BEFORE THE HEARING COMMISSIONERS APPOINTED BY OTAGO REGIONAL COUNCIL

Under	the Resource Management Act 1991
In the matter	of the proposed Otago Regional Policy Statement 2021 (excluding provisions renotified as part of a freshwater planning instrument)

STATEMENT OF EVIDENCE OF DR VAUGHAN KEESING (ECOLOGY) ON BEHALF OF CONTACT ENERGY LIMITED

23 November 2022

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1. QUALIFICATIONS AND EXPERIENCE

1.1 My name is **Vaughan Francis Keesing**.

1.2 I am a Senior Ecologist and Partner with the consulting firm of Boffa Miskell Limited.

1.3 I have been a consulting ecologist for the last 23 years. My qualifications include a Bachelor of Science (Hons, 1st) in Zoology and a PhD in Ecology, both from Massey University, as well as a Diploma in Research Statistics.

1.4 My skills lie in community ecology. I have specialist skills in the areas of limnology (the study of inland waters, including wetlands, as ecological systems), entomology, zoology, and botany, and I have worked extensively in freshwater and terrestrial habitats.

1.5 I have been practising as an ecologist for the last 26 years and have worked in a variety of locations across New Zealand including Otago.

1.6 During that time I have undertaken a wide range of ecological surveys of natural and semi-natural sites, incorporating both botanical and wildlife values. I have provided assessments of values and significance of sites for many councils and private clients, as well as assessing ecological effects of a range of activities on those sites.

1.7 This work has included significance and effects assessments across a range of projects and habitat types, such as:

(a) determining significant wetlands (as part of exercises in the West Coast region and Ashburton to identify Significant Natural Areas (**SNAs**) and in Rangitikei as part of its Protected Natural Areas Programme);

(b) bush significance assessments (eg over 150 Franklin District Conservation lots, 50 Western Bay of Plenty lots, and many more across New Zealand);

(c) large-scale roading projects involving wetland assessment and devising proposals to offset wetland effects (eg MacKays to Peka Peka Expressway and Transmission Gully);

(d) wind farms (eg West Wind, Hurunui, Mill Creek, and Hauāuru mā raki) and hydroelectric schemes (eg Arnold, Wairau, and Coleridge);

(e) over 20 large-scale subdivisions (eg Omaha South (Darby Partners), Long Bay (Landco), Pegasus Bay (Infinity Co), and Ravenswood (at Woodend));

(f) plan changes (eg Porters Ski field expansion); and

(g) assessments of wetland, riparian systems and rivers (eg Hurunui irrigation project, Waitohi irrigation dams, Wakamoekau community water storage; Rakai Water Conservation Order (**WCO**) amendment, Hurunui WCO, Ngaruroro WCO, Lake Summer dam proposal, Conway minimum flow regime, North Christchurch stream minimum flow assessments (macrophyte), Taramakau River riparian wetland assessment, and the Wairau hydroelectric power scheme).

1.8 I have undertaken a number of projects in the Otago region, including ecological assessments for Manawa Energy's Waipori Power Scheme and Deep Stream Power Scheme, the sediment discharge effects of forestry in the Waianakaura River, overseas investment proposals near Wanaka, and investigations of land use potential near Oamaru for Holcim New Zealand Ltd. I have not worked directly on the Clutha Hydro Scheme or the Clutha River.

2. CODE OF CONDUCT

2.1 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in my brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

3. SCOPE OF EVIDENCE

3.1 In preparing my evidence I have reviewed the relevant provisions of:

(a) the proposed Otago Regional Policy Statement (**proposed RPS**)[1];

(b) Contact's submissions and further submissions;

(c) the submissions and further submissions of other relevant parties;

(d) the Regional Council's section 42A report, including the version showing recommendations from the Regional Council's supplementary

[1] In this evidence, where I refer to the proposed RPS I am referring to the section 42A report version.

evidence and additional supplementary evidence (**section 42A report (October version)**);

(e) the Regional Council's supplementary evidence relevant to the ECO and LF Chapters;

(f) the other statements of evidence prepared on behalf of Contact; and

(g) a range of publications as referred to throughout this evidence.

3.2 The purpose of my evidence is to provide comment on the following chapters of the proposed RPS from an ecological perspective:

(a) **PART A: ECO – Ecosystems and indigenous biodiversity**; and

(b) **PART B: LF – Land and freshwater**.

3.3 I have also been engaged by Manawa Energy Limited ("**Manawa**") to provide evidence on matters in the ECO Chapter relevant to its submissions and have prepared a statement of evidence on its behalf. Consequently, my evidence on the ECO Chapter is for the most part identical to evidence I have provided on behalf of Manawa Energy.

PART A: ECO – ECOLOGY AND INDIGENOUS BIODIVERSITY

4. SCOPE OF EVIDENCE ON THE ECO CHAPTER

4.1 In terms of the ECO – Ecosystems and indigenous biodiversity chapter, my evidence will provide:

(a) an overview of the state of biodiversity in the Otago region;

(b) comments on the proposed provisions for identifying and mapping significant natural areas (**SNAs**) in the Otago region, including a high-level overview of how much of the region could meet the criteria currently listed in APP2;

(c) comments on the proposed provisions for managing the effects of existing activities on ecology and biodiversity;

(d) comments on the proposed provisions for managing the effects of new development, including the proposed effects management hierarchy and criteria for biodiversity offsetting and compensation; and

(e) an overview of what current climate change predictions might mean for the region's biodiversity and the role of renewable electricity generation (**REG**) in mitigating the effects of climate change.

4.2 Throughout this evidence, where relevant, I refer to relevant provisions of the Exposure Draft of the Proposed National Policy Statement for Indigenous Biodiversity (**NPSIB Exposure Draft**). However, this document is still subject to public consultation and may well be amended following the submission process. I can provide the panel with an update (if any) on any outcomes from this process when I present my evidence.

5. EXECUTIVE SUMMARY ON THE ECO CHAPTER

5.1 While Otago had large indigenous vegetation cover reductions compared to the other regions in New Zealand from the 1990s to 2008, since about 2010 that loss has diminished; and since 2012, the rate of indigenous vegetation cover loss has significantly reduced. As a general comment, I therefore do not consider that the proposed RPS needs to take such a precautionary and restrictive approach to ecology.

5.2 I consider there are practical difficulties with the proposed RPS, including as amended in the section 42A report (October version) as follows:

(a) The provisions for identifying SNAs are overly broad and are likely to result in large areas of the region being determined to be SNAs;

(b) The proposed provision for existing activities within SNAs (ECO-P5) contains terms that will be subject to debate and is likely to be difficult to apply in practice;

(c) The pathway for new development is overly restrictive and will make it very difficult for new renewable electricity generation activities to be consented. This results in a two-pronged negative outcome for biodiversity:

(i) the benefits of robust mitigation, offsetting and compensation packages will not be available; and

(ii) the critical benefits of renewable electricity generation activities in reducing greenhouse gas emissions will not be able to be realised.

5.3 In summary, I consider the provisions in the proposed RPS may prove obstructive to biological gains and put the future of biodiversity in the region outside of the conservation estate, and other large scale protection lands, significantly at risk.

5.4 The proposed RPS will cause most indigenous features in the region to be considered SNAs even though most of those "SNAs" (especially in peri urban and rural landscapes) will have significant pest and degradation issues relating to size, edge effect and proximity of other land use issues. The proposed RPS currently has a low threshold test for recognition of an area as 'significant'. This appears to be on the assumption that indigenous biological diversity is rare or under imminent threat of loss. However, that assumption is incorrect.

5.5 The proposed RPS then effectively closes off the ability to affect those SNAs because of the way the effects management hierarchy and APP3 and APP4 are drafted (in respect of offsetting and compensation). This will largely remove the ability to cause management gains and long-term management fixes in those features through “trading” (ie an effects hierarchy). The result will be that very few of these features will receive the care they need, noting that very few of them are currently cared for through voluntary means or by the Department of Conservation.

5.6 In addition, it is in my opinion critical to reducing the adverse effects of climate change on biodiversity that renewable electricity generation projects are enabled (with appropriate controls) in order to decarbonise our economy and society. I consider that the provisions in the proposed RPS will make it much more challenging for such projects to be consented in the region.

5.7 I have set out as **Appendices VK.1, VK.2 and VK.3** my suggested amendments to APP 2 (in respect of SNAs); APP3 (in respect of offsetting); and APP4 (in respect of biodiversity).

5.8 I have also considered the **Proposed Energy Sub-Chapter** attached to the evidence of **Ms Hunter**. I consider the proposed provisions are appropriate, from an ecological perspective, but have queried one aspect in relation to EIT-EN-P5.

6. OVERVIEW OF THE OTAGO REGION

6.1 While Otago had large indigenous vegetation cover reductions compared to the other regions in New Zealand from the 1990s to 2008, since about 2010 that loss has diminished. The 2012-2018 period as recorded by NZ Statistics, shows the rate of loss has significantly reduced (see **Figure 1** below). The loss in that period has been predominantly because of shrublands (670ha - 40% matagouri grey shrub and the rest fernland) and indigenous tussock grassland conversion (487ha).

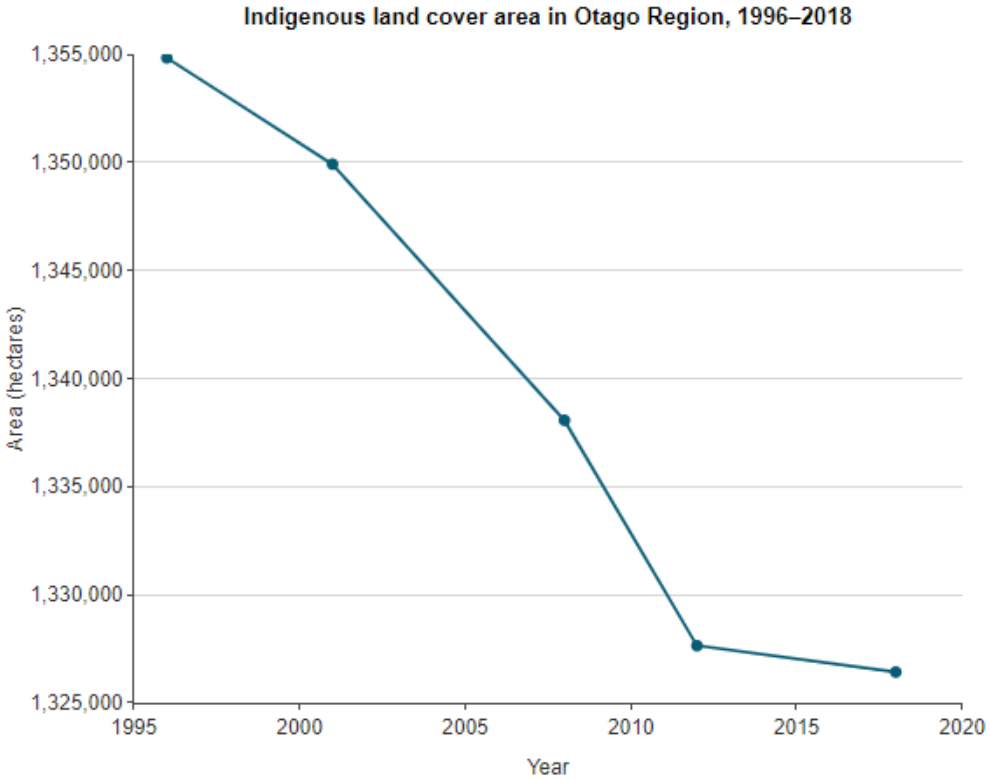

Figure 1: Indigenous land cover area in Otago region, 1996-2018, Stats NZ

6.2 The various mechanisms that have been in place since 2010, but also perhaps the areas of useable land that have been developed, have been relatively successful in stemming the loss of vegetation cover. Based on the evidence, it does not seem to me that the proposed RPS needs to take such a precautionary and restrictive approach in respect of ecology (as I explain further below). While it is desirable to continue to reduce indigenous biological diversity loss, it is not desirable to do so at any cost, especially by preventing options that may deliver biodiversity benefits. This is especially so when the proposed RPS also recognises that restoration and enhancement are required pathways to attaining more indigenous biodiversity.

7. SIGNIFICANT NATURAL AREAS

7.1 In this section, I provide an explanation of best practice for identifying and mapping SNAs.

7.2 The identification of SNAs reflects the Resource Management Act 1991 (**RMA**) section 6(c) requirement to recognise and provide for the protection of areas of significant indigenous vegetation and significant habitats of

indigenous fauna. For many years (since 2004, when Norton and Roper-Lindsay settled in the literature a set of significance criteria adapted from early sets (Whaley, Clarkson and Leathwick, 1995; Norton and Roper-Lindsay, 1999)) it has been accepted that there is a simple suite of basic characteristics that need to be addressed to determine significance.

7.3 Those characteristics are

(a) representativeness;

(b) rarity;

(c) diversity;

(d) distinctiveness; and

(e) context.

7.4 Viability can also be a factor, reflecting the likely persistence of a species or feature in the absence of management.

7.5 The interpretation of these criteria has been subject to argument and subtle variation but in essence they are a measure of how alike to a particular reference condition an assemblage is – that is:

(a) Are all the species present in the various tiers expected?

(b) Is the feature or the species in it rare / threatened / at risk?

(c) What is the level of rarity – varying from national to regional to ecological district?

(d) Is there a diversity of species as expected (for a representative assemblage)?

(e) Are there any special features and does the feature provide an ecologically important contextual role?

7.6 In most cases the criteria had to indicate a level of importance about the feature, for example, a particularly large, species rich, or intact area, or an area holding a number of special species or unusual environmental gradients. That is, the area needed to have had better than typical ecological qualities or to satisfy rarity criteria if it was an ordinary condition (ie having less than 20% of its type remaining as compared to an 1840 proportional representation in the ecological district).

7.7 The principal arguments have always been, however, around the quality of features versus the rarity of features/species and whether the application of decision criteria should or should not consider the quality/intactness of a feature. This has become more of an issue as time has progressed and the perception of the rarity of such features has grown; either because some areas no longer have good quality examples, or because the best quality examples have been protected and the remaining examples are small and/or in poor condition.

7.8 There is now a common belief that indigenous biodiversity across New Zealand is still in serious decline and rarity has become a focus or weighted criterion. However, I do not see the evidence of continuing serious indigenous biodiversity decline. Habitat loss statistics and indigenous land cover information from sources like Stats NZ[2] show that there has been a dramatic decline in habitat loss over the last 30 years (which is likely related to the enactment and effect of the RMA) as well as some increases (indigenous forest in New Zealand increased between 2012 and 2018). The only habitat type that remains at some continued loss is “scrub/shrubland". However, in general, the data shows that, while there are still some point losses related to illegal activities, the decline is largely halted and, in some areas (eg Wellington), is reversed.

7.9 From around 1990 to 2005, many ecologists considered that the best and rarest remaining examples outside of the conservation estate should be completely protected, and a reducing degree of protection provided as quality diminished and as a sufficiency of protection for each type was reached (previously 20% of the historic extent in any ecological district would have been considered sufficient, now 30% is often considered sufficient).

7.10 **Figure 2** below shows the percentage change of indigenous land cover from 1996 – 2018. Some regions are in the positive (ie gaining indigenous land cover), however, Otago has the poorest statistic, with an approximate 2% decrease in indigenous land cover area. This is largely due to tussock grassland conversion that includes loss of grey shrub.

[2] https://www.stats.govt.nz/indicators/indigenous-land-cover

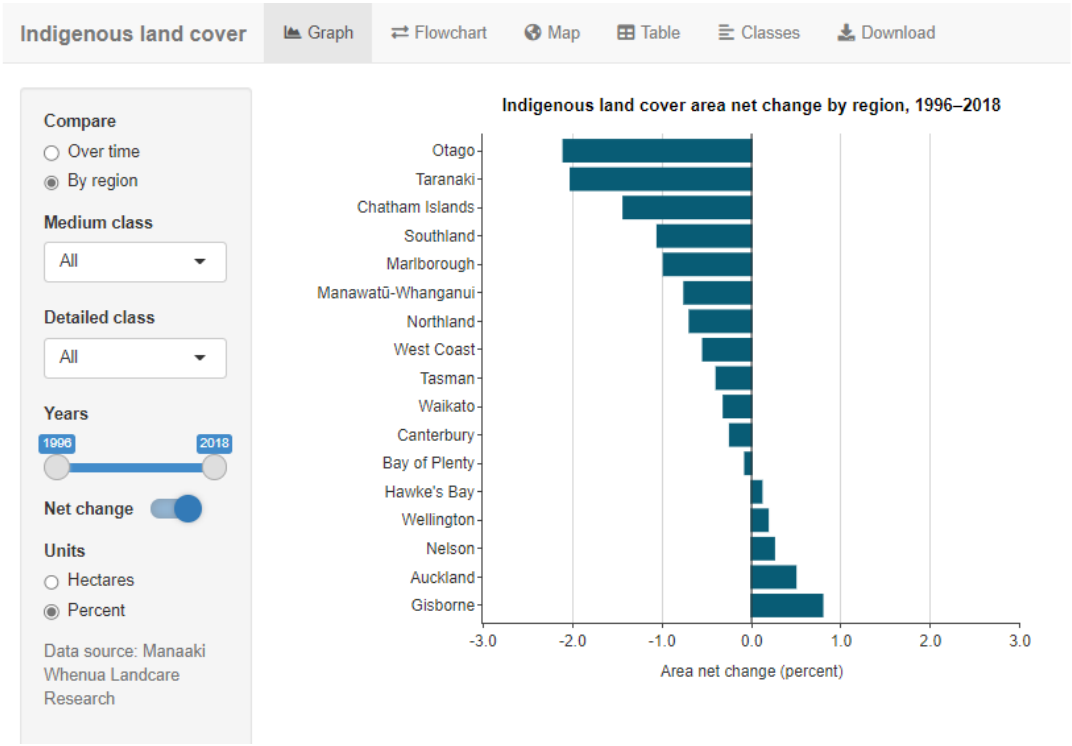

Figure 2: Indigenous land cover area net change by region, 1996-2018, Stats NZ

7.11 However, the modern direction (as evidenced by the NPSIB Exposure Draft (and the earlier version from 2019) and some second generation regional policy statements[3] is that all indigenous species and habitat should be considered rare and in a declining trend. Therefore, the bar as to what constitutes an SNA has been slowly dropping over the last ten years.

7.12 There are issues with lowering the bar for an SNA, in the absence of strong evidence of a need to do so. This can misrepresent what is at risk representative indigenous biological diversity, and highlight the common and tolerant, the non- or semi-functional and areas where quality is degraded. The areas that this lower bar recognises as an SNA (given most of the truly significant areas are protected) are already modified and reduced systems. These areas are typically in the vicinity of human development and land use which often results in unsustainable or non-representative examples, is typically missing tiers (canopy, or ground tier or middle tier) or is significantly compromised because of exotic pest species.

7.13 These features do not offer sustained indigenous biological diversity to our landscapes, and rather require substantive management and input to be

[3] For example, the Greater Wellington Regional Council's Operative Regional Policy Statement, Section 4.41, Policy 23 (page 104).

restored and secured. It is not enough to recognise these features and then simply require them to be avoided. In the absence of incentives for land users of areas in which those features remain, these areas will diminish and/or be lost. This is what happens when those common poorer quality examples are recognised (in my opinion, incorrectly) as "significant".

7.14 Rather than lowering the bar, I consider it preferable that there is a high bar for an area being considered "significant"; and that other planning mechanisms are then used to recognise a lower value remnant and cause a return of indigenous habitat values. This would cater for their betterment, or the betterment in general of indigenous biological diversity even if it means losing some areas from the category of an SNA and so not requiring them to be avoided.

The proposed RPS

7.15 The proposed RPS sets out the proposed criteria for SNAs in APP2. The section 42A report (October version) states that an area is a SNA if it meets any one or more of the criteria listed, being: representativeness, rarity, diversity, distinctiveness, ecological context, and vulnerable and sensitive species.

7.16 I comment on these criteria below.

Representativeness

7.17 The criterion for representativeness in the section 42A report (October version) of the proposed RPS is:

> *"(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."*

7.18 The first sentence in the criterion is sound and follows good practice. However, the second sentence raises a number of issues, as follows:

(a) While it would be appropriate to consider degraded examples where there were few or an under representation of the type in the ecological

district, the criterion does not require that. Instead, it would be possible to always consider degraded examples as meeting this criterion.

(b) Further, the reference to degraded examples is oxymoronic relative to the principal part of the criterion – the feature is unlikely to be representative of its original natural diversity if it is degraded.

(c) The reference to "all that remains" should be considered under the rarity criterion rather than representativeness. If the habitat type is diminished in cover (from its “original” extent) it should be identified as a rare habitat type, rather than a "representative" one.[4]

7.19 Current good practice is to ensure the criterion recognises seral assemblages and not just “climax” ones such that, for example, regenerating shrublands are included but only where they are typical of the expected “reference” assemblages, not of degraded ones.

7.20 The (b) and (c) criteria relate to marine ecosystems which is outside my of area of expertise, however, I do note that these criteria similarly have a lowered bar.

Rarity

7.21 The criterion for rarity (s42A report (October version)) is:

“An area that supports:

(i) An indigenous species that is threatened, or uncommon, or an important population of species that is at risk, 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, or

(iii) Indigenous vegetation and habitats within originally rare ecosystems."

[4] It used to be that representativeness referred to how well a habitat was represented in the landscape (ie the ecological district) relative to its original cover but that use of the term changed in the early 2000s.

7.22 This criterion sets a low bar by including *“uncommon”*. There is a formal scientific method and process for determining *"at risk"* and *"threatened"* species (Townsend et al, 2008). However, there is no such process for determining Otago region's "uncommon" species. A publication in 1994 purported to describe the “local” species (Johnson, 1994), but not the uncommon species. In the absence of an accepted process, this will become a highly debated aspect of the criterion where it is called upon, and I consider it should be removed.

7.23 In regard to subclause (ii) and the proportional representation of a habitat type relative to its original expanse, the 20% retention benchmark was the goal of the Department of Conservation's Protected Natural Areas Programme (**PNAP**) process and is loosely adapted from island biogeography theory (MacArthur and Wilson, 1967) around the extent or amount required to sustain a feature. PNAP identified a retention goal of 20% in an ecological district (O’Connor, Overmars, and Ralston, 1990). However, if a habitat or vegetation type is considered rare because the national proportion is under 20% then some features will automatically meet this criterion irrespective of whether the ecological district has a suitable proportional representation (such as indigenous natural wetlands). In my opinion, this national level focus is not reasonable for a regional policy statement because the regional policy statement should be about the region and the "representation" of its ecological districts rather than being overshadowed by a national cause. I therefore recommend that "nationally" should be removed.

7.24 Under the Land Environments of New Zealand (**LENZ**) models (Leathwick et al, 2002), indigenous vegetation rarity has been modelled and mapped nationally. Graduations of reduced indigenous cover have been categorised as 0-10%, 10-20%, 20-30%, >30 but <10% protected, >30% and 10-20% protected, and so on. This system shows where indigenous vegetation of any type (in the country) has been depleted and is strongly correlated with low gradient lowlands – where farming is the dominant activity.

7.25 However, the model uses a broad approach that is not specific to any one of the various indigenous vegetation types, such that in a “depleted” (<10% remaining) landscape any indigenous cover, for example, manuka regrowth, will trigger significance and tauhinu-bracken regrowth might only be present as a result of periodic farming practices. A change in areas of <10% will trigger the rarity criterion under the LENZ model. In my opinion this is

inappropriate and should not trigger significance. Such seral (and opportunistic) communities (often very simple in terms of taxa richness) in our highly modified landscapes have come and gone with changing land use for over 100 years and their contributions to indigenous biodiversity are both limited but also persistent without special consideration of value, protection, or a significance label. I therefore recommend that "land environment" should also be deleted from subclause (ii).

7.26 Subclause (iii) proposes that indigenous vegetation and habitats within originally rare (“naturally uncommon”) ecosystems are considered to be SNAs. This is a recognised rarity criterion (Wiser et al, 2013) and such ecosystems are typically considered to be more susceptible to loss because there are few of them (ie there is a risk rather than a value driver for significance). However, they are often as plentiful as they always have been and are not “rare” relative to the extent that they naturally should be present. Furthermore, these systems (72 types are recognised (Wiser et al, 2013)) are things such as shell barrier beaches, coastal cliffs, boulder fields of calcareous rocks, or strongly leached terraces and plains and are the basis for supporting distinctive (and therefore qualifying under other criteria) vegetation and animal communities. However, where such distinctive assemblages do not occur on them then they are simply rocks, or cliffs, or leached terraces and are not significant in and of themselves.

7.27 In my opinion and experience, care is required around accepting naturally uncommon as “rare ecosystems.” The assessor should have the ability to consider the level of loss or level of protection already afforded a naturally uncommon system, not automatically find those systems as meeting the rarity criteria. That is, subclause (iii) is not required, and this feature type can be successfully considered under subclauses (i) or (ii).

7.28 Lastly, in respect to subclause (iii), the presence of a species at its distributional range limit is a human construct based on the extent of our surveys and fixed at a point in time. In reality species move constantly depending on gamete mobility, changing climates, conditions and opportunity. Therefore, the range extent or edge as we set it should not of itself be a factor of significant vegetation or habitat of fauna. In my opinion subclause (iii) should be removed.

Diversity

7.29 The criterion for diversity (section 42A report (October version)) is:

"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."

7.30 This has always been a redundant criterion without any comparative metrics and is covered by the other criteria. If a community or area is representative, then it has the expected diversity. If the criterion seeks to identify landscapes with a high number of ecosystem types then it is unusable at a site or feature level. Its principal use, and where it can be distinguished from the representativeness criterion, is in its direction to consider within a site, small scale, high levels of natural physical environment variance leading to mosaics of vegetation/community types that reflect those environmental variances/gradients. This could also be reflected in the distinctiveness criterion. It should not be used, as it often is, to say that the site's diversity is "high" or a pattern of vegetation types is high in the absence of an accepted comparative level of diversity.

7.31 In my opinion the criterion is redundant and should be removed.

Distinctiveness

7.32 The criterion for distinctiveness (section 42A report (October version)) is:

"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."

7.33 As previously discussed, distributional limits are not stable and vary constantly with climate change and other, including human, factors. They should therefore not be a factor that can solely determine significance. Therefore, subclause (i) should be deleted.

7.34 In addition, species of restricted occurrence should not trigger significance without clarification that this is not an artifice of human perturbation but rather a factor related to special or unusual physical habitat requirements or

circumstances which are natural. Otherwise, the criterion becomes simply another way of describing rarity. Therefore, "of restricted occurrence" should be deleted from subclause (iii).

Ecological context

7.35 The criterion for ecological context (section 42A report (October version)) is:

> *"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 flora and fauna between different areas, or*
>
> *(ii) An area that has an important buffering function that helps to protect the values of an adjacent area or feature, or*
>
> *(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, or*
>
> *(iv) A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem."*

7.36 Conceptually this criterion has an important role. However, no metrics are provided to indicate what makes the area important in the various roles described under (i) to (iv) (eg what size, length, area or function is required?) This means that in practice, the criterion can be triggered wherever the assessor considers it *might* be the case.

7.37 In New Zealand, a corridor function has rarely been proven as necessary or helpful for New Zealand indigenous species (in contrast, a corridor function has been shown as detrimental to some isolated indigenous habitats because it facilitates pest species movement (Patterson, 2021; Recio, Seddon & Moore, 2015). An example of a possible corridor function is in relation to the New Zealand long tail bat. In the Waikato, the application of this criterion would mean, for example, that most exotic shelterbelts in the farming landscape would be classified as significant. In Otago it is likely that with greater bat survey in landscapes not considered to hold these species, that the same result will be found and then the same "value" placed on farm

shelter belts and old planted exotic trees. Furthermore, in Otago the consideration of any vegetated linear feature as a skink or gecko corridor is likely but as yet is extremely unfounded. There is also great debate about the functional widths of riparian areas and wetland sizes that are required to achieve certain levels of function. In my opinion, without sound scientific evidence in New Zealand relating to this landscape function, it should not be used to justify significance.

7.38 In other words, an area can nearly always be shown to be important to any indigenous fauna for some part of its lifestyle or for some unproven function (ie buffer, corridor). This results in the criterion being unrealistic and I consider some limits/metrics are required.

7.39 In my opinion, the ecological context criteria should focus on aspects that are measurable and consider the role of the site in the context of the wider landscape, incorporate its size and shape, importance as a store of genetic material (diversity and abundance of individuals), function to buffer and manage pollution, degree of resilience and sustainability, and its role in sustaining regional populations of species.

Vulnerable and sensitive species

7.40 The section 42A report (October version) now includes a further criterion in response to the submission of the Director-General of Conservation as follows:

> *"An area that contains sensitive habitats or species that are fragile to anthropogenic effects or have slow recovery from anthropogenic effects."*

7.41 It is not clear if “fragile” and “sensitive” are to be defined and if a measure of fragility and sensitivity has been made clear, but again it is a measure of risk not of value or importance. I do not know of any studies that test the measure of fragility. There are a number of publications on network fragility (foodwebs and the levels of interconnectivity and the ease which a food web can be demolished), however, there is not an agreed methodology, and I consider this criterion will be interpreted subjectively without any clear and agreed scientific basis.

7.42 If such a habitat was not identified as an SNA by the existing criteria, then it should not be identified through this individual criterion. Those sensitive and fragile habitat to anthropogenic disturbance cannot, by definition, now exist in

the private land space of the Otago region and must only persist in the Department of Conservation estate or in areas of such wilderness and remoteness it is difficult to imagine that those same habitats and species assemblages would not already classify under representativeness, rarity or distinctiveness. This criterion is redundant and should be deleted in order to avoid perverse and subjective outcomes.

What application of the criteria would mean in Otago region

7.43 In this section I consider what areas of the region are likely to be considered SNAs if the RPS includes the criteria set out in APP2 in the section 42A report (October version) of the proposed RPS.

7.44 In summary, I consider that the criteria will lead to significant uncertainty (without added metrics to provide an objective assessment) as well as a "lowering of the bar" such that many more areas/features, often of low ecological value, will be found to be SNA.

7.45 For a start the LENZ threatened environments classification data base (**Figure 3**) shows that all of the red and orange (<20% indigenous cover) in the below map would very likely qualify (where there was any indigenous vegetation) without a site visit (aerial photograph would likely be sufficient) because of the following criterion under rarity *"(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."*

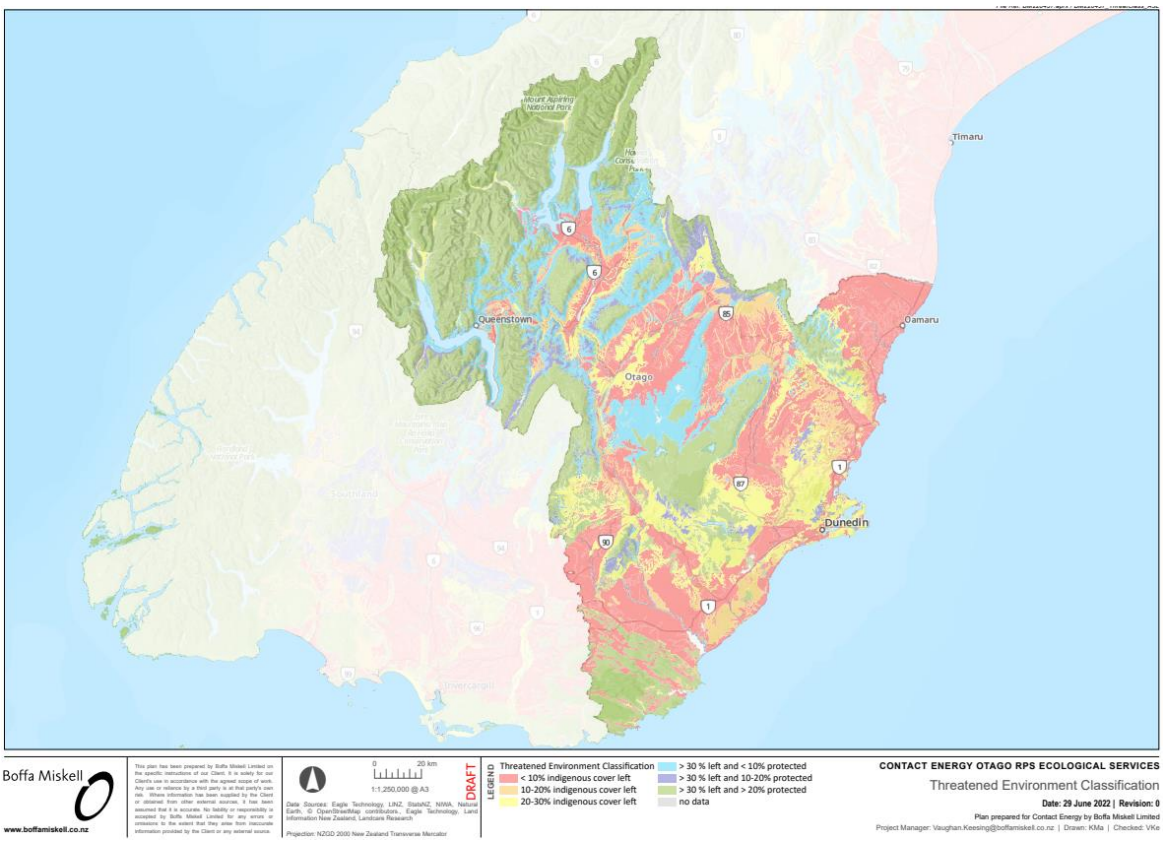

Figure 3: LENZ map of the Otago region

7.46 This is much of the flatter land in the region.

7.47 The yellow and purple areas have sufficient indigenous cover above this particular threshold, but these areas may still be determined to be SNAs under the recommended criteria because of the following (for example):

(a) The vegetation habitat may be representative even though degraded. The representativeness criterion does not provide that where sufficient proportions of representative areas are present, the degraded examples should not qualify.

(b) All natural wetlands, for which there is a very low threshold (ie only meeting the RMA definition of wetland), will be SNA regardless of representativeness because of national and regional rarity (criterion (d)(ii)); its ecological context (criterion (g)(iv)); and the new recommended criterion of vulnerability (criterion (h)).

8. MANAGING EFFECTS OF EXISTING ACTIVITIES (POLICY ECO-P5)

8.1 ECO-P5 (section 42A report (October version)) states that existing activities that are lawfully established within SNAs (outside the coastal environment)

and that may adversely affect indigenous species and ecosystems that are taoka are provided for, if:

(1) *the continuation, maintenance and minor upgrades of an existing activity that is lawfully established will not lead to the loss (including through cumulative loss) of extent or degradation of the ecological integrity of any significant natural area or indigenous species or ecosystems that are taoka, and*

(2) *the* adverse *effects of an existing activity are no greater in character, spatial extent, intensity or scale than they were before this RPS became operative.*

8.2 From an ecological perspective (1) is unmeasurable. While the spatial extent component is measurable, that aspect is already covered by (2). However, the *"degradation of the ecological integrity"* is not measurable. The term *"ecological integrity"* is not defined. The science of ecology defines it in many ways (Wurtzebach and Schultz, 2016), one of them being:

> *"a holistic concept and framework that focuses on conserving native biodiversity, using the natural or historic range of variation as a reference point."*

8.3 Ecological integrity emphasises the importance of ecological processes such as natural disturbance regimes that provide the structures and functions on which the full complement of species in an ecosystem or landscape depends. To date, while the scientific literature has trialled a range of indicators for the complex that is integrity, the results have been mixed. In essence the measure of ecological integrity involves considerable effort and time to construct a complex conceptual model of the species and abundances, the processes and functions present and the level of functioning and then establishing an array of indicators such as species biomass, species fecundities, physical structure, level of invasive species, physical environmental parameters (humidity, wind desiccation, temperature, soil fertility etc).

8.4 In my opinion, there is no chance of an assessment of a small SNA on private land being able to determine the ecological integrity of that feature, let alone if it has changed and if that change is because of a particular periodically experienced disturbance.

8.5 I recommend that ECO-P5 be amended to delete the reference to 'ecological integrity' and to focus on measurable aspects that reflect resilience or sustained presence and quality, such as the extent of area of vegetation cover, the proportion of indigenous cover, the density of tree stems, and a diversity indices (species richness and proportional abundance).

8.6 I also note that the Proposed Energy Sub-Chapter proposes a new set of provisions to manage the effects of existing REG activities. I comment on these provisions below, from an ecological perspective.

9. MANAGING EFFECTS OF NEW DEVELOPMENT (POLICY ECO-P4)

9.1 In essence the policy is supported in that it considers effects to follow a now standard effects management hierarchy. However, in regard to a linear hierarchy, often the best solution is a mixture of management strategies, and the management of effects should not be restricted to a linear interpretation of “hierarchy”.

9.2 Since 1991 the RMA has provided a pathway through the management of adverse effects by way of remedy or mitigation. The use of terms has grown since the 1990s and now there are hierarchies but the essence of the approach is the same:

(a) First, the ecological values of a site are sought to be avoided through design and placement, and driven by the values at risk.

(b) Adverse effects are then minimised, where avoidance cannot reasonably be achieved.

(c) Remedial actions are then carried out, where the effect is temporary.

(d) Finally, compensation action is carried out, either on site, nearby or by way of appropriate scaled responses in the wider landscape.

9.3 While there were sometimes issues with this process, in the main high value ecology was protected and managed and lower value ecology was lost but at least similar values were replaced through mitigation actions. Sometimes these mitigation actions were not managed well but often they delivered successes above what would have been achieved but for the development.

9.4 The essence is that many ecological values are declining from a number of pressures (Department of Conservation, 2020) though perhaps the most prominent one is pest species effects and these are becoming more serious

now than the reducing scale of habitat loss The effects of pests are largely unmanaged in SNAs with no mechanism to require their management. A consent process, with an effects management hierarchy pathway, has provided that mechanism. Large scale restoration, revegetation, waterway creation, pest management, fencing, legal protection, enrichment planting, species salvage and translocation can all occur under an effects management hierarchy, often to a level sufficiently well as to counter the adverse effect of the development, or in some cases to provide net ecological benefits. For example:

(a) The Pegasus Bay development has resulted in the creation / enhancement of large wetlands and lakes.

(b) The Ravenswood development (north Christchurch) has resulted in the development of indigenous wetlands and revitalisation of the Taranaki Stream.

(c) The Mackays to Pekapeka Expressway has resulted in 40 hectares of new indigenous wetland, several kilometres of riparian vegetated and enhanced stream, and 10 hectares of terrestrial coastal forest to be planted. In addition, further vegetation has been delivered to address landscape effects.

(d) Omaha South development led to 20 hectares of kahikatea coastal forest wetland protection, predator fencing of fern bird populations, new wetlands and catchment reafforestation.

9.5 Rio Tinto is developing plans for its Bluff smelter site to undertake significant pest management and rehabilitation as well as biodiversity monitoring and pest monitoring as part of a decommissioning offset following an inventory of ecological values present. There are a wide range of at risk and threated taxa and ecosystems within their sphere of influence and no other mechanisms to cause such ecological management.

9.6 Allowing poorer quality ecological features to be adversely affected in return for better overall ecological outcomes is, and has been, the only real way of achieving tangible additional ecology and ecological management. If no development is allowed in low ecologically value areas, or the linear interpretation of "hierarchy" too rigidly enforced, then there is no mechanism for the ecological management to occur, or the best management, and the

present degrading processes of these environments from pest species and other factors will continue.

9.7 In other words, avoidance of all adverse effects within SNAs does not result in an overall better outcome for ecology and most often a mix of avoidance, remedy and offset management directions results in the best outcome for indigenous biological diversity.

10. EFFECTS MANAGEMENT HIERARCHY

ECO-P6 – Maintaining indigenous biodiversity

10.1 This policy sets out a biological effects management hierarchy that must be applied as follows (section 42A report (October version):

> *(1) avoid adverse effects as the first priority,*
>
> *(2) where adverse effects demonstrably cannot be completely avoided, they are remedied,*
>
> *(3) where adverse effects demonstrably cannot be completely avoided or remedied, they are mitigated,*
>
> *(4) where there are residual adverse effects after avoidance, remediation, and mitigation, then the residual adverse effects are offset in accordance with APP3, and*
>
> *(5) if biodiversity offsetting of residual adverse effects is not possible, then:*
>
> > *(a) the residual adverse effects are compensated for in accordance with APP4, and*
> >
> > *(b) if the* residual *adverse effects cannot be compensated for in accordance with APP4, the activity is avoided.*

10.2 These are now standard principles (not usually criteria) around effects management. However, as I have noted above making it a linear hierarchy of sequential steps for the entire system can reduce or limit the potential for ecological benefits and I often find that a mixture of solutions works best. The wording should reflect that (ie avoid as far as practicable, and so on) such that the end process is an ecological gain.

10.3 For example the NPSIB Exposure Draft (clause 1.5(4)) uses the wording *"where practicable"*. This wording is also used in the NPSFM (clause 3.21(1)). In my opinion it makes sense, where appropriate and ecologically correct, to align the RPS provisions with those documents. I favour the use of the wording *"where practicable"* as it is widely understood and consistent with other documents.

10.4 Both the NPSIB Exposure Draft and the NPSFM also refer to *"where more than minor residual adverse effects…".* Again, I consider that consistency is important and from an ecological perspective, not every mere residual effect must be addressed.

10.5 I also note that an alternative effects management hierarchy is proposed in the Proposed Energy Sub-Chapter developed by **Ms Hunter** and others. I comment on this further below, from an ecological perspective.

Offsetting in the proposed RPS (APP3)

10.6 In this section I comment on the proposed approach for offsetting (again referring to the section 42A report (October version)) of the proposed RPS.

Clause 1 – Situations where biodiversity offsetting is not available

10.7 Clause 1 of APP 3 sets out situations where biodiversity offsetting should not be available. I agree that there should be limits to where offsetting is available. Some species or features are irreplaceable, or are of such extreme rarity, value and complexity that their loss is not tolerable or the ability to replace or recreate them is unlikely. Such species or features are beyond what can or should be offset.[5]

10.8 However, subclauses 1(a),(b),(c),(d) and (e) are too restrictive without clear and better guidance, as I discuss further below.

10.9 The NPSIB Exposure Draft does not set such low limits. Instead, it gives examples where offsetting would be inappropriate, including because of the irreplaceability or vulnerability of the indigenous biodiversity affected. I support this approach but would remove "vulnerability" because I do not know what is meant by that term and in that context. I do not consider that anyone, currently, can define an accurate and measurable 'vulnerability' indicator.

[5] Maseyk, Usher, Kessels, Christensen, Brown. 2018. *Biodiversity Offsetting under the Resource Management Act*. Biodiversity Offsetting draft 1.7.indd (lgnz.org.nz)

10.10 The proposed RPS (section 42A report (October version) sets a low bar as to when offset should not be available. In my opinion this will ultimately provide poorer ecological outcomes for the region. I discuss this below.

*Subclause 1(a) "loss from an ecological district of **any** individuals of threatened taxa…"*

10.11 This clause would prevent offsetting from being available wherever there is any "loss" of any individuals of threatened taxa. As worded, this would mean that if even one individual of a threatened taxa dies (or is displaced from its ED), offsetting would not be available. That does not seem an appropriate limit for an offset and in my opinion is likely to reduce the opportunities for better ecological outcomes.

10.12 This limit precludes an ability to consider alternative proposals that might create a better situation and greater numbers of threatened taxa, especially plant species but also animal species through predator relief and habitat creation, at least locally. I am aware of several examples with active working offsets that are succeeding to increase the number of threatened and at risk taxa, including Ravensdown's Supreme Line Quarry, Pukekawa Quarry, Waihi North Project, Macraes' Deepdell gold mine, Stockton Mine, and Stevenson Aggregates' Drury Quarry.

10.13 The Pegasus Bay development (north Christchurch) is another example, which affected and then recreated extensive wetland habitats and reinstalled Canterbury mud fish (a threatened fish taxa). Without this development the mudfish would have never been recognised in the area and its habitat would have continued to degrade with farming and willow invasion. Had the project been required to avoid the "wetlands" no offset or benefits would have been forthcoming.

10.14 Offsetting required for Deepdell North Mine ensures the protection of the naturally uncommon wetland species *Juncus distegus*, and salvages, rehomes and protects Korero gecko (at risk-declining) as well as providing funding needed for lizard research.

10.15 This clause would create a problematic scenario for any new development, including the development of new wind electricity generation, where it will not be possible to prove that no threatened species (eg black fronted tern, Australasian bittern, kea, long tailed cuckoo, some shags or a range of migratory species) will suffer collision fatalities. While such fatalities are

unlikely based on current data (Bull, Fuller and Sim, 2013), it will be difficult to show that there will absolutely be no fatalities and there are records of at risk species at least colliding with turbines, if not suffering fatalities.

Subclause 1(b) "measurable loss within an ecological district to an at risk-declining taxon…"

10.16 The proposed RPS (section 42A report (October version)) also precludes an offset where at risk-declining taxa (accepting this does not include mānuka) would suffer *"measurable loss"* within the ecological district. It is not clear what this means, however, surely it should be clarified to mean population loss. As currently drafted, even just one individual loss would constitute "measurable loss" (since one individual loss can be measured), however, this would mean the standard is the same as that for threatened taxa under subclause (a). I consider the term “measurable loss” should be defined and rationalised.

10.17 The measures and assessment used might be viable for particular plant species whose locations and populations are well known and monitored, but this measure could not be undertaken for most plant species, any invertebrates and probably not for most lizard. As an example, the pipit (ignoring sub-species) is “at risk / declining” on the mainland and occupies open grassland / shrub (eg farmland) type habitat. I know of only two population estimates published (Chatham island – 0.37 pair/ha[6] and Whangarei (0.36 pair/ha)) and neither of these are for Otago. About 86% of Otago’s landcover is conducive to pipit life history (LAWA, 2022[7]), that is some 2,568,000 ha, meaning a theoretical population (0.36 pair/ha) of 924,480 pairs of pipit in Otago (ie close to 1.8 million birds).

10.18 This example raises a number of questions and uncertainties, including as to whether that species is really declining in the region, and whether the displacement of 3 pairs of birds, for example, constitutes a measurable loss. I have recommended amendments to the criterion to make it clear and workable.

[6] Densities presented without reference in NZ Birds Online
[7] Land, Air, Water Aotearoa (LAWA) - Land Cover

Subclause 1(c) "the worsening of the conservation status of any indigenous biodiversity as listed under the New Zealand Threat Classification System (Townsend et al, 2008);…"

10.19 This criterion appears on the surface sensible, however, determination of a ranking is a complex and somewhat subjective assessment which occurs periodically with a review of abundance (population) and distribution data trends across New Zealand. It is inconceivable that any one project at a site which might remove a species ranked as, for example, at risk (noting at risk includes data deficit, relict and naturally uncommon) could possibly be determined to affect a ranking. The only site species abundance loss that could directly and immediately reflect a population change (short of the death of many thousands) is to the most threatened taxa (such as bittern, kakapo, fairy tern), but these are already at the highest threat ranking. I consider this criterion is impracticable and will only cause confusion and disagreement. In my opinion, it should be deleted.

Subclause 1(d) "the removal or loss of viability of a naturally uncommon ecosystem type that is associated with indigenous vegetation or habitat of indigenous fauna"

10.20 Subclause 1(d) again appears laudable, however, I suggest that rarely, if ever, is there sufficient district or regional level population statistics and population trends that will allow this assessment – certainly to the satisfaction of a regulatory authority.

10.21 As set out above, in my opinion, this limits the ability to provide for offsetting that might lead to an overall better outcome for an at risk-declining taxa. This subclause also appears to close the door to a consenting pathway for specific infrastructure. There are many common at risk species in the Otago region (for example, long fin eel, pipit, red billed gulls, red fin bully, matagouri, red tussock, jewelled gecko etc). It is technically feasible to offset all of these species and all of these species have large populations which reduces the risk of offset failure from only one site.

Subclause 1(e) "the loss (including cumulative loss) of irreplaceable or vulnerable indigenous biodiversity"

10.22 I support the concept of not causing species to be made extinct in an ecological district or at a national level but do not understand what subclause 1(e) means by "irreplaceable or vulnerable". If this is about vulnerability to extinction, the criterion is already covered by subclause 1(a).

In my opinion, the criterion is vague and open to debate and should be deleted. Alternatively, the wording should be aligned with Appendix 3.2(i) of the NPSIB Exposure Draft Appendix 3 2(i) but with the word *"vulnerability"* removed.

Conclusion on Clause 1

10.23 I consider the limits to where biodiversity offsetting should be available as set out in clause 1 are more problematic than beneficial to ecology. In my **Appendix VK.1** I have suggested amendments to the appendix in light of my comments above.

Clause 2 – Situations where biodiversity offsetting may be available

10.24 Clause 2 of APP3 sets out the criteria that must be met in order for offsetting to be available. In general, I agree with these criteria, however, I comment on some of these below.

Subclause 2(b) "no net loss and preferably a net gain"

10.25 This subclause sets a “no net loss and preferably a net gain” outcome, consistent with the NPSIB Exposure Draft. I am more comfortable with a no net loss outcome than a net gain but understand the aspirational aspect of such a policy for councils. However, I do consider that the required outcome should be commensurate with the level and value of the affected indigenous biological diversity. I have practiced ecology in the RMA context for 25 odd years and consider less than minor effects and small reductions in some indigenous biodiversity is acceptable and should be excluded from the "no net loss" concept.

10.26 In the Appendix I have suggested removing the words "preferably a net gain". This is because, while aspirational, net gain is not a directive. I have also suggested removing the words "using an explicit loss and gain calculation". This is because offsets can be transparent and explained without offset models, and sometimes are better without an offset model.

Subclause 2(d) "ecological values being achieved are the same or similar to those being lost"

10.27 I consider that the criterion in subclause 2(d) can lead to perverse outcomes. In some circumstances “trading up” and other good options can

be more beneficial than adhering strictly to a like for like policy. I recommend the criterion is amended.

Subclause 2(e) "positive ecological outcomes …and preferably in perpetuity…"

10.28 I agree that the positive ecological outcomes must endure for as long as the impact, which might be forever, however, the statement “preferably in perpetuity" is unnecessary.

Subclause 2(f) "additional to any remediation or mitigation undertaken…"

10.29 I recommend the removal of the words "additional to any remediation or mitigation undertaken…" in the last sentence because again it is unnecessary; the offset must be additional and is only present after the remediation and mitigation aspects have already been considered.

Subclause 2(h) "the outcome of the offset is achieved within the duration of the resource consent"

10.30 In my opinion this criterion is unnecessary and also unrealistic (eg in circumstances where the offset is targeting a mature forest habitat). A more reasonable approach is that the offset, and its maintenance, shows appropriate progress depending on the circumstances and that there is a process to secure this ongoing progress, by way of legal instruments, and a bond, prior to the consent lapsing. In my opinion, the criterion should be deleted.

Subclause 2(i) " any offset developed in advance of an application for resource consent must be shown to have been created or commenced in anticipation of the specific effect of the proposed activity and would not have occurred if that effect was not anticipated"

10.31 This criterion is also unnecessary, and it could affect the region by reducing the number and expanse and earlier establishment of new biodiversity in the region simply because an application does not have a specific project and therefore specific effect to attach the offset to. As such, a range of beneficial biodiversity projects may simply not begin because of this limitation. In my opinion subclause 2(i) should be removed.

Clause 3

10.32 Clause 3 states that any biodiversity offsetting that is proposed must address all matters in clause 2 as well as several additional matters.

10.33 Subclause 3(a)-(c) are model parameter aspects and are standard.

10.34 However, subclause 3(d) is very problematic. This subclause requires offsetting to *"evaluate the ecological context, including the interactions between species, habitats and ecosystems, spatial connections and ecosystem function at the impact site and offset site"*.

10.35 I assume the subclause intends to require an offsetting proposal to compare and contrast the affected and proposed offset feature, however, the purpose of this comparison is not at all clear. For example, must there be a match of the different features between the two sites?

10.36 Even before a comparison could take place, there are considerable logistical issues with the subclause. It takes university research programmes years to build species interaction models accurately. Taken at face value, subclause 3(d) could not reasonably be undertaken with any scientific rigour without several years of work and considerable cost. If it is to simply be an educated guess of an ecologist then it becomes relatively worthless as a requirement and open to endless debate. In my opinion, subclause 3(d) should be deleted.

10.37 In terms of subclause 3(e) it is also unclear what *"consideration of mātauraka Māori"* means. This is not usually an aspect of most ecologists' training and will require a specific set of skills and understanding (usually from local mana whenua). I recommend this subclause is clarified to make clear what is required.

Other differences between APP3 and the NPSIB Exposure Draft

10.38 In addition to the above, I also note the following differences between the offset criteria in APP3 and the principles for offsetting in the NPSIB Exposure Draft:

(a) In some respects APP3 is preferable to the NBPSIB Exposure Draft in that it focuses on achieving similar ecological values, rather than like-for like.

(b) APP3 has not included the stakeholder provision which is in the NPSIB Exposure Draft. In my opinion, this is an appropriate omission because while stakeholder perspectives are important they can often subvert the ecological outcomes required.

Compensation in the proposed RPS (APP4)

10.39 I also consider some of the criteria in APP4 (section 42A report (October version)) for biodiversity compensation are problematic and may not lead to sound overall ecological outcomes.

10.40 Similar to APP3, clause 1 of APP4 sets out situations in which biodiversity compensation should not be available. My specific comments on clause 1 are:

(a) The limit in clause 1(b) *"removal or loss of the viability of the habitat of a Threatened indigenous species of fauna or flora…"* (noting that the reference to at risk species has been removed following submissions from Oceana Gold which I support) is still problematic as it is about loss of 'viability' that will be extremely difficult to assess / measure where the effect is small scale or partial or could be managed to a better outcome than avoidance. As I have noted already "avoidance" of features which have no management and are under stress and trending in decline require, often substantive, assistance. There is no mechanism for that assistance other than from an offset or compensation. If those pathways are easily removed, as is proposed with this provision, then we will see greater biodiversity decline over the long term as opposed to allowing the activity with management imposed through conditions.

(b) The limit in clause 1(c) has the same flaws as clause 1(b). While the removal or loss of health and resilience of a naturally uncommon ecosystem would normally not be desirable, this should also be given considerable testing. By way of illustration, it might be that the current viability of that feature is limited or that it is sufficiently locally common or that the value of the proposed activity is of such national value that the "trade" is worth it. For example, a new renewable energy development which is critical to reducing New Zealand's greenhouse gas emissions might be sufficiently valuable as opposed to a poor quality farmed dune slack, lake margin, gravel outwash, or leached terrace or coastal turf (all naturally uncommon habitats) (Holdaway, Wiser, and Williams, 2012). There will be examples of naturally uncommon ecosystems that are of current low ecological value that could be offset or compensated for a better outcome. Therefore, as presently drafted I consider that this provision has the potential to lead

to greater biodiversity decline over the long term as opposed to allowing the activity with management imposed through conditions. I have recommended an amendment to the criteria to replace "health and resilience with "viability".

(c) For subclause 1(d), see my comments regarding subclause 1(c) in APP3 (offsetting) above. I consider this criterion is impractical and should be deleted.

10.41 Clause 2 sets out criteria that may mean compensation is available. My comments on this clause are set out below:

(a) As discussed above, the compensation limit in subclause 2(f) that the outcome be achieved within the duration of the resource consent is unnecessary and unrealistic in some circumstances. In my opinion it should be removed. For example, if the compensation provided is the development of a mature forest feature, that may take hundreds of years to come to full fruition, but may be acceptably establishing by year 30. If the compensation process has been followed then there will be the appropriate funds in place, legal and physical protection and management through that 30 years such that there should be a registered entity responsible for that management and monitoring past the expiry date of the consent.

(b) Likewise, and as noted above, subclause 2(g) could have the regional effect of reducing the number and expanse and earlier establishment of new biodiversity in the region. In my opinion it should be removed.

(c) In respect to subclause 2(fa), I recommend removing the words “or considered vulnerable or irreplaceable” from the last sentence for the same reasons outlined in respect of subclause 1(e) of APP3 above.

10.42 In terms of clause 3, I have the same concerns regarding subclause 3(a) and (b) as set out above in respect of APP2 (offsetting).

11. COMMENTS ON THE PROPOSED ENERGY SUB-CHAPTER

11.1 I have reviewed the Proposed Energy Sub-Chapter for the EIT Chapter developed by **Ms Hunter** and other expert planners for electricity generators (attached as Appendix CH.2 to Ms Hunter's evidence).

11.2 I provide the following comments on the provisions in the Proposed Energy Sub-Chapter, from an ecological perspective:

(a) EIT-EN-O1 and O2 and P1 seek to recognise, provide for and protect REG. As explained in my next section, I consider that climate change is an important issue for biodiversity and that it is appropriate for the provisions to provide for renewable electricity generation activities in order to reduce greenhouse gas emissions, and mitigate climate change and its potential effects on biodiversity.

(b) EIT-EN-P2 provides for existing renewable electricity generation activities to be protected, which I consider is important for the same reasons set out above.

(c) EIT-EN-P4 and P5 provide for new and upgraded renewable electricity generation activities and set out an effects management hierarchy. P5 provides that scheduled SNAs and natural wetlands should be avoided where practicable; and where it is not practicable to avoid those areas because of functional or operational needs:

(i) For scheduled SNAs, where more than minor residual adverse effects cannot be avoided, remedied or mitigated, offsetting and compensation must be considered in accordance with the relevant appendices; and

(ii) For natural wetlands (which eventually must also be scheduled by Council), effects are to be managed in accordance with the NESF.

11.3 I consider the proposed approach under proposed P5 is appropriate because it recognises that REG activities may have a functional or operational need to locate in SNAs, and in those cases effects should be managed through the full effects management hierarchy (ie inclusive of offsetting and compensation).

11.4 I consider that the hierarchy proposed is similar to the “normal” process and ensures consideration is given to all the steps and values potentially encountered. The only aspect I do not agree with is in (3) whereby the proposal is to avoid, remedy or mitigate significant adverse effects. I consider this is too high, as in my opinion effects which are more than minor should receive the effects management hierarchy.

12. CLIMATE CHANGE AND BIODIVERSITY

12.1 Recently, Boffa Miskell researched the potential impacts of climate change on New Zealand's natural environment (Parson and Fuller, 2022).

12.2 **Figure 4** below shows diagrammatically where climate change makes impacts (direct and indirect) on factors affecting the governance of ecological functions and processes and how it might impact some human responses which also have flow on consequences for ecology.

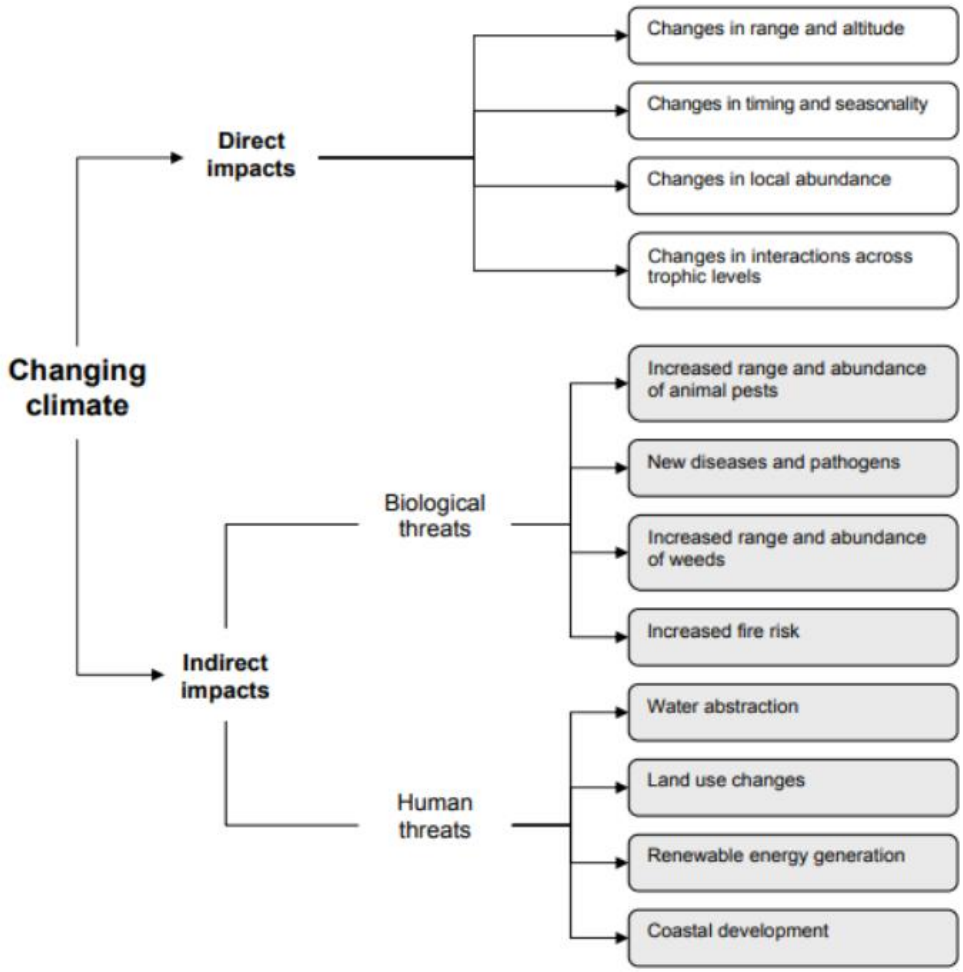

Figure 4: Schematic view of the Impacts of climate change (Parson and Fuller 2022),

12.3 There are significant information gaps in understanding exactly how climate change will impact and interact with New Zealand's natural environment, particularly on biodiversity.

12.4 Any such assessment can be further confounded by the ongoing effects of invasive species, habitat degradation, and the ability of climate change to indirectly exacerbate these pressures.

12.5 However, the growing body of regional New Zealand evidence, combined with strong and consistent global trends, make it very likely that many observed changes in range, phenology, physiology, and morphology of terrestrial and freshwater species can be attributed to regional and global climate changes (IPCC, 2022). An increasing number of changes to New Zealand biodiversity are already being observed that are consistent with these observations.

12.6 The percentage of species at high-risk of extinction increases steeply with rises in global temperatures. This is especially so in aquatic environments.

12.7 The IPCC has predicted that the percentage of species at high risk of extinction globally will increase from 9% (max 14%) at 1.5°C warming to 15% (max 48%) at 5°C warming. The cascading impacts of species loss on ecosystem integrity further reduces environmental resilience and substantially increases the risk of carbon stored in the biosphere being released into the atmosphere due to processes such as widespread tree mortality, wildfire, and declining pollination.

12.8 Observed climate change impacts on New Zealand biodiversity include:

(a) declines in seabird populations such as red-billed gulls (Mills et al, 2008), yellow-eyed penguins (Peacock, L; Paulin, M; Darby, J, 2000), and sooty shearwaters (Scott et al, 2008);

(b) changes in tuatara sex ratios to increasingly male dominant, threatening small and isolated populations (Mitchell et al, 2008);

(c) changes in quality pāua shell characteristic (etching and thinning) at lower pH levels (Cummings, V J et al, 2019);

(d) loss of bull kelp populations in southern New Zealand (Salinger, M J et al, 2020);

(e) increased invasive animal species abundance and predation on native species (Tompkins et al, 2013); and

(f) increased invasive plant species abundance and range (Macinnis et al, 2021).

12.9 Whilst some climate change impacts on New Zealand biodiversity may be countered by increased management interventions such as invasive pest control and habitat restoration, other impacts (eg tuatara sex ratios, pāua shell thinning, bull kelp populations) will depend on reducing the severity of climate change in the long-term.

12.10 A recent article referred to New Zealand as an island example of the impacts of climate change on conservation (Macinnis et al, 2021) and concluded that the impacts are indirect and due to exacerbation of existing threats (in addition to sea rise), such as the success of invasive species, additional fragmentation of habitat (especially those reliant on cooler temperature buffering them from invasive species (eg snow tussock)), and the disturbance of processes (eg mast seeding) (Macinnis et al, 2021).

12.11 Looking at mast seeding as an example - modelling suggests that mast seeding is driven by the interaction between temperature as the floral induction cue and stored resources in plants (Monks et al, 2016). Given both these factors are climate-sensitive, it is expected that climate change will impact the patterns of mast seeding (Schauber et al, 2002; Monks et al, 2016). This in turn will have dramatic impacts on the species reliant on, and that take advantage of, that process.

12.12 Similar changes in patterns, cues and processes are expected in the aquatic ecosystems affecting life history timing, resources and even the acceptability of streams, lakes and the estuaries to some indigenous fish species.

12.13 Considering the above, in my opinion climate change while there are significant uncertainties and information gaps, will lead to a fundamental exacerbation of the current rate of loss of indigenous biodiversity. This will occur through both direct and indirect impacts (as above) by significantly compounding existing issues. None of the studies I have reviewed express climate change as a positive for our indigenous biodiversity. Rather, climate change will have a fundamental detrimental effect on our biodiversity. To address this, it is imperative in my view, from an ecological perspective, that in our environmental management systems we prioritise reducing greenhouse gas emissions and enhance, where we can, the resilience of our indigenous biodiversity.

Why renewable electricity generation is important for protecting biodiversity

12.14 As explained in the evidence of **Mr Hunt**, very large increases in renewable energy generation production are required to provide the electricity to meet New Zealand's decarbonisation goals.[8] There will also need to be a diversity of generation types, including wind, solar and hydro. Low emission, renewable energy generation is a keystone of New Zealand's climate change response.

12.15 While in many cases, the emission reduction benefits of renewable electricity generation do not individually directly impact regional conservation outcomes, the overall climate change mitigation offered by renewable electricity generation does provide indirect benefits. Therefore, I consider that there is a net benefit from renewable energy projects, which (indirectly) provide real value to the nation's indigenous biological diversity. I therefore consider it appropriate that these benefits should be considered in the assessment and effects management of such projects (including to provide access to a full effects management hierarchy, with consideration of offsetting and compensation where relevant).

12.16 In my opinion, given the significant biodiversity threat from climate change, when considering renewable electricity generation projects, a process must be available to enable appropriate (managed through the effects management hierarchy and with caveats around very special species and areas) projects with the potential to attain consent.

12.17 In my opinion the proposed RPS sets the bar for SNAs too low, and then the limits to when offsetting and compensation too high (ie restrictive), such that it will, from an ecology perspective, preclude renewable electricity generation projects that could deliver positive overall biodiversity outcomes for the region (and the country).

[8] Hunt EIC, para 6.2.

PART B: LF – LAND AND FRESHWATER CHAPTER

13. SCOPE OF EVIDENCE ON THE LF CHAPTER

13.1 In terms of the LF – Land and freshwater chapter, my evidence provides:

(a) an explanation of the Clutha Hydro Scheme (CHS) and its effects on the aquatic environment and freshwater ecology;

(b) a summary of Clutha Mata-au freshwater values;

(c) comments on the proposed provisions in the LF – Land and freshwater chapter.

13.2 Throughout my evidence, I refer to key changes proposed in the exposure draft of proposed changes to the NPSFM (**NPSFM Exposure Draft**) where relevant.

14. EXECUTIVE SUMMARY ON THE LF CHAPTER

14.1 The Clutha River Mata-au and its various constructed lakes are acknowledged as having (today, with the CHS) a range of ecological, amenity and recreational values. Many of those values are considered high and related to the naturalness of the waterway or to the resources the waterway brings to the community.

14.2 Aquatic macroinvertebrate communities remain representative and responsive to the different flow regimes without evidence of the flow regime having caused adverse effects. The instream and lake macrophyte communities are more diverse and abundant now as is the exotic fishery. Most aspects of the water as habitat and water's edge have adapted to the CHS flow regime.

14.3 There is no evidence of ecological issues relating to the use of the river water for power generation other than the issue of fish passage (discussed below).

14.4 The provisions in the proposed RPS that set a goal of restoration to a natural state in the context of the CHS are unrealistic and “as naturally as possible” may not be much more or better than it is today.

14.5 In respect of outstanding water bodies, I understand that based on the proposed definition of these under LF-FW-P11 it is possible that parts of the Clutha River would be considered outstanding water bodies. From my

perspective, this water body does not have "outstanding" qualities, from an ecological perspective.

14.6 In respect of natural wetlands, I recognise that the proposed RPS adopts the definition and mapping requirements for these as provided for under the NPSFM, but I provide some comments on these provisions in any event, from a practical perspective.

15. THE EFFECTS OF THE CHS ON THE FRESHWATER ECOLOGY AND WATER QUALITY OF THE CLUTHA MATA-AU

15.1 As explained in **Ms Nelson**'s evidence, the CHS consists of three primary structures, being the Hāwea Dam (and associated Gladstone Gap Stopbank and Spillway), the Clyde Dam and the Roxburgh Dam. There are also two lakes that have developed through the CHS being Te Wairere / Lake Dunstan (behind the Clyde Dam) and Lake Roxburgh (behind the Roxburgh Dam).

15.2 The CHS has been in place and operational in some form and extent for over 70 years. While it is largely a run of river scheme below Lake Hāwea, there is a low level of storage in Lakes Dunstan and Roxburgh. The CHS and the way the river runs with the scheme are part of the state of the Clutha Mata-au and its flora and fauna.

Upper Clutha Mata-au catchment

15.3 The upper Clutha Mata-au is in better condition and has a more valuable and valued fauna and flora than the Hāwea River. High salmonid catch rates are considered the norm although this is less true of the reach between the confluence with the Hāwea River and Lake Dunstan, particularly nearer Lake Dunstan. It has been suggested that the reason for this is not a shortage in large trout but the increasing inability to comfortably fish the reach as willow infestation has made access and fly fishing more difficult (Ryder, 2002b).

15.4 In terms of water quality and aquatic habitat quality the Regional Council found in 2020 that the Upper Clutha Rohe generally has stable macroinvertebrate communities of good to excellent MCIs[9] and good quality water.[10] Only a few tributaries have a lower condition of B and C grade (ASPM)[11] under the National Objectivise Framework (NOF) (Bullock Creek,

[9] Macroinvertebrate community indices
[10] Otago Regional Council 2021
[11] Average score per metric – a method to use several macroinvertebrate quality metrics as one indices

Motatapu and Precipice Creek). It is likely that land use discharges are the cause of this lowered condition.

Lake Hāwea and the Hāwea River

15.5 Lake Hāwea is one of three feeder lakes to downstream hydro-electric power stations at Clyde and Roxburgh. The Lake Hāwea control structure was built in the mid-1950s, increasing the depth of the lake by an average of 15.2 m and the area by 28.5 km^2. The lake has a current normal operating range of between 338 m and 346 m above sea level (a.s.l.). It is a valued salmonid fishery habitat.

15.6 The effects of the management of Lake Hāwea were investigated by Chisholm et al, 2000; then Thompson and Ryder, 2002 and then referred to in Mr Ryder's evidence prepared for the reconsenting of the CHS (2002). That evidence found that the lake level management was not a driver of lake shore vegetation changes, land use was.

15.7 Dr Ryder's evidence also concluded that lake aquatic communities in the littoral zone potentially affected by lake level changes related to water use (plants, invertebrates and fish) were not adversely affected by the management of the lake level for power generation. Salmonid species abundance, and condition were high in Hāwea. There were some initial potential bully abundance effects but those were considered offset by lake variance reducing macrophyte prominence and causing more exposed cobble bed favoured by bully. In 2002 it was recognised that tuna were largely absent in Lake Hāwea – likely because of the dams at Roxburgh, Clyde and Hāwea not allowing passage. I comment on Contact's "trap and transfer" programme for tuna below.

15.8 The Hāwea River (which joins the lake to the Clutha River Mata -Au) is reasonably poor in macroinvertebrate communities but not in regard to water quality. There are no known non-migratory galaxiids. The macroinvertebrate condition has worsened since the 1980s but there has been no operational changes in the hydroelectric draw and use of the Hāwea River. In Dr Ryder's evidence, he did not attribute the lowered instream aquatic condition to the CHS.

Lake Dunstan

15.9 Lake Dunstan (filled in 1992) has “normal” lake ranges in depth and fluctuations (although a 3m wave action height) and is not affected to any

degree by the power generation regime. While there may have been some littoral zone re-adjustment after the lake was initially filled and operated the current situation is stable and the lake fauna is valued, perhaps more so for its indigenous components than its salmonid fishery which is nevertheless valued and productive.

15.10 The Dunstan Rohe compliance with the NOF attributes is generally very good (apart from Mill Creek, which is below the national bottom line and that is likely due to land use discharges not the CHS). The few data on trends, however, suggests that while some water quality attributes are trending better, some are not (for example, nitrogen products) and the condition of the macroinvertebrates is likely not improving. However, these are a result of land use issues not the CHS.

Lake Roxburgh

15.11 It has been concluded that the lake level fluctuations in Lake Roxburgh attributable to the CHS are unlikely to be having a strong adverse effect.[12] The fine silts and macrophyte support a simple low MCI fauna of snails and worms in large biomass. The fish fauna is similar to other lakes with longfin eel (tuna) and koaro still common as well as perch, brown & rainbow trout, chinook salmon and upland bully. Tuna are maintained by transfers (discussed further below).

15.12 The Roxburgh Rohe water quality in the Clutha Mata-au is trending better in general than historically except for turbidity and perhaps ammoniacal nitrogen. Again these are as a result of land use issues and are not attributable to the CHS.

Lower River

15.13 The lower Clutha Mata-au is a relatively confined single thread, large fast river. It is one of the faster flowing rivers in the world. This is important when considering the impact of maximum flows and flow changes related to the on and off nature of hydro generation on the availability of habitat because the river was (prior to hydro schemes) already a difficult fish habitat because of the velocity and volume of the water.

15.14 The lower river (but really its tributaries) support important native and introduced fisheries and bird fauna. Eighteen native fish species (mostly in

[12] KMA (2000) and Ryder (2002)

the tributaries) have been recorded below the Roxburgh Dam – placing the Clutha Mata-au in the top 10% of rivers in New Zealand for species richness. The main stem, however, is noticeably less rich (which, given the size and flow rate is to be expected).

15.15 The lower Clutha Rohe is complex and far more subject to adjacent land use but also being in the lower catchment all of the accumulating factors of the upper catchment. The trends are good except for dissolved reactive phosphorus (DRP) and nitrogen products, which again is a product of land use nutrients and their discharge to the waterways.

16. SUMMARY OF FRESHWATER VALUES OF THE CLUTHA MATA-AU

16.1 The Clutha River Mata-au and its various constructed lakes are acknowledged as having (today, with the CHS) a range of ecological, amenity and recreational values. Many of those values are considered high and related to the naturalness of the waterway or to the resources the waterway brings to the community.

16.2 Aquatic macroinvertebrate communities remain representative and responsive to the different flow regimes without evidence of the flow regime having caused adverse effects. The instream and lake macrophyte communities are more diverse and abundant now as is the exotic fishery. Most aspects of the water as habitat and water's edge have adapted to the CHS flow regime.

16.3 There is no evidence of ecological issues relating to the use of the river water for power generation other than the issue of fish passage (discussed below).

17. THE PROPOSED RPS

Provisions referring to *"as naturally as possible"* and fish passage

17.1 LF-VM-O2 sets out the proposed objectives for the Clutha Mata-au. This provision is now subject to the separate freshwater planning process, but I comment on it here for context.

17.2 A number of the proposed objectives in this provision refer to "restoring" aspects of the river and/or refer to achieving as "natural" state" "as possible". These provisions are set out below.

> *(5) indigenous species migrate easily and as naturally as possible along and within the river system,*

(5A) the ecosystem connections between freshwater, wetlands, and the coastal environment are preserved and, wherever possible, restored,

(5B) environmental flows and levels in water bodies sustain and, wherever possible, restore the natural form and function of main stems and tributaries to support Kāi Tahu values and practices,

17.3 The theme of "natural wherever possible" is also evident in the general freshwater provisions (for example, LF-WAI-P3 refers to restoring natural connections between water bodies and between land and water from the mountains to the sea; LF-FW-O8(4) (to be considered in the freshwater process) refers to fish migrating as naturally as possible; LF-FW-P13(4) refers to reflecting the natural behaviours of a water body wherever possible; LF-FW-P14 refers to restoring a form and function of lakes and rivers that reflect their natural behaviours).

17.4 **Ms Hunter** has recommended amendments to LF-FW-P13 and P14 (preserving and restoring natural character).[13] My evidence below addresses the ecological merit of Contact's "trap and transfer" programme in comparison to any possible more "natural" systems of fish passage.

17.5 As set out in **Ms Nelson**'s evidence, Contact operates a "trap and transfer" programme in respect of the CHS.[14] However, the proposed provisions that refer to restoring waterways to their "natural" form and function could be interpreted as requiring retrofitting dams with fish passage systems.

17.6 There is as yet no solid empirical proof in New Zealand that retrofitting large dam structures such as Roxburgh and Clyde with fish passage systems would work. Small and sloped dams have had a range of successful methods (weir and pools, ladders, mussel spat ramps and pipes, baffles - there are examples of short dam retrofitting in the USA (eg the Roanoke river HEP Dam in North Carolina, a 30m concrete dam) which has resulted in eel passage. However, for tall dam structures (Roxburgh is 76m, Clyde 100m) there is very little proof (none published other than for salmonids overseas) of success for large hydroelectric dams. Furthermore, establishing experimental fish passage structures would require numerous consents and

[13] Hunter EIC, section 9.
[14] Nelson EIC, para 7.19.

likely lead to other ecological effects during construction but also potentially during operation.

17.7 In my opinion, restoring the Clutha Mata-au to any ecological "natural" state (at whatever past point in time that may be) is unlikely to be practicable, nor possible, given it has been significantly altered by the construction and operation of the CHS over many years, the significant land use changes that have occurred and the effects of pest species. Therefore, having policies to achieve that, and ignoring the significant human modification of the catchment, tied with the long lifespan and significant scale of the CHS structures themselves, ignores the ecological reality and the role of the existing trap and transfer scheme for tuna. I therefore consider the amendments proposed by **Ms Hunter** are more appropriate.

LF–FW–P11 Otago's outstanding water bodies.

17.8 The proposed RPS (section 42A report (October version)) states that Otago's outstanding water bodies are:

> *(1) the Kawarau River and tributaries described in the Water Conservation (Kawarau) Order 1997,*
>
> *(2) Lake Wanaka and the outflow and tributaries described in the Lake Wanaka Preservation Act 1973,*
>
> *(3) any water body or part of a water body identified as being within an outstanding natural feature or landscape in accordance with NFL–P1, and*
>
> *(4) any other water bodies identified in accordance with APP1.*

17.9 As set out in the evidence of **Mr Coombs**, the land surrounding Lake Dunstan is currently identified as an outstanding natural landscape in the Central Otago District Plan,[15] therefore Lake Dunstan (or large parts of it) may be considered to be an outstanding water body under the above definition

17.10 It holds this "value" or "rank" despite being a man-made lake and its largely exotic dominated ecology with an atypical fishery and regulated hydrology.

[15] Coombs EIC, para 6.21.

From an ecological perspective I do not consider Lake Dunstan to have outstanding values (see below).

APP1 – Criteria for identifying outstanding water bodies.

17.11 APP1 (section 42A report (October version)) sets out the criteria for identifying outstanding water bodies. Any water body with one or more of the listed outstanding values would be considered an outstanding water body under the proposed Appendix.

17.12 Under "Ecology", the Appendix lists four "sub values / outstanding indicators". It is proposed that any water body displaying specified outstanding ecological values as habitat for the following species would be considered to be outstanding:

(a) habitat for aquatic birds (native and migratory);

(b) native fish habitat;

(c) habitat for indigenous plant communities; and

(d) habitat for trout and salmon.

17.13 As a preliminary comment, ecologists do not use the term “outstanding”. That aside, given the historic fish passage issues, the fact that Lake Dunstan is man-made, and that it is a high use recreational lake and sports fishery, it cannot be said to have “outstanding” value as habitat for native fish (or unique because of the artificial circumstances).

17.14 Similarly, it cannot be said to be outstanding for indigenous plant communities (the lake (as do many) has a considerable Lagarosiphon and Elodea issues and poor indigenous representative aquatic plant communities.

17.15 Lastly the avian community is also affected by the factors affecting the fish and plants but to a lesser degree. This is because for many bird species any vegetation cover (willow included), gravel islands that reduce predation, and any species of fish or algae or macroinvertebrate, are food. In this way the “Bendigo” willow wetlands at the top of Lake Dunstan house a range of bird species including some threatened and at risk species, but not *“one of the highest regional populations of a native aquatic bird species which is endangered, threatened or distinctive”* as set out in APP1. The wetland habitat itself is therefore significant as habitat to these species, however in a

regional context it cannot be said to be “outstanding” from an ecological perspective. Wetlands that might be considered "outstanding" are reflected in Cromarty & Scott’s 1996 directory of wetlands in New Zealand (Cromarty, 1996) where they list the most important wetlands. In the Otago Conservancy those include: Sutton salt lake, Lake Waipori-Waihola complex, the Greenstone River and Caples River complex, the Dart River and Ress River complex and Lake Hayes.

17.16 The table also identifies "habitat for trout and salmon" as a value that can contribute to a water body being considered "outstanding". In my opinion, salmonids should not be included in this list because one of the greater challenges to indigenous fish populations and macroinvertebrate populations, especially mayfly, caddisfly and stonefly, are salmonid populations. The value as salmonid habitat could be considered under the recreational criterion, but it is not an ecological one.

17.17 While ecologists do not generally use the term 'outstanding', in my opinion, from an ecological perspective, an outstanding habitat requires physical characteristics reflective of a zero modification to flow behaviour, immediate catchment / riparian condition, water quality and a dominance of indigenous species, or where a feature is the best of a remaining type (but still with values) and/or supporting threatened species (nationally critical, endangered or vulnerable). It should not reflect an aquatic habitat of ordinary or even less common native species or introduced species in a highly modified habitat. In my opinion, Lake Dunstan does not have these qualities, despite appearing to fall within the definition of an outstanding water body in the proposed RPS.

Provisions relevant to wetlands

17.18 I have also considered the provisions in the proposed RPS relevant to wetlands from an ecological perspective. Some of these are now to be considered in the freshwater hearing (LF-FW-O9 / P9 and P10). However, LF-FW-P8 is to be considered in this process and I comment on this provision below.

Definition

17.19 The proposed RPS (section 42A report (October version) defines "natural wetlands" as having the same meaning as set out in the NPSFM.

17.20 This means that the definition does not differentiate between those indigenous dominated wetlands which are underrepresented and are

important to protect (and manage) but instead will focus on the broad RMA definition of wetland and so will cause the focus and protection to be on exotic dominated damp pastures and exotic dominated often induced areas and wetlands generally without any indigenous biological value or functional role of importance. This has been the case in other areas in New Zealand (eg the Wellington Region).

LF-FW-P8

17.21 LF-FW-P8 is a policy that by 3 September 2030, the following natural wetlands should be identified and mapped; those that are

(a) 0.05 hectares or greater in extent; or

(b) of a type that is naturally less than 0.05 hectares in extent (such as an ephemeral wetland) and known to contain threatened species.

17.22 These sizes are what is required of councils by the NPSFM. I do note that the NPSIB Exposure Draft reflects on a natural wetland being as small as a plot (ie 2 m^2). However, in my opinion, the RPS should indicate the size of a wetland that will be accepted as a minimum functional sustainable wetland and a 2 m^2 wetland is not a sustainable, functioning or valuable feature.

Dr Vaughan Keesing

23 November 2022

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APPENDIX VK.1 – PROPOSED AMENDMENTS TO APP2

The base text is from the section 42A report (October version) in "clean text" and my suggested amendments are shown in tracked changes.

APP2 – Significance criteria for indigenous biodiversity

An area is considered to be a significant natural area if it meets any one or more of the criteria below:

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 where that is all that is left 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 assemblages) that makes up part of at least 10% of the natural extent of each of Otago's original marine ecosystem types.

(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.

Rarity

(d) An area that supports:

(i) An indigenous species that is threatened, ~~or uncommon,~~ or an important population of species that is at risk, or regionally uncommon, 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, or

~~(iii) Indigenous vegetation and habitats within originally rare ecosystems that are insufficiently protected (<30%)~~

~~**Diversity**~~

~~(e) 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

(f) An area that supports or provides habitat for:

(i) ~~Indigenous species at their distributional limit within Otago or nationally, or~~

(~~ii~~) A population of 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~~, having developed as a result of an unusual environmental factor or combinations of factors.

Ecological context

(g) 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 demonstratable connectivity value allowing dispersal of indigenous flora and fauna between different areas, or

(ii) Is a large area with large populations of indigenous species (a gene sink), or

(ii) An area that has an important buffering (including hydrological) function that helps to protect the values of an adjacent area or feature, or

(iii) An area that is important for threatened, at risk or regionally uncommon 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, or

~~(iv) A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal ecosystem.~~

~~**Vulnerable and sensitive species**~~

(h) ~~An area that contains sensitive habitats or species that are fragile to anthropogenic effects or have slow recovery from anthropogenic effects.~~

APPENDIX VK.2 – PROPOSED AMENDMENTS TO APP3

The base text is from the section 42A report (October version) in "clean text" and my suggested amendments are shown in tracked changes.

APP3 – Criteria for biodiversity offsetting

(1) Biodiversity offsetting is not available for an activity that will result in:

(a) the loss from an ecological district of ~~any~~ individuals of Threatened taxa where that loss affects the postnatal viability of the population, other than kānuka (Kunzea robusta and Kunzea serotina), under the New Zealand Threat Classification System (Townsend et al, 2008); or

(b) ~~measurable~~ a loss ~~within an ecological district to~~ of individuals of an At Risk-Declining taxon such that the population viability is reduced within an ecological district, other than manuka (*Leptospermum scoparium*)~~, under the New Zealand Threat Classification System (Townsend et al, 2008)~~; or

~~(c) the worsening of the conservation status of any indigenous biodiversity as listed under the New Zealand Threat Classification System (Townsend et al, 2008); or~~

(d) the removal or loss of viability of a naturally uncommon ecosystem type that is associated with indigenous vegetation or habitat of indigenous fauna where less than 30% of the type is in protection; or

~~(e) the loss (including cumulative loss) of irreplaceable or vulnerable indigenous biodiversity.~~

(2) Biodiversity offsetting may be available if the following criteria are met:

(a) the offset addresses residual adverse effects that remain after implementing the sequential steps required by ECO-P6(1) to (3),

(b) the proposal demonstrates that the offset can reasonably achieve no net loss ~~and preferably a net gain~~ in indigenous biodiversity, as measured by type, amount and condition at both the impact and offset sites ~~using an explicit loss and gain calculation~~,

(c) the offset is undertaken where it will result in the best ecological outcome, and is preferably

(i) close to the location of the activity, and

(ii) within the same ecological district

(d) the offset is applied so that the ecological values being achieved are the same or similar to those being lost or that the trade is upward (ie more valuable ecologically),

(e) the positive ecological outcomes of the offset endure at least as long as the impact of the activity ~~and preferably in perpetuity~~,

(f) the proposal demonstrates that the offset achieves biodiversity outcomes that are demonstrably additional to those that would have occurred if the offset was not proposed, ~~and are additional to any remediation or mitigation undertaken in relation to the adverse effects of the activity~~,

(g) the time delay between the loss of biodiversity and the gain or maturation of the biodiversity outcomes of the offset is the least necessary to achieve the best possible outcome, and

~~(h) the outcome of the offset is achieved within the duration of the resource consent, and~~

~~(i) any offset developed in advance of an application for resource consent must be shown to have been created or commenced in anticipation of the specific effect of the proposed activity and would not have occurred if that effect was not anticipated, and~~

(3) Biodiversity offsetting proposed in any application for resource consent, plan change or notice of requirement, must address all matters in APP3(2), and:

(a) use objective counts and measures wherever possible,

(b) include high value species or vegetation types as components,

(c) disaggregate components of high value species and vegetation types, so that no trade-offs between them can occur,

~~(d) evaluate the ecological context, including the interactions between species, habitats and ecosystems, spatial connections and ecosystem function at the impact site and offset~~ site, and

(e) include consideration of mātauraka Māori *[amend to make clear what is required]*, and

(f) include a separate biodiversity offset management plan prepared in accordance with good practice and which incorporates a monitoring and evaluation regime.

APPENDIX VK.3 – PROPOSED AMENDMENTS TO APP4

The base text is from the section 42A report (October version) in "clean text" and my suggested amendments are shown in tracked changes.

APP4 – Criteria for biodiversity compensation

(1) Biodiversity compensation is not available for an activity that will result in:

(a) the loss from an ecological district of an indigenous taxon (excluding freshwater fauna and flora) or of any ecosystem type,

(b) removal or loss of viability of the habitat of a Threatened indigenous species ~~of fauna or flora~~ population under the New Zealand Threat Classification System (Townsend et al, 2008),

(c) removal or loss of ~~health and resilience~~ viability of a naturally uncommon ecosystem type that is associated with indigenous vegetation or habitat of indigenous fauna, or

~~(d) worsening of the conservation status of any Threatened or At Risk indigenous biodiversity listed under the New Zealand Threat Classification System (Townsend et al, 2008), or~~

(e) the loss (including through cumulative loss) of irreplaceable or vulnerable indigenous biodiversity, and.

(2) Biodiversity compensation may be available if the following criteria are met:

(a) compensation addresses only residual adverse effects that remain after implementing the sequential steps required by ECO–P6(1) to (4),

(b) compensation is undertaken where it will result in the best ecological outcome and preferably:

(i) close to the location of the activity,

(ii) within the same ecological district, and

(iii) delivers indigenous biodiversity gains on the ground,

(ba) where criterion (2)(b)(iii) is not met any financial contributions considered must be directly linked to a specific indigenous biodiversity gain or benefit.

(c) compensation achieves positive biodiversity outcomes that would not have occurred without that compensation, and are additional to any

remediation, mitigation or offset undertaken in response to the adverse effects of the activity,

(d) the positive biodiversity outcomes of the compensation are enduring and are commensurate with the biodiversity values lost,

(e) the time delay between the loss of biodiversity at the impact site and the gain or maturation of the biodiversity outcomes from the compensation, is the least necessary to achieve the best possible ecological outcome,

~~(f) the outcome of the compensation is achieved within the duration of the resource consent,~~

(fa) when trading up forms part of biodiversity compensation, the proposal must demonstrate the indigenous biodiversity values gained are demonstrably of higher indigenous biodiversity value than those lost, ~~or considered vulnerable or irreplaceable~~,

~~(g) biodiversity compensation developed in advance of an application for resource consent must be shown to have been created or commenced in anticipation of the specific effect of the proposed activity and would not have occurred if that effect was not anticipated,~~ and

(h) the biodiversity compensation is demonstrably achievable.

(3) Biodiversity compensation proposed in any application for resource consent, plan change or notice of requirement, must address all matters in APP4(2), and:

~~(a) evaluate the ecological context, including the interactions between species, habitats and ecosystems, spatial connections and ecosystem function at the impact site and compensation site,~~

(b) include consideration of mātauraka Māori *[amend to make clear what is required]*, and

(c) include a separate biodiversity compensation management plan prepared in accordance with good practice and which incorporates a monitoring and evaluation regime.