and significant habitats of indigenous fauna;
 (b) areas of outstanding natural character;
 (c) outstanding natural features and landscapes;
 (d) outstanding waterbodies;
 (e) places or areas containing historic heritage of regional or national significance; or
 (f) places or areas of significance to tangata whenua, including wāhi tapu and wāhi tupuna; and

(3) where (2) cannot be achieved, have regard to the extent and magnitude of adverse effects on the environment and the degree to which unavoidable adverse effects can be remedied or mitigated; and

(4) where the adverse effects are significant, require consideration of alternative sites, routes, methods and design.

EIT-EN-P2 Electricity transmission networks

Enable the ongoing operation and maintenance of electricity transmission networks in Otago by:

(1) recognising the national, regional and local benefits of electricity transmission;
(2) restricting the establishment of activities that may result in reverse sensitivity effects or compromise the operation or maintenance of electricity transmission networks; and

(3) considering any constraints on avoiding, remedying or mitigating adverse effects arising from the technical or operational requirements of the network.

EIT-EN-P3 Small and community scale renewable electricity generation

Provide for small and community scale renewable electricity generation activities that:

(1) Increase the local community's resilience and security of energy supply; and
(2) Avoid, remedy or mitigate adverse effects.

EIT-EN-P4 -Energy conservation and efficiency

Provide for the efficient use of energy by:

(1) Requiring the development of compact and well-integrated urban areas that minimise urban sprawl and trip distances;
(2) Reducing energy waste;
(3) Promoting, or where appropriate requiring, sustainable design and on-site energy generation;
(3) Minimising transmission losses; and
(4) Ensuring design of subdivision and development maximises passive solar gain and provides for multi-modal transport options in urban and rural residential locations.

Part 2 – Infrastructure

Alterative Provisions for Option 2: PORPS 2019 approach with some efficiency and effectiveness improvements

Definitions

Nationally significant infrastructure (as defined in the NPSIB and NESFW)

(1) State highways;
(2) The national grid electricity transmission network;
(3) National renewable electricity generation facilities that connect with the national grid, other than the facilities of existing hydro schemes;
(4) Major gas or oil pipeline services (such as the pipeline from Marsden Point to Wiri, and high pressure gas transmission pipelines from Taranaki);
(5) Any railway (as defined in the Railways Act 2005);
(6) Rapid transit;
(7) Airports that have a runway used for regular air transport services by aeroplanes that have a seating configuration of more than 30 passenger seats;
(8) Commercial ports (as defined in Part A(6) of Schedule 1 of the Civil Defence Emergency Management Act 2002)

Regionally significant infrastructure (revised PORPS definition)

(1) Renewable electricity generation facilities that connect with the local distribution network;
(2) Electricity sub-transmission infrastructure;
(3) Telecommunication and radiocommunication facilities;

(4) Roads classified as being of regional importance in accordance with the One Network Road Classification[1];
(5) Airport and
(6) Navigation infrastructure associated with nationally significant airports and commercial ports;
(7) Defence facilities;
(8) Municipal infrastructure.

Municipal infrastructure:

Infrastructure for:

(1) Conveyance of untreated water from source to, and including, the point of its treatment to potable standard for an urban environment, but excluding its distribution within that urban environment;
(2) Treatment of wastewater from a reticulated system in an urban environment and conveyance for its disposal, but excluding its pre-treatment collection within that urban environment; and
(3) Treatment of stormwater from a reticulated system in an urban environment and conveyance for its disposal, but excluding its pre-treatment collection within that urban environment.

Objectives

EIT-INF-O1 – Nationally and regionally significant infrastructure

Nationally and regionally significant infrastructure is efficient, effective and resilient and provides for the social and economic wellbeing of the Otago community while adverse effects of its use and development on the quality of the natural environment, the health and safety of communities and amenity values are minimised.

Policies

EIT-INF-P1 Operation and maintenance

Enable the operation and maintenance of nationally and regionally significant infrastructure while minimising adverse effects on the environment.

EIT-INF-P2 Upgrades and development

Provide for the upgrading of existing and the development of new nationally or regionally significant infrastructure by:

(1) recognising the national or regional benefits of the infrastructure;
(2) recognising the functional or operational needs of the infrastructure that may constrain their location or operation;
(3) ensuring infrastructure is designed and located to maintain functionality during and after natural hazard events;
(4) coordinating land use activities, including the sequencing and release of land for urban or rural-residential development, to ensure integration with existing or planned infrastructure;
(3) as a first priority, avoiding locating infrastructure in:

[1] https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/projects/onrc

   (a) areas of significant indigenous vegetation and significant habitats of indigenous fauna;
   (b) areas of outstanding natural character;
   (c) outstanding natural features and landscapes;
   (d) outstanding waterbodies;
   (e) places or areas containing historic heritage of regional or national significance; or
   (f) places or areas of significance to tangata whenua, including wāhi tapu and wāhi tupuna; and

(3) where (2) cannot be achieved, have regard to the extent and magnitude of adverse effects on the environment and the degree to which unavoidable adverse effects can be remedied or mitigated;

(4) where the adverse effects are significant, require consideration of alternative sites, routes, methods and design.

EIT-INF-P3 Protecting nationally or regionally significant infrastructure

Manage other activities to ensure the functional or operational needs of nationally or regionally infrastructure are not compromised, including by:

(1) Restricting the establishment of activities that may result in reverse sensitivity effects;

(2) Protecting infrastructure from activities that are incompatible with the anticipated effects of that infrastructure; and

(3) Avoiding, where practicable or otherwise remedying or mitigating adverse effects of activities on infrastructure.

Methods

EIT-INF-M1 - Regional council management

Otago Regional Council will, at the next plan review or earlier if possible, amend its regional plans to the extent necessary to include objectives, policies and methods (including rules where necessary) to give effect to Policies EIT-INF-P1 and EIT-INF-P2 by including provisions that:

(1) Manage the adverse effects of operating, maintaining, upgrading or developing nationally or regionally significant infrastructure activities that:
   (a) are within in the beds of lakes and rivers and the coastal marine area; or
   (b) involve the taking, use, damming or diversion of water and discharge of water and contaminants; and

(2) Restrict the establishment or occurrence of activities that may adversely affect the efficient functioning of nationally or regionally significant infrastructure.

EIT-INF-M2 - Territorial authority management

Territorial authorities will, at the next plan review or earlier if possible, amend their district plans to the extent necessary to include objectives, policies and methods (including rules where necessary) to give effect to Policies EIT-IN-P1 and EIT-IN-P2 by including provisions that:

(1) Control the subdivision, use and development of land to ensure infrastructure can meet any increased demand;

(2) Require the upgrading of existing infrastructure or development of new infrastructure where demand cannot be met by existing infrastructure;

(3) Manage the adverse effects of operating, maintaining, upgrading or developing renewable electricity generation and electricity transmission activities on the surface of rivers and lakes and on land outside the coastal marine area; (4) Preventing the establishment of incompatible activities in locations in close proximity to regionally significant infrastructure that may affect the operation of that infrastructure or result in reverse sensitivity effects; and
(5) Requiring large-scale urban or rural-residential land use change and subdivision to be undertaken in accordance with an Outline Development Plan incorporated into district plans.

Part 3 – Transport

Alterative Provisions for Option 2: PORPS 2019 approach with some efficiency and effectiveness improvements

Objective

EIT-TRAN-O1 Transport network

The transport network:

(1) is effective, efficient and safe;
(2) is integrated with land use; and
(3) supports the movement of people, goods and services.

Policies

EIT-TRAN-P1 – Transport network design

Enable the operation and maintenance of the existing transport network and development of new transport infrastructure provided that:

(1) As a first priority, avoid locating transport infrastructure in:
    (a) Areas of significant vegetation and significant habitats of indigenous fauna;
    (b) Outstanding natural features, landscapes and seascapes;
    (c) Areas of outstanding natural character;
    (d) Outstanding water bodies;
    (e) Places or areas containing historic heritage of regional or national significance; and
    (f) Places or areas of significance to tangata whenua, including wāhi tapu and wāhi tūpuna; and
(2) Where it is not practicable to avoid locating in the areas listed in (1) above due to functional or operational needs of the transport network, avoid, remedy or mitigate adverse effects on those values to the fullest extent possible, including through consideration of alternative routes, methods and site selection.

EIT-TRAN-P2 – Protection of the transport system

Protect the transport system by managing the impacts of other incompatible activities on the transport system, including those that may result in reverse sensitivity.

EIT-TRAN-P3 – Land use and transport integration

Ensure that transport infrastructure has good connectivity by:

(1) Promoting a consolidated urban form;
(2) Placing a high priority on walking, cycling, and public transport, and integrating these transport modes into the design of development and transport networks;
(3) Fostering the uptake of public transport by providing safe, reliable and well sheltered alternatives to private vehicle transport; and
(4) Having high design standards for pedestrian and cyclist safety and amenity taking into consideration the accessibility needs of different sections of the community.

EIT-EN-P4 Transportation and fuels

Reduce the adverse effects of transportation by:

(1) Promoting sustainable transport networks including integrated public transport systems;
(2) Increasing the efficiency of energy use by transportation; and
(3) Encouraging the adoption of renewable or lower emission transport fuels.

Methods

EIT-TRAN-M1 – Regional council management

Otago Regional Council will, at the next plan review or earlier if possible, amend its regional plans to the extent necessary to include objectives, policies and methods (including rules where necessary) to give effect to Policies EIT-TRAN-P1 to EIT-TRAN-P4 by:

(1) Managing the adverse effects of operating, maintaining, upgrading or developing transport infrastructure that:
    (a) are within in the beds of lakes and rivers or the coastal marine area; or
    (b) involve the taking, use, damming or diversion of water and discharge of water and contaminants; and
(2) Restricting the establishment or occurrence of activities that may adversely affect the efficient functioning of transport infrastructure.

EIT-TRAN-M2 – Territorial authority management

Territorial authorities will, at the next plan review or earlier if possible, amend their district plans to the extent necessary to include objectives, policies and methods (including rules where necessary) to give effect to Policies EIT-IN-P1 to EIT-IN-P3 by:

(1) Identifying roads of national or regional;
(2) Providing for the continued operation, maintenance and upgrade of transport infrastructure and the development of new transport infrastructure;
(3) Managing high-trip generating activities by requiring integration with public transport services and providing for safe pedestrian and cycling access;
(4) Including subdivision and infrastructure design standards to recognise the access needs of different sections of the community, including the mobility impaired, the elderly and children;

(5) Restricting the establishment or expansion of activities adjacent to transport infrastructure that may compromise the safety of the transport system;
(6) Requiring large scale land use changes and subdivision to be undertaken in accordance with an Outline Development Plan.

Appendix 19: GNS Report (2021)

Draft 2021 Otago Regional Policy Statement Natural Hazards Chapter Review

SD Kelly
RJ Woods
WSA Saunders
PJ Glassey

GNS Science Consultancy Report 2021/38
May 2021

DISCLAIMER

BIBLIOGRAPHIC REFERENCE

Kelly SD, Saunders WSA, Woods RJ, Glassey PJ. 2021. Draft 2021 Otago Regional Policy Statement natural hazards chapter review. Lower Hutt (NZ): GNS Science. 29 p. Consultancy Report 2021/38.

CONTENTS

TABLES

FIGURES

EXECUTIVE SUMMARY

Following recommendation from the Minister for the Environment, the Otago Regional Council (ORC) are undertaking a complete review of their Regional Policy Statement (RPS).[1] To assist ORC's review, GNS Science was commissioned to undertake a review of the natural hazards chapter of the draft 2020 RPS ('dRPS') and Section 32[2] report accompanying the dRPS.

The purpose of this review is to provide an assessment of the dRPS natural hazards chapter, addressing whether:

- it achieves the purpose of the Resource Management Act 1991 (RMA) and gives effect to national policy direction under the RMA;
- objectives, policies and methods are appropriately aligned; and
- an integrated approach is taken toward the management of natural hazards, including the use of statutory and non-statutory risk-reduction methods.

The review presents a comparison of the dRPS with the good-practise indicators for RPSs from Grace and Saunders (2016), against which the dRPS compares favourably. Where the dRPS does not implement an indicator, this can typically be explained by an underlying factor, such as the structure of the dRPS.

Primary (September 2020) and secondary (January 2021) reviews of the dRPS were undertaken.

The primary review of the dRPS found 11 high-level matters, for which detailed discussion is presented and recommendations stem from. These are summarised as follows:

1. The natural hazard issue be broadened to better encompass the range of natural hazards within the Otago region.
2. The climate change issue statement is integrated across the issue and policy framework in acknowledgement of the potential effects of climate change across other aspects of the environment.
3. Improved incorporation and consideration of wellbeing is also suggested.
4. Risk is currently categorised on a scale of *significant* > *tolerable* > *low/lower*; it is recommended that this is amended to *significant* > *tolerable* > *acceptable* in reflection of risk management standards.
5. In relation to *HAZ-SCHED1 / APP5 Methodology for natural hazard risk assessment*, it is recommended that the likelihood framework is aligned with existing practise or that additional Section 32 discussion is provided to support the existing dRPS approach.
6. Within HAZ-SCHED1, it is recommended that the risk levels (see Point 4 above) are subject to public consultation and that the risk table presented in the dRPS is identified as an interim measure until this is completed.
7. Land-use to be identified as one of ORC's responsibilities within the methods to ensure that they can proactively manage existing uses where needed.
8. Requirement of the best available information/guidance to be considered in all instances.

1 https://www.mfe.govt.nz/rma/reviews-and-investigations-of-local-authorities/otago-regional-council
2 Section 32 of the RMA.

9. Improved integration and acknowledgement of the Ngāi Tahu ki Murihiku management plan and Otago Emergency Management Group.
10. Further engagement with Kāi Tahu be advanced to explore the interaction between the mana whenua provisions and natural hazard provisions.
11. Residual risk is a term defined within the dRPS but not widely used. Recommendations for its incorporation are proposed.

The secondary review of the dRPS considered the response to the primary review, additional terminology and the methodology for risk assessment, which included the development of a Quantitative Risk Assessment methodology.

1.0 INTRODUCTION

1.1 Background

Under recommendation from the Minister for the Environment, the Otago Regional Council (ORC) are undertaking a complete review of their Regional Policy Statement (RPS).[3] While the review and the Minister's recommendation largely derives from requirements centred on ORC's responsibilities relating to the management of freshwater, the review is also being utilised to address identified gaps within other sections of the RPS. To assist ORC's review, GNS Science was commissioned to undertake a review of the natural hazards chapter of the draft 2020 RPS ('dRPS') and Section 32[4] report accompanying the dRPS.

1.2 Purpose

The purpose of this review is to provide an assessment of the dRPS natural hazards chapter, addressing:

- whether it achieves the purpose of the Resource Management Act 1991 (RMA) and gives effect to national policy direction under the RMA;
- whether there is alignment of objectives, policies and methods; and
- whether an integrated approach is taken toward the management of natural hazards, including the use of statutory and non-statutory risk-reduction methods.

1.3 Limitations and Considerations

This report has been prepared in consideration of the following limitations:

- ORC's set of natural hazard maps is incomplete (i.e. full regional coverage across all hazards is not available);
- Community engagement has not occurred regarding risk thresholds/tolerances;
- The dRPS has been prepared within a narrow timeframe[5];
- The dRPS natural hazards chapter needs to direct how local authorities are to manage natural hazards over the life of the dRPS, but also direct how development is to occur prior to future plan reviews occurring; and
- A direct drafting style has been sought to avoid complication.

It should be noted that, where the policy framework of the dRPS is considered within this report, the 'as drafted' dRPS wording is used.

3 https://www.mfe.govt.nz/rma/reviews-and-investigations-of-local-authorities/otago-regional-council

4 Section 32 of the RMA.

5 The Minister for the Environment's recommendation was made on 18 November 2019, with a notification date of the dRPS of November 2020 (extended to January 2021 due to COVID-19).

1.4 Report Structure

This report is structured into five sections, as follows:

Section 1 Introduction.

Section 2 Outline of the methodology utilised for reviewing the dRPS, which relies on GNS Science's risk-based planning and risk management expertise; and regional knowledge, experience and expertise.

Section 3 Summary of the primary review.

Section 4 Key discussion set out relating to the secondary review.

Section 5 A brief conclusion to the report.

2.0 METHODOLOGY

To achieve the purpose of this review, three key tasks were undertaken:

1. The statutory context and requirements of the RPS were assessed.
2. Review of 'good practise' indicators for natural hazards planning under the RMA.
3. Review of the relevant ORC documents, including:
   a. Draft Otago Regional Policy Statement – September 2020, as at 21 October 2020;
   b. Draft Section 32 Evaluation Report – Consideration of alternatives, benefits and costs – Proposed Otago Regional Policy Statement 2021, as at 21 October 2020;
   c. Partially Operative Otago Regional Policy Statement 2019 ('PORPS 2019')[6]; and
   d. Draft Otago Regional Policy Statement – January 2021.

Each of these key tasks is summarised in the subsections below.

2.1 Statutory Context and Requirements

The statutory context relating to the management of natural hazards within a RPS includes, in summary, the following sections of the RMA:

1. Natural hazards are defined in Section 2 of the RMA as:

   "… any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment."

2. Section 3 of the RMA includes a definition of 'effect', which is relevant in terms of interpreting other sections and the functions of territorial authorities. Of particular note is that this definition includes *"any past, present, or future effect"* and any effects *"regardless of the scale, intensity, duration, or frequency of the effect",* and also includes *"any potential effect of low probability which has a high potential impact"*.
3. Part 2 of the RMA includes the following sections and subsections relevant to the management of natural hazards, defences in relation to those hazards and the effects of climate change:
   a. Section 5, regarding enablement of people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while avoiding, remedying or mitigating adverse effects on the environment; and sustainment of the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations;
   b. Section 6 sets out matters of national importance, relevant as follows:
      i. Section 6(a) – providing for the preservation of the coastal environment and the protection of this area from inappropriate subdivision, use and development.
      ii. Section 6(d) – the maintenance and enhancement of public access to and along the coastal marine area.

6 Included following review of the Draft Section 32 report, which heavily references the PORPS 2019.

iii. Section 6(h) – the management of significant risks from natural hazards.

c. Section 7 sets out other matters requiring particular regard, relevant as follows:

iv. Section 7(b) – the efficient use and development of natural and physical resources (land).

v. Section 7(c) – the maintenance and enhancement of amenity values.

vi. Section 7(f) – the maintenance and enhancement of the quality of the environment.

vii. Section 7(g) – any finite characteristics of natural and physical resources.

viii. Section 7(i) – the effects of climate change.

4. Sections 10, 20A and 85 are relevant when considering existing uses and existing resource consents and the 'rights' associated with them. Regarding natural hazards, recent cases have centred on extinguishing existing uses. Section 10(1) sets out that:

"Land may be used in a manner that that contravenes a rule in a district plan or proposed district plan if – either – the use was lawfully established before … and the effects of the use are the same or similar …"

Section 10(4) clarifies that Section 10 of the RMA "*… does not apply to any use of land that is … controlled under section 30(1)(c) (regional control of certain land uses)"*.

Section 20A determines when certain existing lawful activities are allowed once a rule in a regional plan becomes operative and where an existing use requires resource consent. However, in the case of extinguishing existing uses, a prohibited activity status is used where that activity must be discontinued from the date of the prohibited rules becoming operational.

In addition to Sections 10 and 20A, Section 85 regulates how far planning provisions are able to go in restricting the use of private property. Grace et al. (2019) provide a comprehensive discussion of managing existing uses under the RMA.

5. Sections 30 and 31 of the RMA specify the functions of regional and territorial authorities, respectively. In relation to natural hazards, they require:

a. Section 30(1)(c) – "*the control of the use of land for the purpose of … the avoidance or mitigation of natural hazards*".

b. Section 31(1)(b)(i) – "*the control of any actual or potential effects of the use, development, or protection of land, including for the purpose of … the avoidance or mitigation of natural hazards*".

6. Sections 59–62 of the RMA address regional policy statements. Section 59 sets out their purpose[7]; Section 60 deals with their preparation and changes[8]; Section 61 sets out matters to be considered[9]; and Section 62 sets out the contents of regional policy statements, outlining those matters that the RPS *must* state, including:

a. the significant resource management issues for the region;

7 "*… to achieve the purpose of the Act by providing an overview of the resource management issues of the region and policies and methods to achieve integrated management of the natural and physical resources of the whole region*."

8 See Schedule 1 of the RMA.

9 Including the Regional Council functions under Section 30 of the RMA, the provisions of Part 2 of the RMA, Section 32 of the RMA, national policy statements, a New Zealand coastal policy statement, a national planning standard, regulations, management plans and strategies prepared under other Acts and planning documents recognised by an iwi authority.

b. the resource management issues of significance to iwi authorities in the region; and

c. the objectives sought to be achieved by the statement; and

d. the policies for those issues and objectives and an explanation of those policies; and

e. the methods (excluding rules) used, or to be used, to implement the policies; and

f. the principal reasons for adopting the objectives, policies, and methods of implementation set out in the statement; and

g. the environmental results anticipated from implementation of those policies and methods; and

h. the processes to be used to deal with issues that cross local authority boundaries, and issues between territorial authorities or between regions; and

i. the local authority responsible in the whole or any part of the region for specifying the objectives, policies, and methods for the control of the use of land – to avoid or mitigate natural hazards or any group of hazards; and

j. the procedures used to monitor the efficiency and effectiveness of the policies or methods contained in the statement; and

k. any other information required for the purpose of the regional council's functions, powers, and duties under this Act.

In addition, "*a regional policy statement must not be inconsistent with any water conservation order and must give effect to a national policy statement, a New Zealand coastal policy statement, or a national planning standard*."[10]

2.2 Identification of Good-Practise Indicators

Between 2014 and 2016, GNS Science undertook a four-part research project regarding the state of land-use planning for natural hazards in New Zealand. Part 2 of this project comprised a case study analysis of 10 RMA policy statements and plans (operative and proposed) to identify examples of good practise (Grace and Saunders 2016).

The methodology for this review utilises the good-practise indicators identified in Grace and Saunders (2016) (see Table 2.1 below) and employs a traffic light analysis of the dRPS against those indicators (provided in Section 3.2), with comments also provided to offer direction for the further work required (see Table 3.1).

10 Section 62(3) of the RMA.

Table 2.1 Good-practise indicators for RPSs (Grace and Saunders 2016).[11]

Good Practise	Indicators
Planning framework	• Tables that show linkages between issues, objectives, policies and implementation methods improve ease of use, transparency and accessibility of an RPS, especially when natural hazard provisions are spread across different chapters/sections of an RPS. • Policies and implementation methods that are directive toward the content of regional coastal plans, regional plans and district plans set a clear hierarchy and can ensure that the objectives of the RPS are given effect to in other documents. Directive policies also ensure consistency between regional and territorial plans. • Explicitly taking a risk-based approach, using concise and directive language, provides clear policy direction to territorial authorities. • A structure with a small number of objectives and policies (Proposed Waikato RPS: one risk-based objective, three policies; Wellington RPS: three objectives, three policies; West Coast RPS: one objective, four policies), and a larger number of methods of implementation and/or explanatory text, provides a clear and concise framework. • Explicitly requiring consultation with communities about levels of risk from natural hazards emphasises the importance of community involvement. • Policies that specify the types of consequences that must be considered provide specific guidance and ensure consistency between regional and territorial plans.
Monitoring and evaluation	• Inclusion of hazard-specific anticipated environmental results set clear monitoring parameters. Timelines should also be included.
Roles and responsibilities	• Policies clarifying the roles and responsibilities of regional and territorial authorities in hazard management are helpful in ensuring tasks are undertaken, and efficient use of resources (avoidance of doubling up of function). • RPSs are able to assign responsibility to the regional plan to manage risk to existing developments, overcoming the restriction imposed by s10 RMA on district plans doing this.
Interaction with Emergency Management Plans	• Strong links in the RPS to Emergency Management Groups and Group Plans encourages collaboration and efficiencies between the Emergency Management and planning frameworks for managing risk.
Information base/ management	• Method providing strong direction that any hazard information shared with other councils is used as part of the resource consent process and is placed on Land Information Memorandums, helping to ensure that hazard information is available and used to inform decisions.
Uncertainty	• The adoption of a precautionary approach in situations where there is uncertainty surrounding risk is considered good practise (Quality Planning 2013; Saunders et al. 2013). • Plans that address uncertainty directly can provide strong guidance and therefore create certainty of process, if not of fact.

11 Adapted from Table 4.1 and Section 5.2 of Grace and Saunders (2016).

Good Practise	Indicators
Cumulative and cascading hazards	• Cumulative hazards are multiple, unrelated natural hazards that impact on the same area. This area therefore has a higher likelihood of being impacted by a natural hazard event. • Cascading hazards are those different types of hazards all triggered by the same event. When the trigger event occurs, the area will therefore be subject to more than one hazard at the same or a similar time (Beban and Saunders 2013). • Addressing cumulative and cascading hazards in a plan provides a more sophisticated approach to be taken to the management of risk.
Definition of risk	• Including definitions of hazard and risk related terms is helpful – it avoids uncertainty and provides clear direction to territorial authorities. For example, definitions of levels of risk (intolerable, tolerable and acceptable) can be found in the Proposed Waikato RPS.

2.3 Review of the Documents

For the primary review, ORC provided the dRPS and draft Section 32 report (September 2020) for review. The review of these two documents comprises recommended changes in the form of ‘tracked changes’ and comments (provided to ORC) and was undertaken in the context of the purpose, limitations, statutory context and requirements and good-practise indicators. Following review of the draft Section 32 report, the PORPS 2019 was also reviewed, as the draft Section 32 report makes multiple references to the polices within the PORPS 2019 without containing sufficient context for those statements to stand up in their own right.

For the secondary review, ORC provided a revised natural hazards chapter to GNS Science (January 2021) for review, and a similar methodology was followed.

3.0 PRIMARY REVIEW

This section provides a summary of the key points of our review of the natural hazards chapter of the dRPS.

This section addresses the following topics:

1. Recommendations;
2. Good-practise indicators;
3. Framing of issues;
4. The classification of risk;
5. HAZ-SCHED1: Methodology for risk assessment[12];
6. Existing uses and responsibilities;
7. Ability to consider new information or adapt the policy framework
8. Other information;
9. Property and hard structures;
10. Terminology, including residual risk, multiple hazards and resilience;
11. Provision for certain activities;
12. Opportunities to increase directiveness; and
13. Use of the term ‘mitigation’.

3.1 Recommendations

Section 3 contains several recommendations for the dRPS and potentially beyond. For simplicity, this section of the report collectively sets out these recommendations.

1. Broadening of the natural hazards issue statement to better encompass the range of natural hazards within the Otago region.
2. Integration of the climate change issue statement across the issue and policy framework in acknowledgement of the potential effects of climate change across the environment.
3. Amendment of the impact snapshot to better incorporate and consider wellbeing.
4. Community consultation has not been undertaken regarding the level of risk within the dRPS. It is recommended that the dRPS be amended to direct that local authorities undertake consultation with their communities, stakeholders and partners regarding risk levels within the framework of HAZ-SCHED1 and the dRPS.
5. Amendment of the risk scale to ‘significant > tolerable > acceptable’.
6. The basis for the HAZ-SCHED1’s likelihood framework is unclear. In the interest of achieving a level of national consistency, it is recommended that ORC align with existing practise for indicative frequencies and/or include a discussion of the approach in the Section 32 report.
7. Inclusion of land use within HAZ-NH-M1(1) as part of ORC’s responsibilities to ensure that the management of existing uses as an avenue of risk reduction is clearly enabled.

12 HAZ-SCHED1 progressed to become APP5, and then APP6, in subsequent version of the chapter.

8. Enabling the ability to consider new information by directing that the best available information is to be used or is able to be used.
9. Regarding other information, natural hazard provisions within the Ngāi Tahu ki Murihiku management plan should be acknowledged, and recognition of the Otago Emergency Management Group should be considered within HAZ-NZ-M6.
10. Section 3.10.1 identifies that 'residual risk' is defined within the definitions section of the dRPS but not contemplated with the natural hazards chapter of the dRPS. Opportunities to direct consideration of residual risk were identified, and is it recommended that these are adopted.
11. Consultation with Kāi Tahu in relation to the achievement of mana whenua provisions and reconciliation with natural hazard provisions.

3.2 Analysis against Good-Practise Indicators

Section 2.2 of this report outlines current best practise and identified opportunities for improvement to good practise in regard to planning for natural hazards. Table 3.1 provides an analysis of the dRPS against the good-practise indicators identified in Section 2.2 using a traffic light system of assessment.

Table 3.1 Measurement of the dRPS against good-practise indicators and identified opportunities for improvement in good practise based on Grace and Saunders (2016).

Key			
Implemented	**Implemented in Part**	**Not Implemented**	**Implementation Necessary**

Good-Practise Indicator	Comment
1. Tables showing linkages between provisions.	The dRPS does not contain a table demonstrating the linkages between provisions or lists of the methods that implement each policy (as per the PORPS 2019). However, between the PORPS 2019 and dRPS, methods have been restructured under subject headings (i.e. natural hazard methods are under the natural hazards chapter) as opposed to within a separate methods section. The dRPS natural hazard methods extensively refer to the natural hazard policies, thereby demonstrating linkages and removing a requirements for tables.
2. Policies and methods that are directive to lower-order plans.	The methods of the dRPS are directive toward regional (HAZ-NH-M3) and district (HAZ-NH-P4) plans, and the chapter generally contains directive language. Opportunities to increase this directiveness in provisions were identified.[13]
3. Adoption of a risk-based approach.	The dRPS explicitly adopts a risk-based approach, exemplified by HAZ-SCHED1 – Methodology for risk assessment.
4. A structure comprising a small number of objectives, more policies and even more methods.	This good-practise indicator more generally seeks a clear and concise framework. Despite not specifically following this, it is considered that the dRPS is sufficiently clear and concise, aided significantly by its directive nature.

13 For example, directing how system resilience can be encouraged [HAZ-NH-M2(8)(d)], the expected approach to adopting a precautionary approach (HAZ-NH-P5), providing example natural hazard risk reduction measures.

Key			
Implemented	**Implemented in Part**	**Not Implemented**	**Implementation Necessary**

Good-Practise Indicator	Comment
5. Requirement for consultation regarding levels of risk.	One of the acknowledged limitations in undertaking this review (Section 1.3) was that community consultation had not occurred regarding the levels of risk, nor does the dRPS make this a requirement. This is a key recommendation of this review.
6. Policies directive of the types of consequences that must be considered (e.g. loss of life, injury, social and economic disruption, civil defence implications, cost to the community).	HAZ-NH-P2, in conjunction with HAZ-SCHED1, requires the consideration of a range of consequences informing the risk assessment.
7. Hazard-specific anticipated environmental results.	The dRPS does not contain hazard-specific anticipated environmental results ('AERs'). The AER instead reflect the risk-based approach adopted throughout the dRPS. It is not recommended that this approach is changed.
8. Policies clarifying roles and responsibilities.	HAZ-NH-M1 contains a statement of responsibilities. Alignment of these to Sections 30(1) and 31(1) of the RMA is recommended.
9. Strong links to the Emergency Management groups and plans.	The dRPS contains several references to Emergency Management, including within the consideration of consequences of HAZ-SCHED1 and within Issue 9: Cumulative impacts and resilience – the environmental costs of our activities are stacking up and may soon reach a tipping point. A strengthening of these linkages could be provided through the policies and methods.
10. Definitions of hazard and risk-related terms	The definitions section of the dRPS contains definitions for cascading hazards, hard protection structures, multiple hazards, natural hazards, residual risk and risk.
11. Improved linkages between policy direction and land-use planning rules to achieve a specific level of risk rather than just seeking to maintain or not increase risk.	HAZ-NH-P3 and P4 direct that a tolerable or low level of risk is achieved for new and existing development, respectively. While not inherently directive of land-use planning rules, HAZ-NH-M3 and M4 do direct that plans be amended to achieve HAZ-NH-P3 and P4 (among other policies).
12. Consideration of uncertainty and cumulative and cascading hazards.	HAZ-NH-P5 directs that, where natural hazard risk is uncertain or unknown, but potentially significant, a precautionary approach is applied. HAZ-NH-P1 directs that natural hazard areas are identified and that multiple[14] and cascading hazards are considered in doing so.
13. A definition of risk.	The dRPS utilises the New Zealand Coastal Policy Statement definition of risk. It also contains a definition of 'residual risk', meaning "*… the risk remaining after the implementation or undertaking of all available and practicable risk management measures*."

14 It is recommended that 'multiple hazards' is changed to 'cumulative hazards' to reflect common terminology practices.

Overall, the dRPS compares well to the good-practise indicators set out in Grace and Saunders (2016). Where the good-practise indicators are partially implemented, the following sections (particularly Sections 3.1–3.7) provide high-level discussion to assist this. In some cases, implementation is not considered necessary, as other factors within the dRPS's structure and drafting achieve the same outcome of the relevant good-practise indicator (e.g. the good-practise indicators relating to table and structure) or are a better reflection of the direction of the dRPS (e.g. anticipated environmental results).

3.3 Framing of Issues: Natural Hazards, Climate Change and other Values

Part 2 of the dRPS provides the resource management overview for the Otago region, including the significant resource management issues.

Issue 1 addresses natural hazards and Issue 2 addresses climate change; improved integration, broader consideration of the range of natural hazard and impacts and future legislative change are at the core of recommended changes to these issues.

The issue statement for climate change is closely linked to natural hazards, while reference is also made to ecosystems. Impact snapshots provide an overview of the potential impacts of an issue; to better consider wellbeing, a series of amendments are suggested.

3.3.1 Issue 1: Natural Hazards Pose a Risk to Many Otago Communities

Issue 1 addresses natural hazard risk for Otago's communities in the context of an Alpine Fault earthquake, flooding and potential isolation caused by a major event. This statement is limited in its summation of the natural hazard issues in Otago as it does not reflect or broadly cover the breadth of natural hazards that pose a risk to Otago's communities.

While not all hazards are proposed to be managed through specific provisions or controls in district or regional plans (including regional coastal plans), they should be identified to ensure that they can be considered through spatial planning and to link to emergency management responses.

3.3.2 Issue 2: Climate Change is Likely to Damage our Economy and Environment

Climate change is an issue that will impact on natural hazards and environmental systems and exacerbate environmental, social, cultural and economic challenges, which is reflected in the Issue 2 statement. Climate change does not appear as a stand-alone topic in the objectives and policies framework. Increased vertical integration of the topic of climate change should be progressed. This may include how climate change effects may exacerbate, accelerate or result in increased uncertainty relating to biodiversity outcomes, coastal processes, water quality, social and global pressures driving economics and social structures, demand and drivers for urban growth, pest species and primary industries.

Objectives responding to the issue of climate change could also be incorporated in growth planning and supporting infrastructure, design of places and spaces, waste management, water supply/storage and renewable energy solutions.

Recent amendments to the RMA[15] (which come into force on 31 December 2021) repeal Sections 70A and 70B, now requiring regional councils to have regard to the causes of climate change (i.e. greenhouse gas emissions) when considering a discharge application and introducing the ability to consider mitigation of the effects of climate change in this regard. The role that the dRPS and lower-level resource management documents could have in relation to mitigation (through reducing emissions) should be strengthened and provide a clearer foundation for regional policy direction for the built environment and provisions for ecosystems and biodiversity to migrate and adapt in a changing environment.

The inclusion of climate change projections in Table X[16], Issue 2 of the dRPS, while based on current best available information, may present issues in updating this information. While reference is made to Macara et al. (2019), there is no clear discussion of representative concentration pathway scenarios or other considerations such as vertical land movement and erosion or accretion. Reference to best available information would constitute a better approach in Table X's introductory text.

Dependent on the direction taken for vertical integration of climate change through the chapters in the dRPS, horizontal integration of the climate change issue statement as an integrated topic across the issues and policy framework could equally be considered. Either option can support more specific discussion and policy direction relating to climate change and its impacts to be included for each area of the plan, as opposed to primarily in relation to natural hazards.

3.3.3 Impact Snapshots

Under each of the issues, an 'impact snapshot' is made. To better reflect the impact that natural hazards could have on wellbeing, the following changes are suggested:

- Clarification regarding ecosystems being at risk from a 'natural' event or the anthropogenic modification of the environment that further exacerbates this. For example, contaminants affecting ecosystems as a result of a flood event damaging the built environment or coastal squeeze where ecosystems are not able to migrate landward in a natural manner as a result of sea-level rise.
- Further discussion of residual risk and risk transfer (i.e. insurance).
- Discussion of secondary impacts resulting from damage to property or disruption of services, including psycho-social impacts and impacts on health and wellbeing.
- Effects on cultural values, landscapes or taonga species. There is valuable content located in other sections of the dRPS, such as under the Coastal Environment (Taku Tai Moana me Te Wai Māori) section, that could be cross-referenced to provide improved integration.

3.3.4 Integrated Management

The use of the term 'sustainable level' in IM-O3 introduces a metric that does not reflect international and national obligations or goals and should be reconsidered. It is suggested that this be amended to reflect the goal of limiting global average temperature increase to 1.5°C

15 https://environment.govt.nz/assets/Publications/Files/overview-of-changes-introduced-by-the-resource-management-amendment-act-2020-updated.pdf

16 Tables were not numbered within the September 2020 dRPS.

above pre-industrial levels, as per the purpose of the Climate Change Response (Zero Carbon) Amendment Act 2019.

IM-P5 and IM-P7 provide an opportunity for links to the concept of an adaptive approach and the need, in some instances, for a precautionary approach to be reflected in these policies.

Further consideration or explanation may be required to frame how the development of a strategy under IM-M3 in relation to climate change strategies could integrate with any future process to define tolerable levels of risk and triggers or thresholds at which action is taken or review of policy approaches required.

3.4 Classifying Risk

The risk scale utilised within the dRPS comprises *"significant > tolerable > low (or lower)"*. The justification for this scale is unclear; however, it is assumed that 'significant' derives from Section 6(h) of the RMA, while 'tolerable' and 'low' or 'lower' are from two separate commonly utilised scales[17], and their combination and utilisation is not set out within the draft Section 32 report. While the same scale is utilised in the PORPS 2019, the reasoning is not set out in the Section 32 report as for the PORPS 2019.

The term 'tolerable' as a risk descriptor within a scale[17] can be traced back to AS/NZS (2009).[18] Adopting this scale within an RMA risk framework would result in a 'significant > tolerable > acceptable' scale.

The term 'low' within a *high > medium/moderate > low* scale is utilised across multiple sectors and for multiple assessment. Adopting this scale within an RMA risk framework would result in a 'significant > medium/moderate > low' scale.

The terminology of the risk scale utilised within the Bay of Plenty Regional Policy Statement ('BoP RPS') ("*high > medium > low")* (Kilvington and Saunders 2015; Saunders et al. 2013) was subject to considerable discussion ahead of its selection (undocumented).[19] Policy NH 2B of the BoP RPS clarifies the overlap between the two scales as follows:

> ***Policy NH 2B: Classifying Risk***
>
> *Classify risk according to the following three-category risk management framework as detailed in Appendix L:*
>
> 1. *High natural hazard risk being a level of risk beyond what should be tolerated.*
> 2. *Medium natural hazard risk being a level of risk that exceeds the Low level but does not meet the criteria for High risk.*
> 3. *Low natural hazard risk being the level of risk generally acceptable.*
>
> *The policy direction associated with these levels of risk is set out in Policy NH 3B: Natural hazard risk outcomes.*

17 Being "*unacceptable > tolerable > acceptable*" and "*high > medium > low*" (or some version thereof).

18 ISO 31000:2018 has been adopted in Australia; however, the 2009 version remains current in New Zealand at the time of this review.

19 Note that the BoP RPS was notified ahead of the 2017 RMA amendments, including Section 6(h).

Recognising that consistency with the RMA should be at the forefront of the dRPS, ‘significant’ should remain as the highest risk threshold; however, consideration should be given to altering ‘tolerable’ and ‘low/lower’ to align with the remainder of the risk scale, with a standard scale set out above. To avoid the need for a policy such as Policy NH 2B, it is recommended that *‘significant > tolerable > acceptable’* is adopted as the risk scale for the dRPS.[20]

3.5 HAZ-SCHED1: Methodology for Risk Assessment

HAZ-SCHED1 sets out ORC’s methodology for risk assessment and is identified at Paragraph 301 within the draft Section 32 report as being for use *“… by regional and territorial authorities when reviewing regional and district plans, and also by developers when undertaking private plan changes and resource consent applications.”* It is a simplified version of the approach set out in Saunders et al. (2013) and adopted by the Bay of Plenty Regional Council, which was subject to Environment Court examination (ENV-2015-AKL-000151).

3.5.1 Likelihoods and Indicative Frequencies

Step 1 of HAZ-SCHED1 provides the likelihood scale for risk assessment, which adopts five timeframes ranging from ‘almost certain’ to ‘rare’ and an indicative frequency of 10% Annual Exceedance Probability (AEP) (1 in 10 years) to 0.01% AEP (1 in 10,000 years). The basis of these frequencies is unclear. Saunders et al. (2013) also present five timeframes, with differing indicative frequencies, as set out in Table 3.2.

Table 3.2 Comparison of indicative frequencies within the dRPS and Saunders et al. (2013).

Timeframe Level	dRPS Indicative Frequency	Saunders et al. (2013) Indicative Frequency
1	10%+ AEP (once every 1–10 years)	Up to once every 50 years (2% AEP)
2	9.9–1% AEP (once every 10.1–100 years)	Once every 51–100 years (1–2% AEP)
3	0.99–0.1% AEP (once in 100.1–1000 years)	Once every 101–1000 years (0.1–1% AEP)
4	0.099–0.01% AEP (once in 1000.1–10,000 years)	Once every 1001–2500 years (0.1–0.04% AEP)
5	<0.01% AEP (once in 10,000+ years)	2501+ years (<0.04% AEP)

Appendix 5 of Saunders et al. (2013) provides a discussion of timeframes or indicative frequencies for planning for natural hazards, considering the New Zealand Coastal Policy Statement (NZCPS; at least 100 years), the Building Act 2004 (50-year minimum intended building life), case law, the role of warning systems and forecasting (e.g. for tsunami, flooding, landslide and coastal erosion), New Zealand Standards, Council’s duty of care and Land Information Memorandums. Risk thresholds were the subject of evidence heard in the Christchurch Replacement District Plan hearings, utilising the Australian Geomechanics Society (AGS) guidelines, Annual Individual Fatality Risk (AIFR) and thresholds of 10^{-4} (1 in 10,000 AEP), where risk mapped as being greater than 10 resulted in prohibited activity status for subdivision and buildings. It must be recognised that how AIFR aligns with the

20 Where, in this case, ‘significant’ has been used as a proxy for ‘intolerable’ or ‘unacceptable’.

likelihood of a natural hazard event occurring (and potentially impacting property or life safety) has not been considered in New Zealand planning frameworks; however, based on this evidence, it would appear that the indicative frequencies adopted within the dRPS are out of step with current practise.

While it must be acknowledged that there is no standard guidance on likelihood levels for planning for natural hazards, it is recommended that the dRPS align with similar practises for indicative frequencies. The effect of doing so would result in a more conservative risk table. In order to support this change, further explanation in the Section 32 report on the reasoning behind the likelihood levels should be provided.

3.5.2 Levels of Risk

Step 3 of HAZ-SCHED1 contains the risk table for assessing (land-use) activities. The draft Section 32 report does not provide any indication of how the thresholds for the levels of risk have been reached (recognising the limitations of this review [Section 1.3]). Other examples in practise have achieved this through community consultation (BoP RPS) or by a decision-making committee following the provision of expert advice (Christchurch Replacement District Plan).

The ability for communities to determine their level of risk is a good-practise indicator (Indicator 5, Table 3.1) and, as Kilvington and Saunders (2015) demonstrate, these levels of risk differ across community members, infrastructure providers, experts (Figure 3.1) and council staff (Figure 3.2). Kilvington and Saunders (2015) show that an aggregated risk level table results in changes both up and down the levels of risk compared to the single expert source opinion (Figure 3.3). To adapt to the differing tolerances noted by Kilvington and Saunders (2015), flexibility is required within the framework to reflect community values.

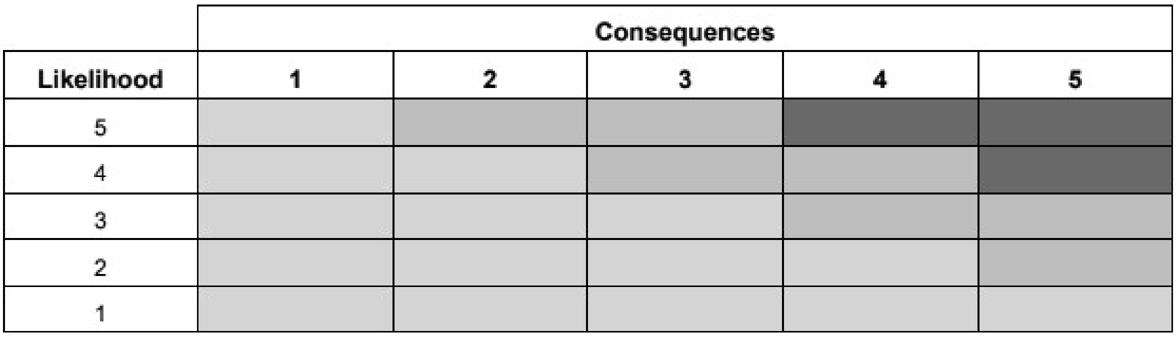

Figure 3.1 GNS Science indicative template for a single expert source risk table. Source: Kilvington and Saunders (2015).

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain					
Likely					
Possible					
Unlikely					
Rare					
Green: Low Risk, Yellow: Tolerable Risk, Red: Significant Risk					

Figure 3.2 Otago dRPS risk table.

Likelihood	Consequences				
	Insignificant 1	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
Likely 5					
Possible 4					
Unlikely 3					
Rare 2					
Very Rare 1					

Figure 3.3 The final Bay of Plenty risk table. Source: Kilvington and Saunders (2015).

In lieu of region-wide consultation being undertaken, it is recommended that the dRPS be amended to direct that community (district-level) consultation is undertaken with regard to the levels of risk adopted with the assessment at a territorial authority level. The risk table within HAZ-SCHED1 should be clearly identified as an interim table, with an accompanying statement of expectations that each district determines what significant, tolerable and acceptable risk is for their communities. Kilvington and Saunders (2015) and Bell et al. (2017) provide a methodology for communities and stakeholders to contribute to this process, and exercises are available to assist with this.

3.6 Existing Uses and Delegation of Responsibilities

Within the dRPS, the responsibilities of regional council and district councils were identified as a potential barrier to effectively being able to manage existing uses. These two topics, existing uses and delegation of responsibilities, are addressed together.

The management of existing uses, and particularly extinguishing existing uses, is a highly contentious issue, as exemplified by Bay of Plenty Regional Natural Resources Plan – Plan

Change 17 and the Whakatāne District Plan's Plan Change 1 in relation to the Awatarariki fanhead, Matatā.

With regard to regional and district plans, HAZ-NH-P3 and HAZ-NH-P4 direct that ORC and territorial authorities amend their plans to *"require implementation of natural hazard risk reduction measures including, where practicable, to existing land uses"*. The process for managing existing uses under the RMA is considered in Grace et al. (2019) and exemplified by the Awatarariki fanhead, Matatā case (Saunders and Smith 2020). In reviewing the dRPS, several provisions would be in potential conflict with ORC's anticipation of managing existing uses or result in confusion surrounding the roles and responsibilities between regional council and territorial authorities when approaching the management of existing uses.

Section 10(1) of the RMA allows land to be used in a way that contravenes a rule in a district plan or proposed district plan in certain circumstances; the effect of this is to not allow territorial authorities to extinguish existing uses through use of prohibited activity status. Section 10(4) clarifies that Section 10 does not apply to land controlled under Section 30(1)(c) or restricted under Sections 12 and 13. Therefore, a regional council may implement a prohibited activity status within a regional plan to extinguish existing use rights.[21] It has been identified that the dRPS could identify this tool more clearly. HAZ-NH-M1 does not include controlling land use [Section 9(2)] as one ORC's responsibilities. Management of existing use rights through Section 9(2) is therefore not clearly anticipated by the dRPS, and the ORC could be accused of acting beyond their identified responsibilities if the use of regional land-use rules were pursued in regional plans.

It is recommended that the management of land uses be included within HAZ-NH-M1(1) as part of ORC's responsibilities to ensure that this avenue of risk reduction is clearly enabled.

3.7 Ability to Consider New Information or Adapt the Policy Framework

HAZ-NH-PR1 sets out the principle reasons (split into natural hazard and climate change sections) for adopting the provisions. Within the natural hazards section, it states:

> *"The changing nature of natural hazard risk due to climate change means that provisions need to be able to adapt to a future natural hazard environment."*

This statement is commended; however, its intent is not reflected within the policy framework, which does not include policy directing an adaptive approach in the face of uncertainty, changing natural hazard risk and climate change. Potential mechanisms to improve the policy framework include better reflection of Dynamic Adaptive Policy Pathways (Bell et al. 2017).

HAZ-NH-M2(7) directs that 'current projections' for sea-level rise information be taken into account in both regional and district plans. However, HAZ-NH-M2(8)(a) directs that the *"… best relevant … data"* be taken into account. To reconcile this, it is recommended that an option for the 'best available information' be added to HAZ-NH-M2(7)(c).

The discussion included in 'addressing impacts' under Issue 1 is limited and could include additional comment on precautionary principles, uncertainty and adaptive approaches. Additional text could be included to support consideration of adaptive options and the need to ensure that a future path is not pre-determined (path dependency).

21 Provided several other legal tests are passed.

The framing of Issue 9 *Cumulative impacts and resilience – the environmental costs of our activities are stacking up and may soon reach a tipping point* includes some well-crafted direction around the need to understand that natural systems are dynamic and subject to multiple stressors. The adaptive approach and setting of thresholds and triggers is also applicable to risk tolerance and the risk of adverse effects, alongside natural resources.

3.8 Other Information

In setting out the content of regional policy statements, Section 62 of the RMA contemplates other information needed to inform regional policy statements. With regard to natural hazard (and climate change), this extends to iwi authorities and Emergency Management Groups and area- or place-based policy, strategy or management approaches. National strategy and guidance relevant to infrastructure (and climate change), resilience and management of risk continues to evolve, and further dRPS development (through the notification process) should remain alive to these national discussions.

Section 61(2A)(a) of the RMA requires ORC to "*take into account*" relevant planning documents recognised by an iwi authority, if they are lodged with the council.

ORC has a 'Memorandum of Understanding and Protocol' with Kāi Tahu and Aukaka and the *Kāi Tahu ki Otago Natural Resource Management Plan 2005* lodged with ORC. *Te Tangi a Tauira: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008* is also lodged with ORC. These matters are set out in the introductory text for the dRPS. In particular, the Ngāi Tahu ki Murihiku management plan contains policies relating to natural hazard risk management that the dRPS should demonstrate that it has taken into account.

Also of note to natural hazards and climate change is Te Rūnanga o Ngāi tahu He Rautaki mō te Huringa o te Āhuarangi – the Te Rūnanga o Ngāi Climate Change Strategy. However, it is understood that the Climate Change Strategy has not been lodged with ORC.

Emergency Management Plans are structured by the Civil Defence Emergency Management Act 2002, and their consideration within a regional policy context is required by Section 61(2)(a)(i) of the RMA. Issue 9 of the dRPS contemplates Emergency Management connections, but this link is not made within the policy framework of the natural hazards chapter. Recognition of the Otago Emergency Management Group at HAZ-NZ-M6 should be considered as part of the other incentives and mechanisms for local authorities, particularly the management of residual risk.

3.9 Property and Hard Protection Structures

The term 'property' does not appear within the policy framework but does appear within HAZ-SCHED1 regarding consequences (Step 2) and impacts on property. The term is also included within the explanation, principal reasons and anticipated environmental results sections of the dRPS.

HAZ-NH-P7 considers the mitigations for natural hazards, in particular, hard protection structures. This effectively sets out the criteria for when hard protection structures will be provided for or considered, a criteria in its current form that must be met in its entirety before hard protection structures are contemplated. Of note within the criteria is that a hard protection structure is essential to reduce risk to a "*tolerable level with no reasonable alternatives; adverse effects are addressed; there is significant public benefit; and the works are for the functioning ability of a lifeline utility or a facility for essential or emergency services*".

While it is inherent that ‘property’ should be (and may be expected to be) considered when undertaking a risk assessment, the lack of inclusion of the term ‘property’ within HAZ-NH-P7 could be viewed as an intentional signal that ORC is signalling that hard protection structures should not be utilised to protect private property.[22] ORC’s intended position should be more clearly identified in the policy.

3.10 Terminology

This section considers frequently used terms that could be better defined to align with common practise or defined to provide users with certainty.

3.10.1 Residual Risk

Residual risk is the risk remaining after the implementation of management measures and is defined as such within the dRPS. It is the risk held or adopted by the community but can also reflect the exceedance of risk management measures (e.g. stopbanks being overtopped or burst or seawalls being overtopped).

Residual risk is utilised several times within the dRPS, and recommendations seek to increase its use within HAZ-NH-P2 and HAZ-NH-P7 in relation to risk assessments and mitigating natural hazards. ISO31000 (AS/NZS 2009) includes the following definition that merits consideration for inclusion to provide greater clarity:

> *“Residual risk is the risk left over after you’ve implemented a risk treatment option. It’s the risk remaining after you’ve reduced the risk, removed the source of the risk, modified the consequences, changed the probabilities, transferred the risk, or retained the risk.”*

3.10.2 Multiple Hazards

The term ‘multiple hazards’ is defined as meaning *“… where two or more unrelated natural hazard events may occur”.* This would more typically be termed ‘cumulative hazards’.

3.10.3 Resilient or Resilience

‘Resilient’ or ‘resilience’ is defined in the dRPS as meaning *“… the capacity and ability to withstand or recover quickly from difficult conditions”.* Adoption of a nationally applied definition for resilience should be considered. The National Disaster Resilience Strategy (MCDEM 2019) states on Page 2 that resilience is:

> *“… the ability to anticipate and resist disruptive events, minimise adverse impacts, respond effectively, maintain or recover functionality, and adapt in a way that allows for learning and thriving.”*

3.11 Provision for Certain Activities

Policy MW-P4 provides for the sustainable use of Māori land and requires avoidance of adverse effects on the health and safety of people. This directive policy language may conflict with potential for mana whenua to develop land holdings in areas that may be subject to varying

22 By extension, ORC are also directing that Territorial Authorities do not seek to protect private property with hard protection structures.

elements of natural hazard risk. Further development of these policies may provide additional guidance as to how avoidance is to be achieved or reconciled within the dRPS framework. It is suggested that this is a specific topic for engagement with Kāi Tahu.

3.12 Opportunities to Increase Directiveness

It is recognised that a direct drafting style was sought to avoid complications in the interpretation of RPS policies. Opportunities to improve the directiveness of the dRPS typically centre on the use of common RMA plan terms that are not defined. Examples identified within the dRPS include the following:

- *"Reasonably practicable"* – used in HAZ-NH-P3 around reducing tolerable natural hazard risks. It is recommended that the dRPS include some risk reduction measure expected in this instance and/or develop an assessment to evaluate whether measures are reasonably practicable, e.g. a cost/benefit analysis or list of matters to be considered, akin to the best practicable option in Section 2 of the RMA. *"Where practicable"* is also utilised regarding existing land uses at HAZ-MH-M3(2) and HAZ-NH-M4(2).
- *"Precautionary approach"* – used in HAZ-NH-P5 in relation to uncertain or unknown but potentially significant or irreversible effects, e.g. where an event could have major or catastrophic consequence. The outcome that ORC expects of councils and decision makers when faced with these circumstances, particularly with regard to meeting the policy direction of the dRPS, should be more clearly directed in the policy.
- *"Give preference"* – used in HAZ-NH-P6 in relation to the protection of natural features and systems that provide hazard mitigation. "*Give preference*" appears to be assuming a weighting between two options (e.g. hard versus soft), which does not give effect to Policy 25(e) of the NZCPS.[23]
- The introductory text to HAZ-NH-P7 states: *"Provide for hard protection structures only when: …"*. It is suggested that *"<u>Consider</u> hard protection structures only when: …"* is more directive of the outcomes sought within the NZCPS, as well as more directive of hard protection structures effectively being a last resort in certain circumstances.
- *"Encouraging system resilience"* – in relation to the amendment of regional and district plans to take into account the effects of climate change in HAZ-NH-M2. This method statement needs to reflect and provide examples of the diversity of systems. Examples of actions (linked to exemplar systems) would assist councils in implementing this method.

3.13 Use of the Term 'Mitigation'

The term 'mitigation' (or 'mitigate') carries several meanings when considered within a RMA, natural hazards and climate change framework.

1. The purpose [at Section 5(2)(b) of the RMA] directs that, as part of sustainable management, adverse effects of activities on the environment are avoided, remedied or mitigated, while Section 17 further sets out this duty.
2. In relation to natural hazards, Sections 30(1)(c)(iv), 31(1)(b)(i) and 62(1)(i)(i) contain direction regarding avoidance or mitigation of natural hazards.
3. When considered within a climate change context, mitigation typically means the reduction of emissions.

23 "*Discourage hard protection structures and promote the use of alternatives to them, including natural defences*."

Policy HAZ-NH-P10 seeks to ensure that *"… Otago's people and communities are able to adapt to or mitigate the effects of sea level rise and climate change, over no less than 100 years"*. Within this context, the use of the term 'mitigate' could be interpreted as any or all three (as above). The term 'adapt' can also refer to multiple actions, including risk avoidance, accommodation and acceptance.

To clarify the meaning of 'mitigate' within this policy, it is recommended that the following changes are made:

> *'HAZ-NH-P10: Climate change and Sea level rise*
>
> *Ensure Otago's people and communities are able to adapt to ~~or~~ and mitigate the effects of sea level rise and climate change, over no less than 100 years'.*

The effect of these changes is to clarify the action and outcomes expected in relation to sea-level rise and climate change, respectively, reflective of the nuances of the term 'mitigate' across the RMA, natural hazards and climate change.

4.0 SECONDARY REVIEW

Following provision of GNS Science tracked changes and comments on the September 2020 version of the dRPS, and several discussions, ORC provided a revised natural hazards chapter to GNS Science (January 2021) for review.

4.1 Response to Primary Review

Several tracked changes and comments from the September 2020 version of the dRPS had been adopted by ORC within the January 2021 version, including changes to:

1. Risk-scale terminology (3.10 above)
2. Inclusion of residual risk (3.10.1)
3. Inclusion of land within ORC's responsibilities (3.6 above), and
4. Amendment to the Likelihood Scale within the risk assessment (3.5 above).

There were also substantial changes to the chapter that were not part of the primary review. These include:

- A revised Policy HAZ-NH-P4 applicable to existing development, which adopts Policy 4.1.7 of the PORPS 2019 and includes several new terms to the dRPS;
- Removal of the 'content' within the Consequence Table;
- Removal of the 'content' within the Risk Table; and
- The inclusion of a Quantitative Risk Assessment step.

These changes are the focus of this section of the report.

4.2 Terminology

Policy HAZ-NH-P4 addresses existing natural hazard risk and sets out six directives for achieving this. Points 1 and 2 encourage and discourage activities that reduce and increase risk or community vulnerability, respectively. As set out in Saunders et al. (2020), 'vulnerability' is not a term widely found within RMA documents, but it is included within NEMA's National Disaster Resilience Strategy[24] and defined as:

> *"**Vulnerability** is the conditions which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. Vulnerability includes physical vulnerability, which refers to the level of damage sustained by built structures as a result of a hazard event. It also includes social vulnerability, which refers to damage to livelihood, social connections, gender, and other factors that influence a community's ability to respond to, cope with, and recover from a disaster."*

This definition of vulnerability is the same as the United Nations Office for Disaster Risk Reduction Strategic Framework 2016–2021.[25] To assist implementation of the dRPS and achievement of the outcomes sought, it is recommended that this definition of 'vulnerability' is adopted within the dRPS.

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24 https://www.civildefence.govt.nz/assets/Uploads/publications/National-Disaster-Resilience-Strategy/National-Disaster-Resilience-Strategy-10-April-2019.pdf

25 https://www.undrr.org/publication/unisdr-strategic-framework-2016-2021

Further to the point above on vulnerability, Point 3 of Policy HAZ-NH-P4 utilises the term ‘exit strategies’. This term is not defined within the dRPS but could be interpreted in several different ways. For example, it could mean either ‘evacuation’ or ‘managed retreat’. To clarify the outcome sought, a definition of ‘exit strategy’ should be included within the dRPS, or the term should be refined for the outcome sought.

Following further revision of the dRPS chapter, the policy framework refers to ‘activities’ as opposed to ‘development’. This is subtle yet important difference. The use of both or individual terms should be reviewed for consistency and clarity of policy direction.

4.3 Methodology for Risk Assessment

4.3.1 Consequence Table

Step 2 of the natural hazard risk assessment process requires an assessment of the consequences from a natural hazard event. Within the September 2020 version of the dRPS, this table was populated in accordance with Saunders et al. (2013) (Figure 4.1). The January 2021 version of the dRPS presented an unpopulated consequence table.

There is a risk to consistency of approach if this table remains blank. It is recommended that this table is populated to enable natural hazard risk assessments to be based on a consistent framework (i.e. likelihood and consequence are fixed).

The most current example relevant to the dPRS approach that is operative within an RMA document is within the BoP RPS. The BoP RPS consequence table (Figure 4.2) is similar to the table presented within Saunders et al. (2013), with the exception being that the BoP RPS consequence table does not include economic consequences.

Severity of Impact	Built				Economic	Health & Safety
	Social/Cultural	Buildings	Critical Buildings	Lifelines		
Catastrophic (V)	≥25% of buildings of social/cultural significance within hazard zone have functionality compromised	≥50% of affected buildings within hazard zone have functionality compromised	≥25% of critical facilities within hazard zone have functionality compromised	Out of service for > 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for > 6 months (affecting < 20% of the town/city population)	> 10% of regional GDP	> 101 dead and/or > 1001 inj.
Major (IV)	11-24% of buildings of social/cultural significance within hazard zone have functionality compromised	21-49% of buildings within hazard zone have functionality compromised	11-24% of buildings within hazard zone have functionality compromised	Out of service for 1 week – 1 month (affecting ≥20% of the town/city population) OR suburbs out of service for 6 weeks to 6 months (affecting < 20% of the town/city population people)	1-9.99% of regional GDP	11 – 100 dead and/or 101 – 1000 injured
Moderate (III)	6-10% of buildings of social/cultural significance within hazard zone have functionality compromised	11-20% of buildings within hazard zone have functionality compromised	6-10% of buildings within hazard zone have functionality compromised	Out of service for 1 day to 1 week (affecting ≥20% of the town/city population people) OR suburbs out of service for 1 week to 6 weeks (affecting < 20% of the town/city population)	0.1-0.99% of regional GDP	2 – 10 dead and/or 11 – 100 injured
Minor (II)	1-5% of buildings of social/cultural significance within hazard zone have functionality compromised	2-10% of buildings within hazard zone have functionality compromised	1-5% of buildings within hazard zone have functionality compromised	Out of service for 2 hours to 1 day (affecting ≥20% of the town/city population) OR suburbs out of service for 1 day to 1 week (affecting < 20% of the town/city population)	0.01-0.09 % of regional GDP	<= 1 dead and/or 1 – 10 injured
Insignificant (I)	No buildings of social/cultural significance within hazard zone have functionality compromised	< 1% of affected buildings within hazard zone have functionality compromised	No damage within hazard zone, fully functional	Out of service for up to 2 hours (affecting ≥20% of the town/city population) OR suburbs out of service for up to 1 day (affecting < 20% of the town/city population)	<0.01% of regional GDP	No dead No injured

Figure 4.1 Consequence table from Saunders et al. (2013).

Consequence level	Built			Lifelines utilities	Health & safety
	Social/cultural	Buildings	Critical buildings		
Catastrophic	≥25% of buildings of social/cultural significance within hazard assessment area have functionality compromised.	≥50% of buildings within hazard assessment area have functionality compromised.	≥25% of critical buildings within hazard assessment area have functionality compromised.	A lifeline utility service is out for > 1 month (affecting ≥ 20% of the town/city population) OR out for > 6 months (affecting < 20% of the town/city population).	>101 dead and/or >1001 injured
Major	11–24% of buildings of social/cultural significance within hazard assessment area have functionality compromised.	21–49% of buildings within hazard assessment area have functionality compromised.	11–24% of critical buildings within hazard assessment area have functionality compromised.	A lifeline utility service is out for 1 week – 1 month (affecting ≥ 20% of the town/city population) OR out for 6 weeks to 6 months (affecting < 20% of the town/city population).	11–100 dead and/or 101–1000 injured
Moderate	6–10% of buildings of social/cultural significance within hazard assessment area have functionality compromised.	11–20% of buildings within hazard assessment area have functionality compromised.	6–10% of critical buildings within hazard assessment area have functionality compromised.	A lifeline utility service is out for 1 day to 1 week (affecting ≥ 20% of the town/city population) OR out for 1 week to 6 weeks (affecting < 20% of the town/city population).	2–10 dead and/or 11–100 injured
Minor	1–5% of buildings of social/cultural significance within hazard assessment area have functionality compromised.	2–10% of buildings within hazard assessment area have functionality compromised.	1–5% of critical buildings within hazard assessment area have functionality compromised.	A lifeline utility service is out for 2 hours to 1 day (affecting ≥ 20% of the town/city population) OR out for 1 day to 1 week (affecting < 20% of the town/city population).	≤1 dead and/or 1–10 injured
Insignificant	No buildings of social/cultural significance within hazard assessment area have functionality compromised.	<1% of buildings within hazard assessment area have functionality compromised.	No damage within hazard assessment area, fully functional.	A lifeline utility service is out for up to 2 hours (affecting ≥ 20% of the town/city population) OR out for up to 1 day (affecting < 20% of the town/city population).	No dead No injured

Figure 4.2 Bay of Plenty Regional Policy Statement consequence table.

Economic consequences were not included within the BoP RPS because of the difficulty in determining which indicator to use for regional GDP. For example, regional council and Statistics NZ were found to hold different data for GDP of the region. In considering the economic indicator, alongside the other indicators, it was determined that the different scale at which they are set out (e.g. hazard zone versus region-wide) does not provide for a balanced comparison of the consequences of a hazard event.

In discussing the January 2021 version of the dRPS, and the consequence table, the point of each consequence being based on a percentage, while health and safety is based on a numeric count, was raised. During the development of the risk-based approach, it was considered whether health and safety should utilise a percentage of population or number. However, it was considered that a count should be utilised for two primary reasons:

1. Because the indicators are based on a hazard extent (a comparatively small spatial scale), a percentage system could under-represent or dilute the severity of an event when set within a city such as Dunedin (a comparatively larger scale). When tested, the percentage system was not found to accurately portray the severity of event within a larger regional or district population setting.
2. A percentage system results in fractions of a life being the measure, and it was preferred that a life be counted as a life, rather than fractions needing to be negotiated.

4.3.2 Risk Table

The September 2020 version of the dRPS presented a populated risk table, as discussed in Section 3.5.2. The January 2021 version presented a blank risk table.

Should the risk table be populated without region-wide consultation being undertaken, it is recommended that the dRPS be amended to direct that community consultation is undertaken on the levels of risk adopted with the assessment at a territorial authority level. It should be noted that the risk table within HAZ-SCHED1 is an interim table until each district determines what significant, tolerable and acceptable risk is them.

Presenting a populated risk table provides those giving effect to, and seeking consistency with, the RPS a reference point for risk assessments prior to district councils developing district-specific risk tables in consultation with their communities.

4.3.3 Quantitative Risk Assessment

Queenstown Lakes District Council (QLDC) were provided opportunity to comment on the dRPS. QLDC identified that HAZ-SCHED1 would benefit from the inclusion of a quantitative risk assessment (QRA) method. Subsequently, a QRA was developed for HAZ-SCHED1. This comprises the selection of a range of representative scenarios, modelling of the AIFR and annual property risk (APR), analysis of losses, determination of risk level and, if necessary, a reclassification of the risk level.

The QRA forms Step 4 of HAZ-SCHED1.

The trigger for a QRA to take place is when the qualitative risk assessment comprising Steps 1–3 finds that the risk is significant; the reasons and purpose for this being the trigger are two-fold:

1. To provide certainty for land uses that generate an acceptable or tolerable risk level.
2. To ensure that, where land uses generate a significant risk level, a robust and defensible assessment and understanding of risk underpins this classification.

The original drafting of the QRA trigger was that, where two out of the three natural hazard scenarios found risk that was tolerable or significant, a QRA would be required. This trigger is recommended by GNS Science. This trigger would add an additional level of robustness and defensibility to risk assessments undertaken where they find risk at the higher end of the spectrum. This may also increase the opportunity for expert assessment to differ such that a different outcome (whether a QRA is required or not) is reached.

4.3.3.1 Risk to People and Property

The QRA requires a range of hazard scenarios, including the maximum credible event, to be modelled, with AIFR and APR scenarios derived in relation to the range of hazard and loss exceedance distributions generated.

The relevant risk thresholds are derived from the Australian Geomechanics Society (2007a) and Taig et al. (2012) in relation to AIFR. Taig et al. (2012) consider that, within a New Zealand regulatory setting and established risk tolerability levels, a tolerable AIFR could be set within a range of 3 x 10^{-5} to 10^{-3} and that 10^{-4} is a suitable starting point for deliberation. This is consistent with the suggested tolerable AIFR within the Australian Geomechanics Society (2007b). The Australian Geomechanics Society (2007b) also suggest risk tolerability thresholds for new development at 10^{-5}, or one order of magnitude lower than for existing development. By adopting the Australian Geomechanics Society (2007b) risk thresholds for new and existing development and extrapolating them, the following has been developed:

- For new development:
  - at less than 1 x 10^{-6} per year, the risk is re-categorised as acceptable;
  - between 1 x 10^{-6} and 1 x 10^{-5} per year, the risk is re-categorised as tolerable; or
  - at greater than 1 x 10^{-5} per year, the risk is re-categorised as significant.
- For sites with existing development:
  - at less than 1 x 10^{-5} per year, the risk is re-categorised as acceptable;
  - between 1 x 10^{-5} and 1 x 10^{-4} per year, the risk is re-categorised as tolerable; or
  - at greater than 1 x 10^{-4} per year, the risk is re-categorised as significant.

The original drafting of the QRA included the redevelopment of a site within the 'new development' series of thresholds. The Australian Geomechanics Society (2007b) define existing development and new development as:

> *"'Existing Development' includes existing structures, …*
>
> *'New Development' includes any new structure or change to an existing slope or structure. Where changes to an existing structure or slope result in any cut or fill of less than 1.0m vertical height from the toe to the crest and this change does not increase the risk, then the Existing Slope / Existing Structure criterion may be adopted. Where changes to an existing structure do not increase the building footprint or do not result in an overall change in footing loads, then the Existing Development criterion may be adopted."*

It is considered that these definitions support the interpretation that redevelopment should be considered alongside or as an aspect of new development, particularly where a reduction of existing significant risks is sought.

It is noted that the Australian Geomechanics Society (2007a) and Taig et al. (2012) relate to AIFR only and that no guidance has been developed for tolerable APR. The Australian Geomechanics Society (2007b) ultimately considers that "*The regulator is to establish the Tolerable Risk Criteria for loss of life and property loss"*. For APR, aligning the risk tolerance with AIFR is suggested as a starting point in this regard.

It is recommended that both AIFR and APR are adopted within the QRA in recognition that not all natural hazards have the capacity to result in fatalities but may result in significant damage to property. While APR is briefly considered in Australian Geomechanics Society (2007a) it does not go as far as to suggest tolerability thresholds. Where AIFR is binary, in that 'a life is a life', property or asset damage requires more nuance in first determining the amount of damage (as a percentage of the value of the property) and the importance or criticality of that development (see Clause A3 of the Building Regulations 1992).

5.0 CONCLUSION

The purpose of this review was to provide an assessment of the dRPS natural hazards chapter, addressing whether:

- it achieves the purpose of the RMA and gives effect to national policy direction under the RMA;
- there is alignment of provisions; and
- an integrated approach is taken to the management of natural hazards.

To achieve this, a review of several dRPS versions, draft Section 32 report and PORPS 2019 was undertaken, and the dRPS was compared against good-practise indicators (Grace and Saunders 2016).

Overall, the dRPS compared well against the good-practise indicators. Notwithstanding this, opportunities for improvement have been identified regarding several aspects of the dRPS natural hazards chapter.

Recommendations stemming from this report address engagement on the threshold of risk levels, the risk scale, indicative timeframes utilised in the risk assessment, enabling ORC to consider existing uses, ORC's ability to consider new information, other information from iwi and Emergency Management groups, the prioritisation of natural hazard assessments and addressing residual risk within the dRPS.

6.0 ACKNOWLEDGEMENTS

The authors would like to thank Lara Clarke and Tom FitzGerald of GNS Science for their reviews of the draft report.

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Appendix 20: Origin Report (2020)

Regional Policy Statement Heritage Advice

Otago Regional Council

26 June 2020

Introduction

Otago Regional Council has approached Origin Consultants to prepare some advice to inform Policy 5.2.2 within the partially operative Regional Policy Statement. Presently the policy reads:

> **Policy 5.2.2**
>
> Identify historic heritage places and areas of regional or national significance, using the attributes in Schedule 5.

The Schedule 5 referenced in this policy reads:

> **Schedule 5 Criteria for the identification of historic heritage values**
>
> The identification of items, places and areas of historic heritage value will be based on but not limited to the following criteria:
>
> 1. The extent to which the item, place or area reflects important or representative aspects of Otago or New Zealand history.
> 2. The association of the item, place or area with events, persons, or ideas of importance in Otago or New Zealand history.
> 3. The potential of the item, place or area to provide knowledge of Otago or New Zealand history.
> 4. The importance of the item, place or area to tangata whenua.
> 5. The community association with, or public esteem for, the item, place or area.
> 6. The potential of the item, place or area for public education.
> 7. The technical accomplishment, value or design of the item, place or area.
> 8. The symbolic or commemorative value of the item, place or area.
> 9. The importance of identifying historic items, places or areas known to date from an early period of New Zealand settlement.
> 10. The importance of identifying rare types of historic items, places or areas.
> 11. The extent to which the item, place, or area forms part of a wider historical and cultural item, place or area.[1]

[1] These criteria are adapted from S66(3) of the Heritage New Zealand Pouhere Taonga Act 2014. This section provides the criteria with which HNZPT make a determination about which items, places, or areas are designated as Category 1 on the List/Rārangi Kōrero.

ORC has identified that the concept of "regional or national [heritage] significance" has not been defined within the Regional Policy Statement, and this has implications for the potential effectiveness of Policy 5.2.2.

To address this issue, this report seeks to establish:

- Whether the terms 'regional or national significance' relate to the Category I and II Listed Heritage Places.
- Whether any other councils' (regional or district) define 'regional or national significance.'
- Whether it is appropriate and/or useful to continue to use both terminologies, and the implications of doing so.
- Whether there is the need for additional work reviewing Schedule 5 to align it with the requirements of Policy 5.2.2.

As part of this investigation, the heritage assessment policy of HNZPT and several selected councils is reviewed. The councils reviewed include:

- Waitaki District Council
- Dunedin City Council
- Clutha District Council
- Central Otago District Council
- Queenstown Lakes District Council
- Christchurch Regional Council
- Environment Canterbury
- Wellington City Council
- Greater Wellington Regional Council
- Auckland Council

Note on Definition

The report has adopted the term ***geographic heritage criteria*** or ***geographic criteria*** to collectively refer to the practice of identifying heritage significance at an international, national, regional, or local level.

Do geographic criteria relate to the Category I and II listed heritage places, and if so, how?

The identification of "areas of regional or national significance" is not derived from and does not directly relate to HNZPT listing criteria. HNZPT listing is determined by the criteria included in Section 66 of the HNZPT Act 2014:

66 Criteria

(1) Heritage New Zealand Pouhere Taonga may enter any historic place or historic area in the New Zealand Heritage List/Rārangi Kōrero if it is satisfied that the place or area has **aesthetic, archaeological, architectural, cultural, historical, scientific, social, spiritual, technological, or traditional significance or value**.

(2) Heritage New Zealand Pouhere Taonga may assign the status of Category 1 or Category 2 to any historic place, having regard to the nature of the places to which those categories may be assigned (as described in section 65(4)(a)).

(3) Heritage New Zealand Pouhere Taonga may assign a status under subsection (2) only if it is satisfied that the place has significance or value in relation to 1 or more of the following criteria:

(a) **the extent to which the place reflects important or representative aspects of New Zealand history:**

(b) **the association of the place with events, persons, or ideas of importance in New Zealand histor**y:

(c) **the potential of the place to provide knowledge of New Zealand history:**

(d) **the importance of the place to tangata whenua:**

(e) **the community association with, or public esteem for, the place:**

(f) **the potential of the place for public education:**

(g) **the technical accomplishment, value, or design of the place:**

(h) **the symbolic or commemorative value of the place:**

(i) **the importance of identifying historic places known to date from an early period of New Zealand settlement:**

(j) **the importance of identifying rare types of historic places:**

(k) **the extent to which the place forms part of a wider historical and cultural area.[2] (emphasis added)**

While the HNZPT Listing Policy does reference geographic criteria, this is part of a more general statement outlining the wholistic approach of the list. Policy 1.1 of the HNZPT policy reads: *The List includes internationally, nationally, regionally, and locally significant heritage*. Rather than discriminating between these criteria, the policy implies that **all** significant heritage is included on the list irrespective of their geographic affinity (i.e., national or regional significance). No definition is provided for these geographic criteria.

Recently HNZPT have produced an internal set of significance assessment guidelines discussing the various criteria included in the Act. This set of guidelines includes a robust analysis of the significance assessment criteria and how they should be interpreted by HNZPT staff in administering the HNZPT List. Though they do not suggest making significance assessments based specifically on geographic heritage criteria, they do outline how geographic factors can influence assessments using the Act's criteria. For example, an assessment of *architectural* significance may include the consideration of building designs that utilise materials specifically associated with a locality (such as schist in Central Otago). Alternately, an assessment of *rarity* might consider if a particular structure was the only example known nationally (such as the Tuapeka Mouth Punt and Jetty).

Separate from the list, the HNZPT Act does introduce the idea of *national* significance in relation to their identification of National Historic Landmarks:

81 National Historic Landmarks/Ngā Manawhenua o Aotearoa me ōna Kōrero Tūturu to be established

(1) Heritage New Zealand Pouhere Taonga must establish and maintain a list of places of outstanding national heritage value, to be called the National Historic Landmarks/Ngā Manawhenua o Aotearoa me ōna Kōrero Tūturu.

These landmarks are envisioned as the most significant sites within the HNZPT List, and their landmark status is designed to promote "an appreciation of the places of greatest heritage value to the people of New Zealand" (HNZPT Act 2014 Section 81(2)(a)). However, the idea of what constitutes outstanding *national* heritage value is not articulated beyond some very general criteria in Section 81(3) of the Act:

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[2] Emphasis added.

(3) A place must not be included on the Landmarks list unless it is of outstanding national heritage value, having regard to 1 or more of the following:

(a) the outstanding historical significance of the place in relation to people, events, or ideas of the past:

(b) the outstanding physical significance of the place in relation to its archaeological, architectural, design, or technological qualities:

(c) the outstanding cultural significance of the place to tangata whenua or other communities in relation to its social, spiritual, traditional, or ancestral associations.

Do any other councils' (regional or district) define 'regional significance,' and if so, how?

Of those reviewed, only three councils – Auckland Council, Queenstown Lakes District Council (QLDC), and Wellington City Council – explicitly include geographic criteria in their assessment of heritage significance. Auckland Council and QLDC use geographic criteria to distinguish between their differing levels of heritage significance. Section B.2.2 of the Auckland Unitary Plan reads:

(1) Classify significant historic heritage places in Schedule 14.1 Schedule of Historic Heritage in one of the following categories:

(a) Category A: historic heritage places that are outstanding **significance well beyond their immediate environs**;

(b) Category A*: historic heritage places identified in previous district plans which are yet to be evaluated and assessed for their significance;

(c) Category B: historic heritage places that are of considerable **significance to a locality or beyond.**[3]

Section 26.2.2 of the Queenstown Lakes District Plan reads:

- Category 1 Heritage Features warrant the highest level of protection as they are **very significant nationally or regionally.** Category 1 shall include all places of the highest historical or cultural heritage significance including, but not limited to, all features in Category 1 or the Heritage New Zealand 'New Zealand Heritage List/Rarangi Kohero.'
- Category 2 Heritage Features warrant permanent protection because they are **very significant to the District and/or locally.**
- Category 3 Heritage Features are **significant to the District and/or locally** and their retention is warranted. The Council will be more flexible regarding significant alterations to heritage features in this Category. Category 3 shall include all other places of special historical or cultural value.[4]

Wellington City Council includes geographic criteria for some entries on the Council's Heritage Inventory. However, geographic criteria are not universally assessed in the Inventory and the Wellington District Plan, Wellington City Council Heritage Policy, and the Greater Wellington Regional Council Policy Statement make no mention of geographic criteria in the identification of heritage items.

No definitions of these geographic criteria have been able to be identified in any of the Unitary/Regional/District Plans or associated heritage documentation and information available from the council websites.

The heritage policies of some other councils – Christchurch City Council, Environment Canterbury, and Central Otago District Council – imply the consideration of geographic criteria, but it is not included as an explicit

[3] Emphasis added.
[4] Emphasis added.

factor in determining differing levels of heritage significance. Instead, a heritage item's specific regional or local significance is highlighted as a factor in its listing/scheduling/registration. Section 2.3.2.2.1 of the Christchurch District Plan notes that a heritage item will "**be of significance [or high significance] to the Christchurch District (and may also be of significance nationally or internationally),** because it conveys aspects of the Christchurch District's cultural and historical themes and activities, **and thereby contributes [or strongly contributes] to the Christchurch District's sense of place and identity.**"

Environment Canterbury's Regional Policy Statement also notes that their Policy 13.3.1 (their heritage recognition policy) is designed to capture "historic heritage items, places or areas that are of significant historical or cultural value, **as they make the highest contribution to the identity of the Canterbury Region."** Similarly, Central Otago District Council notes in Section 14.4.2 of their district plan that heritage buildings and objects "**contribute to the community's visual sense of place and are often significant local landmarks as well**…" Though not apparently intended as such, these policies provide a potential definition for geographic criteria: **the contribution of a heritage item to a national/regional/local sense of place**. However, it will be necessary to properly establish how this sense of place would be assessed if this definition is to be of any use.

Is it appropriate and/or useful to continue to use both terminologies, and the implications of doing so? Does there need to be additional work reviewing Schedule 5 to align it with the requirements of Policy 5.2.2?

Four options have been identified for the ORC to consider in response to these questions.

<u>Option A – Retain Status Quo.</u>

This would involve the least time and effort to revise the policy but would do little to achieve the objective that *Historic heritage resources are recognised and contribute to the region's character and sense of identity* (Objective 5.2 in the draft RPS). The ambiguity over the geographic criteria in Policy 5.2.2 would remain.

No changes to Schedule 5 will be necessary.

<u>Option B – Maintain the policy of identifying regional and national heritage and develop an assessment framework to achieve this.</u>

This approach would work to identify the most significant heritage sites within the Otago region and has the potential to highlight important heritage not otherwise identified by city and district councils. However, several factors are necessary for this approach to be successful:

1. A definition of what constitutes regional or national heritage significance must be developed. This may be adapted from a yet-unidentified existing heritage identification policy (either in New Zealand or overseas) or created specifically for the ORC. It is suggested that a definition would be informed by ideas of place and special character important to Otago and New Zealand. This could potentially draw upon the existing themes identified in Policy 5.2.1.
2. The development or adaption of heritage assessment criteria that take into account the council's definition of Regional and National significance. These should also be written to recognise both the tangible and intangible aspects heritage of sites in the region (e.g., region/nationally-specific vernacular architectural buildings and techniques, or sites associated with historical persons or events of specific importance to Otago or New Zealand).
3. A proactive heritage identification program of field surveys, local engagement, and work with district city councils, to identify sites that may have regional or national heritage significance.
4. Liaison with district and city councils to ensure that identified sites are given appropriate heritage protection in district plans. Alternately, ORC may wish to create and maintain its own heritage list that

councils can use as a resource in district plan reviews, though this may add an extra degree of complication to an already fractured system of heritage listing.

Any changes to Schedule 5 would be dependent on the development of future definitions of regional and national heritage, and heritage assessment criteria.

This approach is expected to be quite resource intensive, but if adopted it would potentially place ORC as a national leader in terms of recognising what actually constitutes 'regional and national heritage.' The establishment of what constitutes regionally significant heritage may also inform other initiatives in the future. For example, it could provide a foundation to explore the economic value of the region's heritage as a component of the tourism and hospitality sectors. Finally, this approach would make ORC, Alongside Auckland Council, a national leader in proactive heritage identification.

Option C - Abandon geographic criteria and fully adopt the HNZPT criteria for heritage identification.

If this approach was taken an updated Policy 5.2.2 may read something like:

- Identify significant historic heritage places within the Otago Region.
- Categorise significant historic heritage places into one of the following:
    - Category 1 – Places of special or outstanding historical or cultural significance or value.
    - Category 2 – Places of historical or cultural heritage significance or value.
- Assessment of heritage value should be made with regard to the criteria outlined in Schedule 5 and the process outlined in the latest version of the HNZPT Significance Assessment Guidelines.

Schedule 5 would need to be updated to read something equivalent to:

The identification of items, places and areas of historic heritage value will be based on their significance or value as relating to one or more the following criteria:

- Aesthetic
- Archaeological
- Architectural
- Cultural
- Historical
- Scientific
- Social
- Spiritual
- Technological
- Traditional

The subsequent categorisation of significant historic heritage places will be based on their significance or value as relating to one or more of the following criteria:

- The extent to which the place reflects important or representative aspects of New Zealand history.
- The association of the place with events, persons, or ideas of importance in New Zealand history.
- The potential of the place to provide knowledge of New Zealand history.
- The importance of the place to tangata whenua.

- The community association with, or public esteem for, the place.
- The potential of the place for public education.
- The technical accomplishment, value, or design of the place.
- The symbolic or commemorative value of the place.
- The importance of identifying historic places known to date from an early period of New Zealand settlement.
- The importance of identifying rare types of historic places.
- The extent to which the place forms part of a wider historical and cultural area.

This option consists largely of an adaption of the wording in Sections 65-66 of the HNZPT Act 2014. The criteria in these sections of the Act are used by HNZPT to assess heritage items for inclusion on the HNZPT List/Rārangi Kōrero.

The appropriateness of the assessment criteria used by HNZPT are debatable. For example, the meanings of several criteria potentially overlap – scientific and technological, aesthetic and architectural, cultural and traditional – and this can make the assessment of heritage significance challenging. In lieu of a guidance document explaining these criteria (until last year), most councils have chosen to construct their own heritage assessment criteria as they see fit. The result is an inconsistent heritage identification policy across districts.

However, the advantages of the HNZPT criteria today is that they are:

- Legally recognised.
- Utilised nationally by HNZPT assessments.
- Well defined by the HNZPT Significance Assessment document.

This latter point is the most important, as the Significance Assessment Document helps remove the criteria's ambiguity and makes them usable for identifying heritage significance.

The adoption of the HNZPT criteria provides two opportunities:

1. The proactive identification and protection of heritage places within the Otago region, similar to that outlined in points 3 and 4 in Option B above. This would have the associated costs and benefits of this approach.
2. A nationally consistent foundation that will allow ORC to advocate for a harmonised system of heritage identification across councils within the Otago region. Presently each council has a unique approach to heritage. The regional coordination of these disparate systems could potentially be a valuable service provided by the ORC. Waikato Regional Council has previously shown interest in this idea of a regionally consistent framework for historic heritage management.[5]

Option D - Hybrid integration of HNZPT criteria and geographic significance.

This approach has two steps. Firstly, the basic HNZPT criteria (aesthetic, archaeological, architectural, etc.) would be used to identify a place with heritage significance. Secondly, geographic criteria would be used to identify the relative importance of a significant heritage place. If this approach was taken an updated Policy 5.2.2 may read something equivalent to:

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[5] Waikato Regional Council, "Objective 3.17 Historic and Cultural Heritage," 2010, https://www.waikatoregion.govt.nz/Council/Policy-and-plans/Regional-Policy-Statement/Regional-Policy-Statement-Review/Section32/10Heritage/Effectiveness-and-efficiency-of-policies-and-methods/Objective-317Historic-and-cultural-heritage/.

- Identify significant historic heritage places within the Otago Region.
- Classify significant historic heritage places in one of the following categories:
    - Category 1 – Nationally Significant
    - Category 2 – Regionally Significant
    - Category 3 – Locally Significant
- Assessment of heritage value should be made with regard to the criteria outlined in Schedule 5 and Part 1 of the latest version of the HNZPT Significance Assessment Guidelines.

Schedule 5 would need to be updated to include the base heritage assessment criteria (Aesthetic, Archaeological, Architectural, etc.) and any definition or guidance on what constitutes the varying levels of geographical significance.

There are several factors to consider for Option D:

1. It is dependent on the effective definition of what constitutes each level of geographic significance (like Option B).
2. It provides an opportunity for the proactive identification and protection of heritage places within the Otago region and comes with the associated costs and benefits (like Options B and C).
3. It may be able to provide a foundation for a harmonised system of regional heritage identification (like Option C). However, given that Option D involves a partially new heritage assessment framework it may be challenging to convince councils to adopt it. The introduction of *yet another* variety of heritage assessment in the region may also be counterproductive.

Conclusion

In summary:

- Geographic criteria are not used by HNZPT to determine heritage significance for entries on their List/ Rārangi Kōrero. HNZPT National landmarks must be of 'national significance,' but this is not defined.
- Some councils use geographic criteria in their assessment of heritage significance, but none define what actually constitutes national, regional, or local significance.
- ORC's choice to use geographic criteria is dependent on the council's vision for heritage management and appetite for allocating the necessary resources.
    - Option A (status quo) would require minimal resources but would not improve the recognition of heritage resources in Otago or foster their contribution to the region's character and sense of identity.
    - Option B (develop national/regional assessment framework) would be resource intensive but has the potential to provide the council with an assessment framework that would allow the proactive recognition of the region's heritage. If implemented, this approach could place ORC as a national leader in the recognition of regional heritage.
    - Option C (adopt HNZPT framework) would require minimal resources and provide ORC with an already-established heritage assessment framework with which it could work to coordinate the harmonisation of the varied heritage policies within the Otago Region.
    - Option D (hybrid framework) has the potential to facilitate a proactive heritage management policy like Option B and a framework for a harmonised heritage policy like Option C. However, it would be resource intensive. Policy harmonisation may also be more challenging without a new heritage assessment framework.

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26 June 2020