Report pursuant to s 42A Resource Management Act 1991

In the matter of:	A Notice of Requirement to construct, operate, use, maintain and improve approximately 11.5km of new State Highway connection between Ashhurst and Woodville
And:	A hearing by Manawatū District Council, Palmerston North City Council and Tararua District Council pursuant to s 102
Requiring Authority:	New Zealand Transport Agency
Hearing date:	25 March 2019

PALMERSTON NORTH CITY COUNCIL

MANAWATU DISTRICT COUNCIL

TARARUA DISTRICT COUNCIL

Section 42A Technical Evidence: Ecology

By: James Lambie

Executive Summary

1. The proposed highway project Te Ahu a Turanga, and the Notice of Requirement for the designation of the highway traverses land environments that are considered 'Chronically' or 'Acutely Threatened Environments' at a national scale. This means that the combinations of landform and climate that are present in this landscape contain less than 20% or 10% (respectively) of cover in indigenous vegetation. Any further loss of the extent of indigenous indigenous vegetation in these environments risks species extinctions and/or undermines the viability of ecosystems to support the diversity of indigenous flora and fauna remaining in the landscape.

2. The Project as proposed will have:

   a) Significant ecological effects at several sites of high to very high ecological value including old growth forests and wetlands. The effects include the potential for around 28 hectares of areal loss of indigenous vegetation. There are also related effects on increased habitat fragmentation and reduced ability for fauna to utilise remaining habitat, edge effects, direct impacts on fauna due to clearance, and the increased potential for pest plant and pest animal invasion into remaining habitats.

   b) Significant permanant effects on the natural character of the aquatic environment stemming from the permanent loss of riparian vegetation (for margins of both streams and wetlands) associated with bridges, and the loss of riparian and stream bed habitat associated with culverts.

3. Old growth forest and wetlands are difficult to replace (potentialy irreplaceable) due to limited options for replicating the ecological conditions found in these habitats. The Project Assessment of Ecological Effects ("**AEE**") identifies that there remains the potential for high and very high magnitudes of effects on these high and very high valued ecosystems.

4. NZTA experts agree that there are significant ecological effects associated with the Project. If not avoidable, those effects are unlikely to be fully remedied or mitigated at point of impact. Instead NZTA rely on any residual effects on biodiversity being offset for a net-gain in indigeneous biological diversity. While Policy 13-4 of the One Plan provides for offsetting for net-gain, it does so only to a point. Offsetting, for example,

can be inappropriate for a ecosystem or habitat type by reason of its rarity, vulnerability or irreplaceability.

5. I agree that, without moving the indicative road design so that it completely avoids significant habitats altogether, NZTA will need to prepare a comprehensive and transparent mitigation and offsets package that demonstrates indigenous biological divesity net-gain under the One Plan.

6. For that reason, and given the high vulnerability and potential irreplacement of some of the habitats affected, I have focused on the proposed offsetting regime to examine whether there is sufficient scope and certainty that it would likely satisfy One Plan Policy 13-4, bearing in mind the directives within the RPS.[1]

7. For terrestrial vegetation types, including old growth forests, a net-gain in areal extent is clearly demonstrated through Environmental Compensation Ratios ("**ECRs**"). It is technically feasible to achieve like-for-like replacement of tree canopy and sub-canopy composition over time (25 years) through planting like-for-like species arragements. There is a lack of milestones asssociated with species composition, but this might be resolved with conditions that give effect to like-for-like species composition and timing.

8. I am concerned with the present lack of landowner agreement for potential recipent sites for remedial, mitigation and offsetting work. The lack of (and need for) perpetual third-party agreement on restoration sites casts doubt on the practical feasibility of offsetting implementation. This doubt extends on to whether the natural character of the stream margins can be sufficiently maintained and enhanced to mitigate or offset the effects of bridges, culverts, and stream diversions.

9. I am concerned that there may be insufficient wet land (i.e. seepages and other perenially wet areas that are presently dominated by non-indigenous vegetation) available for the proposed offset planting regime for wetland rehabilitation. NZTA have presented maps which suggest that there is enough room (for example at the recent Mitigations Workshop (held 15 February 2019) [NZTA, 2019; page 6]) , but without

[1] See Policy 6-1(c) of the One Plan. These functions extend to review of policies like Policy 13-4 in this circumstance due t the heavy reliance of offsetting in the Proposal.

greater precision over how these habitats will be built, practical feasibility remains doubtful. However, if enough sites with suitable hydrology can be secured by NZTA, a net-gain in wetland habitat is technically achievable. In turn, wetlands indigenous habitat restoration is likely to improve the natural character of the wetlands restored.

10. With respect to rare plants (and in particular the avoidance of significant effects to swamp maire and ramarama), the proposed offset regime should be effective as long as options do not give rise to effects that extend beyond the effects envelopes established relied on in NZTA evidence. I agee with Dr Forbes that an embankment that will affect swamp maire trees and the adjacent wetland habitat is most likely to fail to meet the the One Plan. Any level of effect that goes beyond the effects envelope and the prescription for reducing effects on swamp maire and ramarama must be avoided.

11. The demonstrated net-gain in terrestrial vegetation is likely to (in general), but not conclusively, result in a net-gain for native birds. I am concerned that a significant operational effect – the potential for bird strike – has not been examined in the context of restored habitats. This is particularly important given that the NOR is through an operational windfarm. Vehicle traffic also introduces a new and increased threat of bird strike. Any habitat replanting that results in birds moving more often through the windfarm or the road corridor increases the risk of strike and potentially nullifies the anticipated net-gain.

12. I question the validity of possum control as a means of mitigating or offsetting the short-term effects on birds that arise from the time lag in new habitat formation, accidental death and disturbance during construction, and operational effects such as bird strike. Possum numbers are already below the thresholds identified by Dr Forbes over the Project area.

13. I do not question the validity of rat, mustelid, and cat control in areas where offset habitats replace pasture. However, to demonstrate a net-gain, the management outcomes for these pests need to be linked with positive outcomes for birds comensurate with measure of loss, rather than be an aim of the offset plan in of itself. Also, to demonstrate net-gain work would need to be in places where the control of these pests is not already taking place.

14. I do not support any proposal to physically relocate nests, nestlings, or newly fledged chicks (including dotterel). Such attempts are likely to result in the death of the birds and nullify the attempt to avoid the effect. Instead, disturbance of nests, nestlings, and newly fledge chicks should be avoided. Any unavoidable bird mortailities during construction should be recorded and be part of a permanent effect for NZTA to remedy or offset.

15. I support the concept of an avifauna management plan in as much as it can be used to better quantify the mortalities that result from construction effects of the Project and strategise for the targetted remediation of those losses. The suggestion that NZTA should consider species re-introductions[2] to the area has some merit in that it would clearly indicate some kind of gain over immediate losses. However, it requires the acceptance of the Department of Conservation ("**DOC**"). Such a strategy will need to be balanced with an assessment of ecosystem carrying capacity and the risks posed by bird strike. It will also need to demonstrate how this "trading up" results in biological diversity net-gain.

16. If bat roosts are found in or near the old-growth forest habitats during the next tranche of monitoring, or bat roosts are found during the site walkovers, it is my opinion that the destruction of those habitats must be avoided. This is because the presence of bat roosts increases the "irreplaceabilty" of old growth forest beyond a level to which effects can be feasibly offset.

17. Otherwise, where bat roosts are not located, the avoidance of a direct effect of on bats should be able to be achieved through the bat management plan. The plan will also bring benefits in quantifying immediate effects and providing remediation strategies. However, less clear is whether the proposed habitat restoration and pest management regime (which may not provide the habitat quality gains anticipated) will result in a net-gain for bats.

18. I support the use of a lizard management plan as a means of avoiding immediate and direct effects on lizards. However, the success of such a strategy depends on factors like the lizard carrying capacity and predation levels in the recipient environment. It is

[2] Brent Barrett, Submission Number S317

difficult at this stage to identify whether there are exisiting recipent sites to be confident that the relocation of lizards is practically feasible. That there is capacity within exisiting habitats to take on translocated lizards will need to be confirmed by NZTA. Otherwise, I agree that the increase in areal extent of habitats is likely to result in a net benefit for lizards in the longer term.

19. There is very little evidence presented with respect to effects on terrestrial invertebrate communites and rare invertebrates due to paucity of published information. While I agree that the habitat quality proxy is a useful approach to determining the effect of habitat removal on invertebrate communities in general, the methodology risks the misidentification of the value of habitats of rare species and so potentially underestimates the importance of the habitats.

20. While it is reasonable to suggest that enhancing existing habitat through inter-planting, reduction of edge effects, browser control, and predator control would enhance exisiting invertebrate communities, the invertebrate response to these mitigation opportunities is not quantified against the loss of old-growth forest habitats (because these mitigation opportunities are tied to less vulnerable habitat types). Also, the generic conclusion which includes a comment that the proposed habitat replacement will result in a net-gain for invertebrates is entirely at odds with the observation [Appendix 6.B, Section 6.B.2.1.2 page. 2] that habitat restoration rarely results in invertebrate fauna that replaces that which was lost.

21. Ecological equivalence and potential irreplacability caused by the need to consider forest age has not therefore been demonstrated. At this stage I cannot accept that the proposed ECRs and mitigations result in an offset for net-gain for invertebrates.

22. It is plausible that the proposed net increase in indigenous habitat may result in some kind of biodiversity trade off. For instance a swap for a greater quantity of common invertebrates in the environment (particularly flying insects) for a loss of individuals of rare invertebrates or invertebrates with a low propensity to move from existing habitats into new ones. However, this “trade” is insufficiently quantified to be certain that it will result in a net biological diversity gain.

23. A more qualified (qualitative) assessment of indices of invertebrate community abundance, health, rarity and vulnerability in the high value habitats is necessary for the purpose of establishing net-gain. This information may be used to benchmark the

trajectory of invertebrate communities in replaced, restored, and rehabilitated habitats, with strategic milestones and responses to facilitate a net-gain in invertebrate community diversity over 25 years. This would necessitate the development of an invertebrate management plan.

24. As noted above, there are associated effects on the natural character of the aquatic environment stemming from the permanent loss of high value riparian vegetation associated with bridges, culvert, and stream diversions. NZTA experts have assessed a selected set of attributes of natural character but the assessment falls short of clearly showing how the changes in these attributes (some of which remain significantly diminished after proposed mitigations / offsets are applied) lead to the One Plan expectation that the natural character of streams, wetlands, and their margins be preserved and protected.

25. Reliance on third party cooperation to offset biodiversity effects also casts doubt on whether effects on riparian ecological attributes of natural character can actually be mitigated, I am concerned that there will not be physically enough space in which to implement stream riparian habitat enhancement commensurate with the loss of natural character in the streams affected.

26. While I agree with Dr Forbes' assessment of the stream margin and terrestrial ecology attributes for natural character, and I surmise that there is a direct (1:1) relationship between these attributes and their values assessment for indigenous biodiversity, I do not agree with any conclusion that equates a net-gain in habitat to effective mitigation of the effects on riparian natural character. The equity between biodiversity gain and natural character effects mitigation is further reduced where biodiversity offsets may not occur in the same catchments that the aquatic natural character effects occur in.

27. Overall, while the effects and significant habitats are accounted for, it is not clear in places that the proposed ecological mitigations and offsets balance the residual significant effects. Even in places where mitigations and offsets appear technically feasible, there is some doubt over the practicalities of implementation, largely (often) because of the need to secure the agreement of third parties – preferably in perpetuity.

28. This lack of certainty makes it difficult to determine that the Project will achieve the net biolgical diverstity gain and preservation of natural character required by the One Plan.

This creates some doubts over whether the alignment is achievable within the footprint of the NOR along parts of the route (noting the directive 'avoidance' policies under the One Plan).

29. Given the significant effects associated with areal loss of vegetation and potential irreplacability of faunal values (which includes the Western QEII), and the uncertainties around appropriateness and sufficiency of offsets, I am of the opinion that avoidance of the Western QEII should be further explored as an option (including considering changes to road design speed and geometry etc to accomodate). It does not appear that adequate consideration has been given to these more localised alternatives for the purpose of avoiding significant efects; at least not in consideraiton/ supported by any depth of analysis (in Appendix 6)compared with (for example) Western Rise options.

30. I also question why Option 3 was not identified as "fatally flawed" during the initial short listing exercise. The QEII status of the affected land should have indicated the presence of high value ecosystems for which it was probable that there would be significant effectson biodiversity could not be avoided, remedied or mitigated.

Contents

1 Introduction

1. My full name is James Stuart Lambie. I hold the qualification of Bachelor of Science (Massey University) and a Master of Applied Science in Resource Management (Lincoln University).

2. I am a freelance ecologist and biosecurity policy advisor with 18 years of experience in indigenous ecosystems inventory, assessment, monitoring, and pest management. I am presently also engaged as a casual staff member with the Manawatū-Wanganui Regional Council ("**MWRC**") as an advisor (ecology) and have been in this position since July 2017. Prior to this I was employed by MWRC first in the role of Research Associate (ecology), then Environment Scientist (ecology) then Science Coordinator, for 11 years. I am a member of the New Zealand Ecological Society and member of the New Zealand Biosecurity Institute.

3. My work includes project-based technical investigations that involve desk-top and in-field assessment of effects of proposed activities on terrestrial, wetland, and freshwater ecosystems. I also undertake technical reviews of resource consent applications that involve ecological considerations, including assessing the appropriateness of proposals to avoid, remedy, mitigate, and/or offset effects on indigenous biodiversity.

4. On behalf of MWRC as applicant, I designed the wetland and lake margin biodiversity effects avoidance, remedy, and mitigation package for the consent to harvest aquatic weeds from Lake Horowhenua (2015-16). On behalf of MWRC as regulatory authority I have assessed the proposed biodiversity avoidance, remedy, and mitigation packages for a number of large-scale proposals including Puketoi Windfarm, Project Central Wind windfarm, and Mt Munroe windfarm.

5. I have prepared this evidence on behalf of the Territorial Authorities, Palmerston North City Council ("**PNCC**"), Manawatū District Council ("**MDC**") and Tararua District Council ("**TDC**")l (the "**Territorial Authorities**") in relation to the Notices of Requirement ("**NOR**") for Te Ahu a Turanga – Manawatū Tararua Highway Project (the "**Project**") lodged by the New Zealand Transport Agency ("**NZTA**"). I understand that my evidence will accompany the planning report being prepared by the Territorial Authorities under s 42A of the Resource Management Act 1991 ("**RMA**").

1.1 Expert Witnesses – Code Of Conduct

6. I confirm that I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detractt from the opinions that I express, and that except where I state I am relying on information provided by another party, the content of this evidence is within my area of expertise.

2 Background and Scope of Evidence

2.1 Background

7. The Project is defined as the construction, operation, use, maintenance and improvement of approximately 11.5km of new State highway connection between Ashhurst and Woodville under the RMA. This proposed new section of State Highway will replace the indefinitely closed State Highway 3 route through the Manawatū Gorge. It will provide a connection between the eastern and western sides of the Ruahine and Tararua Ranges, tying into the western entry to the closed Gorge route, running north of the Manawatū Gorge and south of Saddle Road, and emerging near Woodville.

8. A detailed description of the Project is set out in Part C of the Project AEE and a summary description in the s 42A Planning Assessment.

9. The continuing incremental decline in New Zealand's indigenous biodiversity is considered this nations' most insidious environmental problem (BCG, 2018). Threatened Environments Classification System (Walker *et al*.; 2007) is a useful way of putting the potential adverse effects on biodiversity of Project into a national context. The Threatened Environments Classification System uses combinations of landform and climate (land environments) overlaid with remaining indigenous vegetation as a surrogate for indigenous biodiversity. Applying that system, the Project traverses land environments that are considered 'Chronically' or 'Acutely Threatened Environments' at a national scale.

10. Chronically Threatened Environments are those where there is between 10% and 20% indigenous cover remaining. In these environments, the remaining vegetation occurs in small, sparsely distributed patches. This high degree of habitat fragmentation threatens the persistence of indigenous flora and fauna that remain. Further habitat

loss will disproportionately exacerbate risks to indigenous biodiversity (Walker *et al*., 2007).

11. Acutely Threatened Environments are those where there is less than 10% indigenous cover remaining. In these environments, the remaining vegetation occurs in rare, often highly modified, isolated fragments with poor ecological connectivity. Further habitat loss may be expected to result in species extinction or accelerated decline in remaining species and ecosystem types, and to severely compromise the viability of remaining habitat patches nearby (Walker *et al.*, 2007).

12. A revised NZTA list of the remaining indigenous vegetation identifies 11 distinct indigenous ecosystem types and one non-indigenous ecosystem type within the NOR designation [Forbes, 2019, Attachment 5].[3] Two of the sites old growth forest (alluvial) and old growth forest (hill country) are assessed as having "very high" ecological value, five are assessed as "high" (secondary broadleaved forest with old growth signatures, old growth treelands, advanced secondary broadleaved forests, raupō dominated seepage wetlands, and divaricating shrublands), three as "moderate" (secondary broadleaved forests and scrublands, kānuka forest, and (other) indigenous-dominated seepage wetlands) and two as "low" value (exotic-dominated seepage wetlands and mānuka/kānuka shrublands) as habitats for indigenous flora and fauna.

13. The Project as proposed will have significant ecological effects associated with the potential loss of around 28 hectares of indigenous land cover and three hectares of exotic-dominated wetland. The effects not only include the areal loss of vegetation, but also associated effects on increased habitat fragmentation, barriers to fauna to utilise remaining habitat within the wider landscape, increased edge effects on remaining fragments, direct impacts on fauna due to clearance, and increased potential for pest plant and pest animal invasion into remaining habitats.

14. The Project will also have associated effects on the natural character of the aquatic environment stemming from the permanent loss of riparian vegetation and stream bed habitat associated with bridges, culverts, and diversions.

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[3] While NZTA (2019) Mitigation Workshop notes show 16 types, four of these are sub-types that have been split between QEII sites and elsewhere.

15. Some of the ecosystems and habitats affected - particularly old growth forest, swamp maire stands (which are included in the raupo-dominated seepage wetlands), and indigenous-dominated wetlands - are highly vulnerable to further loss due to their national and/or regional scarcity. Furthermore, old-growth forests and wetlands are irreplaceable due to limited options for replicating the ecological conditions found in them.

16. Due to unavoidable, significant ecological effects that cannot be otherwise remedied or mitigated, the Project as proposed relies heavily on biodiversity offsetting to result in an overall net-gain in biodiversity in the local landscape as prescribed by One Plan Policy 13-4. However, there are limits to which offsetting can be used. Notably, Policy 13-4 d) iv states that offsetting may be deemed inappropriate for the ecosystem or habitat type by reason of its rarity, vulnerability or irreplaceability.

2.2 Scope of evidence

17. I have been asked to assess the ecological and related natural character elements of the NOR. My assessment considers the following matters:

    a) The statutory context;

    b) An overview of the existing environment in terms of the scale and nature of the terrestrial and aquatic ecological values;

    c) Adequacy of NZTA's investigations and outcomes/findings;

    d) Likely key effects (positive and adverse) on the environment of allowing the Project;

    e) Appropriateness of any proposed mitigation measures or monitoring;

    f) Submissions relating to terrestrial and aquatic ecological matters and effects on biodiversity; and

    g) Any other matters.

18. My evidence should be read in conjunction with expert evidence of the other experts that have contributed to the s 42A Planning Assessment. In particular, the evidence of

John Hudson (natural character), Logan Brown (freshwater), and Gregor McLean (earthworks and constructions).

2.3 Statutory Context

19. The relevant statutory documents and provisions relevant to the evaluation of the NOR have been set out in the s 42A Planning Assessment.

20. For the purposes of preparing this s 42A report, I have had particular regard to Chapter 6 (Indigenous Biodiversity, Landscape and Historic Heritage) and Chapter 13 (Landuse Activities and Indigenous Biological Diversity) of Horizons' One Plan, and its focus on giving effect to RMA ss 6(a), 6(c)) and 7(d). In doing so, I am assessing the proposal as presented, on the understanding that NZTA's experts present a worst-case scenario for effects on indigenous biodiversity. The purpose is to ascertain whether the proposal meets the objectives and policies of the One Plan. As the proposal may change or other matters may come to light before and during the regional resource consenting phase, my evidence should not be considered as a prelude to any decision of MWRC. My assessment is only an indication of the likelihood that NZTA can build a road within the NOR corridor with acceptable effects (as suggested by NZTA),[4] under the One Plan policy framework.

21. The past and current indigenous vegetation cover of the Manawatū-Wanganui Region, and justification for regulatory protection of terrestrial biodiversity under the One Plan, is comprehensively reviewed by Dr Maseyk in her technical report to support the development of the One Plan policies for biodiversity (Maseyk; 2007). The salient points are succinctly covered in Chapter 6.2.1 of the One Plan and so are not repeated here. In summary:

22. Only 23% of the Region's original forest cover and 3% of its wetland habitat remain;

    a) The lower-lying and coastal areas (most easily developed parts) of the Region typically have less than 10% of original habitat. These habitats are small, fragmented and under pressure from pests and disturbance; and

[4] As one example, see section 44.11 of the AEE.

b) Aquatic indigenous biodiversity is in a similar state of degradation.

23. Chapter 6.1.2 concludes that if these habitats and the linkages between them are to survive they will require protection and ongoing management. To address the decline in indigenous biodiversity, the One Plan sets the objective to "*Protect areas of significant indigenous vegetation and significant habitats of indigenous fauna and maintain indigenous biological diversity, including enhancement where appropriate*". (Objective 6-1).

24. To achieve Objective 6-1, One Plan Policy 6-1 (a) apportions responsibility to MWRC for setting objectives, policies, methods and rules. The responsibility of territorial authorities includes such measures "*as they see fit for the purpose of recognising amenity, intrinsic and cultural values associated with indigenous biological diversity, but not for the purpose of protecting significant indigenous vegetation and significant habitats of indigenous fauna…*" (Policy 6-1 b)).

25. Ultimately therefore the responsibility for regulating the Project's land use activities that affect significant indigenous vegetation and significant habitats of indigenous fauna sits with Horizons, with a resource consent phase for the Project still to occur once final design is settled by NZTA. However, the territorial authorities still have functions relating to indigenous biological diversity when exercising powers and functions under the RMA, and in doing so need to consider the policies and objectives in the RPS (Chapter 6).

26. These functions extend to review of policies like Policy 13-4 in some circumstances.[5] I have reviewed the proposed Project against Chapter 13 of the One Plan; first to check the significance assessment of indigenous habitats potentially affected to determine if they are classified as "rare", "threatened", or "at-risk" habitats (Policy 13-5), and then following the consent decision-making process for activities in such habitats (Policy 13-4).

[5] See Policy 6-1(c) of the One Plan.

Policy 13-5 – assessing the significance of an area of indigenous habitat

27. Policy 13-5 contains the criteria to assess the significance of indigenous habitats due to their representativeness, distinctiveness and rarity, and/or ecological context.

28. The ten ecosystem types originally identified in Appendix 6.A have been tested against One Plan Policy 13-5 (Appendix 6.A. Table 6.A.11). Seven are identified as triggering one of more of the criteria of ecological significance listed within that policy (note; there are two ecosystems represented in the first column of Table 6.A.11). Of these, six can be classified as "threatened" habitat types following Policy 13-5 criterion (a)(i) a) and one described as "rare", due to meeting Policy 13-5 criterion (a)(ii) e).

29. In the response to DOC/Wildlands [Forbes, 2019; Attachment 5], Dr Forbes revises the list to split "divaricating shrublands" from "mānuka and kānuka shrublands" and to include "exotic-dominated seepage wetlands" These changes have been assessed directly against RMA s 6(c).[6]

30. The exotic dominated seepage wetlands are assessed as having low value but are ecologically significant by virtue of being wetlands.

31. While these systems are less likely to trigger Policy 13-5 due to the lack of indigenous dominance (a key aspect introduced to the One Plan to rate indigenous ecosystems above non-indigenous ecosystems when ranking significance for indigenous biodiversity), they may trigger Policy 13-5 (a)(iii) a) or b) (ecological context of connectivity or buffering) due to proximity or linkage to other significant habitats. The ecological context of the exotic-dominated wetlands has not been presented by Dr Forbes. For now, I have assumed the wetlands will be of less importance to MWRC at the time of the resource consent applications but I do not discount that they will trigger Policy 13-5.

32. As these wetlands may be appropriate recipient sites for biodiversity offsetting for effects on indigenous-dominated wetlands, I am however of the view that they should

[6] The nine other ecosystems have also been re-assessed against RMA s6 (c) but their significance status does not change.

be included in the overall account for significant ecosystems but by rating the value as "low" (as Dr Forbes does).

33. The divaricating shrublands are also assessed as generally insignificant. However, Dr Forbes split these from the original mix called "mānuka, kānuka and divaricating scrublands" because they have potential to be significant habitats for lizards. If lizards are discovered in these habitats, then they are likely to meet Policy 13-5 criterion (a)(ii) a) (habitat for rare species). While I am satisfied for now with the conclusion that these are not significant habitats, I am aware that this conclusion may change with further information.

Policy 13-4 –threatened and rare habitats and managing effects

34. One Plan Policy 13-4 b) governs activities in "threatened" habitats or "rare" habitats assessed to be significant under Policy 13-5. Policy 13-4 follows the RMA effects hierarchy where any more than minor effects on these habitats must first be reasonably avoided, then remedied or mitigated (if not able to be reasonably avoided) at the point where the adverse effect occurs, or finally, where avoidance, remediation or mitigation is not able to reasonably occur, offset in a manner which achieves net-gain in indigenous biological diversity.

35. Whether NZTA has adequately assessed alternative routes to avoid any more than minor effects on biodiversity is a point I cover in consideration of alternative sites, routes, or methods below. The potentially significant adverse effects that arise - if not avoidable - are unlikely to be fully remedied or mitigated at the point of impact either. NZTA's experts therefore considered the appropriateness of offsetting. They share the view that any residual effects on biodiversity can be offset for a net-gain in indigenous biological diversity.

36. Policy 13-4 b) iii of the One Plan provides for offsetting for net-gain but only to a point. Importantly, Policy 13-4 d) iv states that offsetting may be deemed inappropriate for the ecosystem or habitat type by reason of its rarity, vulnerability or irreplaceability. The question is then firstly, whether offsetting is even available when dealing with the particular ecosystem or habitat type.

37. Appendix 6.A of the AEE presents Figure 2 from Pilgrim *et al*. (2013) which aptly describes the situations where offsets are unlikely to be appropriate, situations where

a high level of proof is needed that an offset is feasible ("beyond reasonable doubt"), where a modest level of proof is needed ("clear and convincing evidence") and where a lower level of proof ("balance of probability") might be reasonable to demonstrate the appropriate of the offset [Appendix 6.A. Figure 6.A.8. page 62.]. In my opinion, the vulnerability generally associated with habitats in "acutely" and "chronically" threatened environments, and the high level of irreplaceability specifically attending old-growth forests and indigenous-dominated wetlands, place a high burden of proof (beyond reasonable doubt) on NZTA to demonstrate a net-gain.

38. Using the technical material presented with the NOR application, I have reviewed the adequacy of the avoidance, remedy and mitigation approaches presented by NZTA's ecologists. I concur with them that, without moving the indicative road design so that it completely avoids significant habitats altogether, NZTA will need to prepare a comprehensive and transparent mitigation and offsets package that demonstrates net-gain

39. If the Project is unable to demonstrate net-gain with a high level of proof that the offsets will be successful, then it may necessitate changes to the alignment in and around NOR corridor to ensure it responds to the directive (avoidance) approach of the One Plan when addressing significant adverse effects on "threatened" and "rare" ecosystems.

Natural Character

40. I have also considered the objective and policies of the One Plan with regard to natural character - in particular, Objective 6-2, Policy 6-8 and Policy 6-9 as described by Mr Percy and Mr Hudson. Using the technical material presented with the NOR application, I have reviewed the adequacy of the assessment with respect to the biophysical and ecological attributes of riparian habitats of streams and wetlands. I have assessed whether the measures proposed avoid significantly diminishing these attributes where they are high or very high, or otherwise lead to managing effects so that natural character is preserved and protected.

2.4 Reports and material considered

41. As part of preparing this statement of evidence, I have read and/or make reference to the following reports and documents:

a) Blayney, A. and Sievwright, K. (2018). Te Ahu a Turanga; Manawatū Tararua Highway Project Report 6.B: Terrestrial fauna ecological effects assessment technical report (including appendices 6.B.1 and 6.B.2). [ref. Appendix 6.B];

b) Dalzell, L (2018). Te Ahu a Turanga; Manawatū Tararua Highway Project Notices of Requirement for Designations Volume 2: Assessment of Effects on the Environment and Supporting Material [ref. The AEE];

c) Department of Conservation (2018). Battle for Our Birds Tiakina Nga Manu; Possum and rat control in Te Apiti – Manawatū Gorge (ref. DOC, 2018);

d) Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment guidelines for use in New Zealand: terrestrial and freshwater ecosystems [2nd edition] (2018). (Ref. EIANZ; 2018);

e) Evans, B. (2018). Te Ahu a Turanga; Manawatū Tararua Highway Project: Technical Assessment #4 Landscape, Natural Character and Visual effects (Evidence) [ref. Evans, 2018];

f) Faulker, B. (2018). Te Ahu a Turanga; Manawatū Tararua Highway Project Appendix 4.A: Natural Character Assessment [ref: Appendix 4.A.];

g) Fea, I.N. (2018). The responses of New Zealand's arboreal forest birds to invasive mammal control (PhD Thesis, Victoria University [ref. Fea, 2018];

h) Forbes, A. (2018). Te Ahu a Turanga: Technical Assessment #6 (Evidence) [ref. Forbes, 2018];

i) Forbes, A (2018). Te Ahu a Turanga – Manawatū Tararua Highway Project Assessment of Terrestrial Vegetation and Habitats (ref. Appendix 6.A);

j) Forbes, A. (2019). Letter addressed to Wildland Consultants regarding Te Ahu a Turanga; Manawatū Tararua Highway Project Response to Ecology Review, dated 1 February 2018 (but should have been dated 2019). [ref Forbes, 2019];

k) Handford, P. (2017). Te Apiti Manawatū Gorge Biodiversity Management Plan. (ref. Handford, 2017);

l) Horizons (2018). Draft Biosecurity Animals Operational Plan 2018-2019. (ref. Horizons, 2018);

m) Miller, K. (2018). Te Ahu a Turanga; Manawatū Tararua Highway: Freshwater - ecological impact assessment (including appendices 6.C.1 to 6.C.4). [ref. Appendix 6.C];

n) NZTA (2018). Te Ahu a Turanga; Manawatū Tararua Highway Project Notices of Requirement for Designations Volume 2: Assessment of Effects on the Environment and Supporting Material [ref: AEE];

o) NZTA (2019). Te Ahu a Turanga February 2019 Ecology Mitigation Workshop [ref. NZTA; 2019];

p) Singers, N (2018). Manawatū Gorge Realignment – Threatened Plant Survey [ref. Appendix 6.A.G];

q) Maseyk, F., Ussher, G., Kessels, G., Christensen, M., and Brown, M. (2018). Biodiversity Offsetting under the Resource Management Act - a guidance document prepared for the Biodiversity Working Group on behalf of the BioManagers Group. (ref. Maseyk, et al.; 2018);

r) Maseyk, F (2007). Past and Current Indigenous Vegetation Cover and the Justification for the Protection of Terrestrial Biodiversity within the Manawatū Wanganui Region. Technical Report to Support Policy Development. Horizons Regional Council report 2007/EXT/790. [ref. Maseyk; 2007];

s) Pilgrim, J. D., Brownlie, S., Ekstrom, J. M., Gardner, T. A., von Hase, A., Kate, K. T., & Ussher, G. T. (2013). A process for assessing the offsetability of biodiversity impacts. Conservation Letters, 6(5), 376–384. [as referenced in Appendix 6.A];

t) Walker, S. Cieraad, E. Grove, P., Lloyd, K. Myers, S., Park, T., and Porteous, T. (2007). Guide for the Users of the Threatened Environment Classification (ver 1.1) Manaaki Whenua Landcare Research. (ref. Walker et al.; 2007).

2.5 Site visit

42. I undertook a site visit on 18 July 2018 with Dr Forbes and am familiar with the surrounding environment. I am particularly familiar with the most vulnerable indigenous terrestrial and wetland habitats having visited the forest, scrubland and wetland areas identified as the "Western Rise" and "Western QEII" (between chainages 4000 and 5800 within the NOR area). I am also generally familiar with the area due to my involvement in preparation of the One Plan, and its subsequent application within the region.

3 Existing Environment

43. The existing terrestrial, wetland, and aquatic environment (as well as the natural character of the aquatic environment with respect to biophysical attributes) is well described in Appendices 4.A, 6.A, and 6.C. I have very few concerns with the observations made by NZTA's experts and other than to reiterate that the Project envelope contains ecosystems of high to very high ecological value, I shall not repeat the bulk of their observations in my evidence.

44. As a result of interaction with DOC/Wildlands, Dr Forbes identifies the location and extent of important habitats inside the NOR corridor, including indigenous vegetation and wetlands that may be affected by spoil sites and enabling works [Forbes; 2019, Figure 1, pages 21-23]. This figure now includes indigenous habitats previously excluded on the assumption that the road designation would avoid them. I agree with the addition of these habitats. As Appendix 6.A contains a worst-case assessment of vegetation removal for some habitats, the concept of not mapping areas of vegetation as a means of avoidance was counter-productive to assessing the scale of opportunity available for restorative management.

45. The species list by Dr Forbes (2019) [Forbes; 2019, Attachment 3] and more refined maps [Forbes; 2019, Figure 1; page. 22 to page 23] provides a more complete picture of vegetation communities and their composition

46. As a result of interaction with Meridian, NZTA also presents a revised map showing the scale of restorative opportunity [NZTA, 2019; page 6]. By restorative opportunity, I mean places where areas dominated by exotic species can be replaced with

indigenous cover to provide for new habitats or where low-value indigenous habitats can be enhanced to improve biodiversity outcomes. On the face of it, the areal extent of opportunity is more than 500 hectares, providing a lot of scope to implement mitigations and offsets as posed. However, much of the opportunity (particularly wetland restoration opportunity) lies outside the NOR and is therefore subject to third party cooperation.

47. I note the absence of vehicular traffic in the existing environment. The potential operational effect of avian mortality through traffic-related bird strike is raised, but not considered in any great depth in the AEE, Appendix 6.A, or Appendix 6.B. While much of the NOR is within an operational windfarm (and so bird strike is an existing effect), the nature of the risk is different and so the effects are likely to be different. To manage the effects, I suggest that the risk be more fully considered when ascribing appropriate offsets. I also suggest that options for reducing the risk be considered when designing planting plans close to the road.

48. Appendix 6.A also gives no information on the current state of the environment with regard to pest animal densities. Predator and browser management is one of the anticipated mitigation/offsetting responses for the Project. This assumes that browsing and predation are at densities across the Project area which are detrimental to the maintenance of biodiversity. Appendix 6.A and the draft condition in the AEE capture this assumption by requiring the residual trap catch/tracking rates ("**RTC**") for possums and rats to be maintained 5% or below.

49. As a general assumption, the proposed possum and rat targets overlook some key activities by other agencies that are likely to reduce the density of possums and rats in the landscape surrounding the NOR designation area. These activities include possum and rat control on the public lands in the Manawatū Gorge Scenic Reserve ("**MGSR"**) for the express purpose of benefitting birds (e.g. Handford, 2017; DOC, 2018) and MWRC's control of possums in the Whakarongo, Balance and Woodville Possum Control Operation ("**PCO**") areas (e.g. Horizons, 2018).[7]

50. Based on my understanding of the current efforts and aspirations of Horizons' PCO programmes, DOC management of MGSR, and the aspirations of the Manawatū Gorge

Governance Group[8] it is likely that the possum residual trap-catch index is below 5% in the areas put forward for potential mitigations and offset planting. This situation is likely to be maintained into the future through continued intervention by those agencies following their own objectives[9]. Even if those efforts do not maintain <5% RTC at all times, they would likely achieve all of the anticipated benefits of habitat improvement that possum control brings.

51. Noting that Singers observes for Area A "…that effective possum control is occurring, and canopy condition was observed to be high with no obvious browse on palatable species" (Appendix 6.A.G, page. 8), any further reduction in possum density by NZTA, aimed at habitat improvement (and the benefits this brings for fauna utilising the improved habitat), could be a misplaced objective.

52. The current density in the proposed offset areas is not known for rats but can be estimated. In forested areas where rat habitat is good, they are likely to be above 5%. It is my experience from research at Totara Reserve that MWRC's generic possum control efforts, while they affect rats, are unlikely to sustain rat tracking indices below 5%. In pastoral areas where rats will be more transient, tracking indices may be below 5%. It is likely rat tracking indices will eventually increase in ex-pastoral sites where indigenous forest and shrub ecosystems are proposed to be restored.

53. Other predators such as stoats, ferrets, and cats are likely to be present and will continue to be present in the landscape. I am not aware of whether the present or proposed management regimes of other parties reduce the incident effect of these predators on birds to the lowest possible level achievable. However, I consider it necessary to assume that the efforts of these management regimes already help protect native birds from decline.

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[8] As a party to the Manawatū Gorge Governance Group, NZTA already make a financial contribution to predator control on the south side of the Manawatū Gorge. To my knowledge, NZTAs contribution is (in part) to satisfy an existing consent requirement to manage pests on the south side of the gorge as mitigation for biodiversity effects stemming from work associated with the 2014 slip event.

[9] The map of the area of interest of the Te Apiti – Manawatū Gorge Biodiversity Management Plan [Handford, 2017 page 4] includes Ashhurst Domain and areas of private land on the south side of the Manawatū Gorge which are congruent to areas depicted as potential planting areas in Appendix 6.A.

54. Herbivory in the form of ungulate animal browse in areas that are not fenced off from stock has been well noted in Appendix 6.A. That areas that are fenced have much less noticeable browser damage suggests feral ungulates such as goats and deer, if present, are not a significant problem. It is possible (although not known directly to the writer) that this situation arises as a result of DOC efforts to manage ungulate pests in the MGSR.

4 Data Collection and Assessment Techniques

55. Dr Forbes and the NZTA team of ecologists providing technical information give a well-reasoned account of the significant ecological resources and potential effects. However, in some cases the accounts are not sufficiently robust for the information to be used to assess the scale and appropriateness of remedies, mitigations, and offsets where the significant ecological effects are unavoidable. In this section I assess the data collection and assessment techniques, and comment on concerns these raise as part of my review.

Terrestrial and Wetland Indigenous vegetation / plant communities

56. Terrestrial and wetland indigenous vegetation is described in Appendix 6.A, Forbes (2018), Forbes (2019), and NZTA (2019).

57. Dr Forbes follows nationally recognised vegetation community assessment methodologies. The system of classification of the forests and wetlands, while not specified, follows a nationally recognised approach (Singers and Rogers, 2014). Species composition, structure, and condition information has been collected [Appendix 6.1 appendices B, C, and D, and Forbes (2019)], and is used to inform ecological value and effects assessment. I agree with the approach.

58. The assessment of the significance of the relevant habitats follows Policy 13-5 of the One Plan. With the exception of noting exotic-dominated wetlands as significant, and notwithstanding my comments regarding the detection of rare invertebrates in non-significant indigenous habitats, I believe assessment of the habitats has been consistent with the One Plan.

59. Dr Forbes gives a well-reasoned assessment of effects. The scaling of the level of and significance of effects follows a nationally recognised (EIANZ; 2018) protocol. Assessments of the scale of effects are consistent with that protocol.

60. Dr Forbes also correctly places value, and assesses effects on indigenous habitats such as secondary broadleaved forest and scrublands, and exotic-dominated wetlands, that fail to meet the One Plan Policy 13-5 assessment of significance.

61. I agree with the submission of DOC (and subsequent work by Dr Forbes) that NZTA should better identify, map, and account for exotic-dominated wetlands and include a more refined presentation of non-significant indigenous ecosystems [Forbes 2019]. This approach is consistent with the idea that regional and district resource management plans should contain policies for biodiversity offsetting for **any** form of indigenous biodiversity, not just forms that are identified as significant under the RMA [Maseyk *et al*.; 2018].

62. By mapping these sites, it becomes clearer where there are opportunities for offsetting for a net-gain through habitat enhancement. This is particularly important with respect to assessing the offset opportunity for seepage wetlands; where restoration by conversion from exotic-dominated seepage wetlands to indigenous-dominated seepage wetland ecosystems is feasible (in contrast to building new seepage wetland hydrosystems from scratch).

63. In his evidence, Dr Forbes asserts that the alluvial old growth forest, raupō seepage wetland, and stands of swamp maire at CH4000-4400 (the Western Rise) are "… *both highly vulnerable (they contain highly threatened species or ecosystems) and highly irreplaceable (there are few options for replacing or conserving the potentially affected biodiversity components elsewhere)"* [Forbes, 2018, paragraph 51]. Dr Forbes is aware that these habitats are very near the "irreplaceable" end of the offsetting spectrum and he discusses the limits to offsetting the effects on these habitats in Appendix 6.A [section 6.3 pages 58-63].

64. Dr Forbes runs several scenarios for road alignments for the Western Rise in an attempt to find one that reduces the magnitude of effects on these systems from very high (offsetting is unacceptable) to moderate with appropriate offsetting [Forbes, 2018, paragraph 58, page 23].

65. Dr Forbes' approach to combine the assessment of appropriateness of the offset into the assessment of the magnitude of effect is likely to skew his assessment toward the conclusion that it is technically feasible to replace highly vulnerable or highly irreplaceable ecosystems, rather than concluding that offsetting would be inappropriate. In instances where offsets are being tested, I am not overly concerned about mixing the feasibility of an offset with the effects assessment, as long as it demonstrates that each iteration first seeks to avoid, remedy, and mitigated effects (i.e. puts the effects hierarchy in the correct order) until the magnitude of effects reach a level where it becomes technically feasible to fully compensate residual impacts through an offset. Dr Forbes' process is consistent with offsetting guideline preamble regarding limitations presented by Maseyk *et al*. (2018) [Table 1, page 4] and follows the process of assessing offsetability from Pilgrim et al. (2013) [reproduced in Appendix 6.A, Figure 6.A.5. page. 57].

66. Dr Forbes has found after exploring a range of options to cross the Western QEII that it is not possible to reduce the magnitude of effect from very high on the old growth forest at that site. Dr Forbes considers this forest type less vulnerable[10] and considers the opportunity to replace such forests as higher in contrast to the old growth forest habitat of the Western Rise. These situations are used to justify his opinion that an offset for effects on (rather than complete avoidance of) the Western QEII is appropriate. However, Dr Forbes does not present the same level of analysis for the Western QEII as applied to the Western Rise habitats [per Appendix 6.A, section 6.3 pages 58-62, and Appendix 6.A. Appendix F].

67. Given where Dr Forbes places the Western QEII on the scale of conservation concern [Appendix 6.A. Figure 6.A.7, page. 61], I believe this site is no less vulnerable than the Western Rise. The Western QEII site certainly sits in the high to very high corner of Figure 6.A.8 on page 62 for which a high burden of proof is placed on demonstrating that the offset is appropriate and feasible. This assumes relevance when considering the appropriateness of offsetting.

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[10] Western QEII old growth forest is identified as One Plan rimu/tawa–kamahi forest habitat type, of which there is estimated to be 19.5% remaining in the region. The old growth forest of the Western Rise is identified as fitting either the podocarp/tawa–mahoe or kahikatea-pukatea-tawa habitat type for which there is estimated to be less than 2.5% remaining in region for each.

68. With respect then to Policy 13-5 (d)(iv), I place emphasis on offsets being "*…not …allowed, **where inappropriate**, for the ecosystem or habitat by reason of its rarity, vulnerability, or irreplaceability*". If it can be reasonably shown that an offset proposal can fully compensate the irreplaceable, then such an offset could be deemed to be appropriate.

69. As I have already identified, I am not concerned that combining the offset acceptability assessment with the magnitude of effects assessment is likely to skew an ecologist toward accepting an offset rather than avoiding the effect – this skew is catered for by following offsetting guidelines. My concern is whether the offsets proposed actually do demonstrate ecological equivalence for the loss forest type (old growth forests) or functional hydrosystems (wetlands). If ecological equivalence is not demonstrated, then the offset does not fully compensate (i.e. replace) the loss of the irreplaceable. If this is the case, I am of the opinion that activities that affect these habitats must be avoided.

70. To avoid effects as far as possible, and to provide certainty of scale of the areal extent of those effects, Dr Forbes uses an effects envelope approach to enumerate the absolute extent of highly vulnerable and irreplaceable habitat that may be removed, and applies worst-case (total loss) of less vulnerable (but still important) habitats. The calculated potential areal loss of vegetation is designed to limit the scale of vegetation clearance (when imposed as conditions of the NOR) and is used to calculate the size of the vegetation replacement for mitigating or offsetting the effects. I concur with the approach for the clarity and certainty it provides on the areal scale of loss.

71. Appendix 6.A. [section 6.4, pages 63-65] contains detail concerning a bespoke biodiversity management package that seeks to remedy or mitigate the significant adverse effects on indigenous vegetation and offset for net-gain the loss of this vegetation. I agree that courses of action - such as inter-planting in existing habitat to close canopy gaps and reduce edge effects, establishment of like-for-like (in terms of composition) replacement habitats for those lost, sustained browser and predator control of replanted areas and fencing to exclude stock - are all means by which significant effects on biodiversity might be remedied, mitigated, or offset.

72. The concept of applying Environmental Compensation Ratios ("**ECR**") to achieve net-gain is a sound way of demonstrating a net-gain in areal extent. However, whether the

proposed ECRs are commensurate with time lag, vulnerability and irreplaceability of habitat types (as required by offsetting principles) requires further consideration by a range of stakeholders if these are to be deemed to be acceptable offsets that demonstrate net-gain.

73. As I discuss later in my evidence, the feasibility of delivering an offset is an important step in the offsetting assessment process. Appendix 6.A. [figure A.6.9] appears to show sufficient space inside the NOR, and opportunity outside the NOR, to implement the habitat re-establishment (re-planting) aspect of the biodiversity offset package. However, there does not appear to have been any provision within the maps for the application of the offsets at a site level. The absence of certainty around whether all of this space/ opportunity is available for the purpose of offsetting is, in my opinion, compounded by the submissions of significant stakeholders in opposition.

Rare or Threatened flora

74. The investigation into the presence or otherwise of rare or threatened flora is presented in [Appendix 6.A.G, (an appendix of Appendix 6.A]. The report provides a detailed account of the vegetation composition for the very high value and high value ecosystems potentially affected by the Project.

75. Mr Singers uses appropriate techniques to identify a list of rare or threatened species likely to be present in the NOR corridor, before searching for those species by walking the indicative alignment and any other areas that they are most likely to be found. While the report does not indicate sampling intensity or the duration of the visit (i.e. how hard Mr Singers looked), the level of specificity of mapping indicates much time was spent in these areas. The possibility that rare or threatened plants were missed is remote, although confirmation of their absence cannot be absolute.

Native birds

76. The investigation into the potential effects of the proposal on native birds is presented in Appendix 6.B of the AEE. The report uses existing information of various levels of quality to determine the variety of native birds that are present in the NOR corridor and the habitats that are most likely to be important for nesting and foraging. The methodologies include nationally recognised protocols to assess relative abundance as well as presence. Given the volume, intensity and quality of bird observations, I

concur with the observation made in the report that the cited list of birds is the total species count for the area. Although not explicitly stated, the methods employed by the assessors mean there is existing pre-construction data on relative density. This is likely to be useful for gauging actual operational effects of the road.

77. Blaney and Sievwright provide a well-reasoned worst-case assessment of the effects on avifauna following the EIANZ (2018) guidelines. This worst-case assessment is at the scale of the NOR corridor for all indigenous shrublands, secondary broadleaved forests and scrublands. It assumes total loss even though this may not eventuate. Where avoidance and minimisation of effects is proposed through specific effects envelopes in moderate or greater value habitats [as identified in Appendix 6.A], the worst-case assessment assumes the effects will be limited to the effects envelope. I concur with the methodology and the conclusions on values and scale of effects reached [section 6.B.6.4].

78. The Appendix 6.B report acknowledges the limitations of the methodologies, timing of surveys, and cryptic nature of some birds that can cause uncertainty about the nature of the fauna and scale of effects. The limitations are adequately addressed by recommending a precautionary approach that involves pre-clearance surveys of habitats with moderate or greater value so as to identify the presence of nesting birds and then avoid disturbing these birds where possible.

79. Appendix 6.B also acknowledges the possibility that the location of the road may change. It assumes the worst case is based on the size of the effects envelopes, the assessment provides a suitable level of certainty to the potential scale of effects on birds that arise from design changes (as long as changes stay within the size of the effects envelopes for each habitat type as prescribed in Appendix 6.A).

80. There is very limited assessment of operational effects relating to bird strike, with these being tied up in a general list of effects that include construction effects. I am not convinced that the recommended approaches for avoidance and mitigation (which include construction effects) also cover the operational effect of bird strike. The general conclusion of the report and the bird specific avoidance responses is also confusing with respect to whether those responses must be required (avoidance) or are not required but help reduce effects [Appendix 6.B, section 6.B.7.5, page. 67].

Bats

81. The investigation into the potential effects of the proposal on bats is presented in Appendix 6.B. The report adopts methodologies that include nationally recognised protocols to assess the possible presence of bats in the Project area.

82. Blaney and Sievwright apply a well-reasoned approach to bat discovery – first employing a method that would detect a substantial bat population (which would indicate very high ecological value) and then recommending follow-up investigations to either confirm the presence of bats or infer (but not confirm) absence. Until this second tranche of investigation is concluded, the actual value of affected habitats for bats and the potential scale of effect remains uncertain. The report acknowledges this uncertainty and it avoids using the EIANZ (2018) approach to calculate significance of ecological effects for this reason.

83. Instead of estimating the significance of effects, Blaney and Sievwright recommend a reasonable response in the form of a detailed management plan. This management plan is to contain "*a detailed* approach *to avoid, remedy, or mitigate the assessed effect of the road designation on bats*…" [Appendix 6.B. page. 67] once more information about the presence and habitat usage is known.

84. The proposed bat management plan also includes the need to consider a "…*post mitigation level of effect on long-tailed bats and how any residual effects will be managed*…" [Appendix 6.B. page. 67]. Blaney and Sievwright propose that the bat management plan include the identification and implementation of appropriate offsets where necessary. I consider this approach to be entirely appropriate. There is no value in deriving mitigations or offsets for bats, unless there is a reasonable expectation (based on presence information) that such a response is necessary, available and feasible.

85. The obvious problem is not being able to determine at this stage (without presence information) what the offset(s) might look like. In my opinion, any assessment of the bat management plan proposal for a sense of the net-gain is doubtful at best.

86. The proposed bat management plan [condition 15, page. 177] is intended to include procedures for bat roost removal, and where necessary set out an approach for habitat replacement and pest control. However, given the uncertainty around the steps

required to avoid, remedy, mitigate and offset any potential effects, I am concerned that these conditions pre-suppose (and potentially limit) the response that should include (for example) avoiding the disturbance or destruction of roosts altogether.

87. This situation highlights the difficulty of trying to make clear the actions that will demonstrate net biodiversity gain without limiting the options available to NZTA to avoid, remedy, or mitigate effects in the first instance. I address issues regarding the value of pest control and habitat replacement for bats in further detail in the section on Mitigation and Environmental offsetting.

Native lizards and native frogs

88. The investigation into the potential effects of the proposal on lizards and frogs is presented in Appendix 6.B. The report uses methodologies that include nationally recognised protocols to assess possible presence of lizards.

89. I agree with the approach to use lizard threat status and habitat utilisation to assign ecological value to habitats that are most likely to be utilised by lizards rather than using the indigenous vegetation type values assigned by Dr Forbes [Appendix 6.A] as a proxy. This has the advantage that non-indigenous vegetation that is high-value lizard habitat has not been excluded from consideration.

90. Blaney and Sievwright use a nationally recognised (EIANZ; 2018) approach to identify the scale of ecological values, the potential magnitude of effect, and the level of ecological effect across the extent of the Project corridor rather than just the indicative road design. This means the scale of effects pertains to the whole NOR corridor and changes to the road design do not change the effects assessment. I concur with this approach.

91. Blaney and Sievwright acknowledge the limitations of the existing survey data and cautiously recommend all habitats that may be suitable for lizards need to be scrutinised with pre-clearance surveys. Given the confirmed presence of several at risk species within the MGSR and lack of intensive lizard surveys, I agree that it is appropriate to use habitat suitability as a proxy for assuming species presence in this area.

92. Based on the limitations of data and methods of detecting lizards, I am of the view that the report provides a reasonable response to the management of significant effects in the form of the proposed lizard management plan. The plan is directed to contain details of a survey and salvage methodology, establishment times of survey equipment, timing for surveys and salvage, a release site for salvaged lizards, and requirements to enhance or protect the release site(s) from predation and disturbance [Appendix 6.B, section 6.B.7.2 page 65]. I agree that these are all relevant matters for inclusion in a plan.

93. To my mind, the translocation of lizards is a remedy (as it resolves a direct threat), not mitigation. The degree to which it is an ecologically appropriate response will depend on the lizard carrying capacity and the level of lizard predation in the recipient habitat – translocation is not appropriate if the recipient habitat is already at carrying capacity (there is not enough room) or the translocated lizards are subject to an increased risk of mortality. The management plan approach however accounts for all of these matters.

94. I note that authorisation for the disturbance of lizards is required under the Wildlife Act. While a separate process, the likelihood of obtaining consent from DOC is critical to NZTA being able to undertake an appropriate response commensurate with the scale of effects on lizards by the Project.

95. There is comment in the general recommendation [Appendix 6.B, section 6.B.7.1 page. 64; last paragraph of section] that in "…*any areas subject to predator control*…" "…*the* ***value of this pest control for fauna mitigation comes from the flora values (which provide habitat)***…" However, there is a lizard-specific observation [section 6.B.7.1 (page 65); last paragraph of section] that with "… *the proposed mitigation planting to replace habitat* ***and pest control that will reduce the predation rates on the remaining populations of native lizards****, the effects of the designation will have a Low magnitude of effect for all sections of the designation for herpetofauna within the site*." This inconsistency in describing how the benefits of pest/predator control might be ecologically attributed to lizards needs further explanation. I discuss the issue further in mitigation and environmental offsetting.

96. With respect to native frogs, the report presents the scant evidence available. It is highly unlikely (although not impossible) for native frogs to be present. If native frogs

are found (most likely to happen during lizard relocation forays), there should be no other recourse but to delimit the extent of the population and avoid this area completely.

97. Non-native lizards and frogs are not considered at threat of extinction and impacts upon them are no cause for biodiversity conservation concern (in fact the rainbow skink is considered a pest).

Terrestrial Invertebrates

98. The investigation into the potential effects of the Project on terrestrial invertebrates is presented in Appendix 6.B. It concludes that there is little existing data on invertebrate communities and rare taxa applicable to the NOR corridor. In his evidence, Dr Forbes summarises the habitats that are most likely to be important for terrestrial invertebrates [Appendix 6, paragraph 31].

99. Blaney and Sievwright determine that the assessment of ecological value for terrestrial invertebrates can be based on a qualitative assessment of ecosystem factors that affect terrestrial invertebrate community assemblages (habitat quality proxy approach). Using a habitat quality proxy approach is well-reasoned, and is based on published observations that relate habitat quality to invertebrate diversity and rarity. Using these factors a bespoke ecological value scoring process is devised. I would comment that this is not a nationally standard scoring process and I do not know if the approach has been used in other applications or if it has been subject to wider peer review.

100. In my opinion Blaney and Sievwright were never going to be able to identify any habitat that meets their "very high" level of ecological value based on species rarity. This is because:

a) "*…at-risk and threatened species have been suggested within the scoring guide to contribute to a very-high ecological value…*" [Appendix 6.B, page 3; first paragraph];

b) "*…in New Zealand there has not been enough taxonomic or population study to* provide *an assessment on a threat status of individual species…*"(Appendix 6.B, page 3, paragraph 1), and

c) there has been no specific effort spent looking for invertebrates in the Project envelope.

101. There is therefore a risk that the significance of the habitats with respect to rare taxa or taxa with limited dispersion rates has been underestimated. The level of response required to mitigate or offset effects of proposed habitat loss on invertebrates may also be underestimated as a consequence. I recommend imposition of a condition requiring a targeted investigation into terrestrial invertebrate diversity in the high and very high valued sites to establish baseline diversity indices and thereby remove some of the doubt with respect to the presence of rare or at-risk invertebrates.

102. Section 6.B.2.1.2 [page 2] clearly acknowledges that "…*the replacement of sufficient vegetative diversity is not standard in mitigation practices, and standard revegetation approaches are unlikely to achieve the restoration of the invertebrate communities* lost *in a timely fashion*." Yet, the report concludes that one of the "… *primary response*[s] *for mitigation for terrestrial invertebrates* ***is to create new habitats*** *and enhance remaining habitats, such as the MGSR*." (section 6.B.7.3 paragraph 1). This apparent contradiction in the ecological attribution of habitat replacement for invertebrate communities, invertebrate diversity, and rare or threatened taxa makes it difficult to assess the ecological equivalence of the proposed offsetting package. I consider this further in mitigation and ecological offsetting.

Natural Character

103. The effects on natural character are described in Appendix 4A and the technical assessment of Evans (2018). Establishing the biophysical status of an area is the first step in any natural character assessment and I have therefore reviewed the assessment riparian margin Appendix (6.A) and how these are rephrased as attributes of natural character in my capacity as an ecologist.

104. I agree with the selection of and focus on "terrestrial ecology" and the "morphology and physical modification" attributes to describe the riparian margins of streams and wetlands. My preference would have been for the terrestrial ecology key notes detailed in Appendix 4.A (Section 6.5 pages 63-64) to have detailed the One Plan Policy 6-8 attributes concerning natural elements, processes and patterns, and the biophysical, ecological, and morphological aspects considered by Dr Forbes in forming his assessment.

105. I surmise that there is a 1:1 relationship between the indigenous ecological values and habitat quality assessments detailed in Appendix 6.A and the biophysical attributes of the stream and wetland margin natural character. For streams especially the high terrestrial ecological functionality of the riparian vegetation has a significant role to play in in-stream ecological processes – as a source of food (terrestrial invertebrates that fall into the streams as food for fish, and leafy and woody debris as food for aquatic macro-invertebrates), in-stream cover for aquatic life (woody debris falling into streams), and shading.

106. To that effect, there seems to be a high degree of consistency between the biodiversity value of habitats described in Appendix 6.A and their transfer into natural character attribute values in Appendix 4.A. My only concern is that, given the strong influence of the riparian margin on in-stream ecological process and the relationship between the riparian margin and stream form, riparian margin attributes are not weighted and are treated equally to less visible attributes such as nutrient status. Mr Hudson and Mr Brown explore the issues that not weighting attributes has on diluting the significance of the diminishment of key attributes of natural character.

107. Appendix 4.A. generally reaches the conclusion that the enhancement of affected catchments through restoration of exotic-dominated riparian margins, stock proofing (fencing), and extension of the QEII legal protection over restored areas will be sufficient to mitigate the effects on the natural character of the biophysical environment.

108. However, these are offsets and mitigations posed by Dr Forbes for effects on biodiversity. While I surmise there is a 1:1 relationship between habitat quality and value and the natural character of stream and wetland margins, it does not directly translate that giving effect to the biodiversity effects though offsetting will mitigate the effects on natural character. This is because the offsets may or may not occur in the same catchments.

109. Given the quantum length of stream affected in Appendix 6.C. [Appendix 6.C. Section 4.4.1 (Watercourse Modification)] I am concerned that there will not be physically enough room in some catchments – particularly catchment 7 – to implement the anticipated mitigations. The problem is hinted at in Appendix 4.A. [paragraph 230 c) page 54] but not deeply explored as a potential impediment to successfully mitigating

effects. Furthermore, Appendix 6.C. [Section 4.2, last paragraph] identifies that mitigation will also likely be required outside the designation corridor. The implementation of the mitigation(s) is therefore subject to the agreement of third parties.

110. As a result, I cannot agree with the conclusion in the AEE that there will be no net loss of natural character on the stream inside the NOR corridor. There are aquatic and riparian biophysical aspects that will be significantly diminished and the proposed biodiversity offsets may not address this loss.

5 Project Effects

111. Dr Forbes (2018) concludes, that "*...on the basis of the offset package proposed, in my view the Project will have net benefits in respect of terrestrial ecology value*s." [Forbes, 2018, paragraph 15]. I acknowledge the sentiment, as this is the point of offsetting for net-gain. If the offsets eventually result in ecologically equivalent habitats in a demonstrable way, then the net increase in the areal extent of indigenous habitats could very well result in the net benefit of a (very slight) reduction in the vulnerability of rimu/tawa-kamahi forests, swamp maire stands, and wetlands. It must be remembered though that offsetting is a way of responding to significant net adverse effects that have not been avoided, remedied, or mitigated in the first instance.

5.1 Construction Phase Effects

112. The effects of the construction phase on terrestrial and wetland ecosystems is well described in Appendices 6.A and 6.B and adequately captured (in brief) in the AEE. I have very few concerns with the observations made by NZTA's experts and shall not repeat the bulk of their observations here.

113. Appendix 6.C (aquatic environment effects) purposefully omits an assessment of effects of construction, but goes on to lists the usual effects associated with construction works such as reduced water quality as a result of sediment run-off. In effect, Miller does produce an assessment of construction effects on the aquatic environment; but they are considered to be minor as it is assumed that NZTA will be able implement best practice erosion and sediment control. In my opinion, this assumption leaves the consideration of construction effects on aquatic natural

character less informed than it should be. We are also unable to assess whether the NOR has sufficient space to implement best practice sediment and erosion control measures. These matters are discussed further in the evidence of Mr McLean and Mr Brown.

5.2 Operational Phase Effects

114. Similarly, the effects of the operational phase on terrestrial and wetland ecosystems are well described in Appendices 6.A, and 6.B and captured briefly in the AEE. I do not dwell on these at large with the exception of avian mortality resulting from vehicular bird strike.

115. While avian mortality is identified as a potential effect of the operation of the road [Appendix 6.B. page 61], the analysis following this [Appendix 6.B. Table 6.B.12 pages 62-63] only attributes avian mortalities to construction effects. There is no assessment of the scale of the operational effect in the form of vehicular bird strike. This may be because the effect is considered to be no more than minor, but it is not stated as such within the Appendix or related reports.

116. Instead, Appendix 6.B. generalises all avian effects into specific comments pertaining to each zone [see Table 6.B.12 pages 62-63], with the conclusion reached that effects can be considered low if the recommended mitigations are in place. Turning to the specific recommendations for avifauna [Appendix 6.B. section 6.B.7.5. page 67-69] I find that the mitigations to address the avian mortalities cover construction effects only. This leaves the operational effects to be seemingly addressed by the more general comment that the increase in habitat area (through the operation of ecological compensation ratios) provides mitigation for the impacts on fauna identified earlier in the report [6.B.7.1 page 64].

117. I have a concern that these recommendations do not consider that any mitigation plantings near the road could potentially induce birds to fly through traffic. As vehicular bird strike is not an effect experienced by birds in the habitats subject to being lost, it seems to be contrary to the concept of net-gain to replace those habitats with one that have bird strike as a new inherent risk. The mitigation / offset planting areas would need to be just as “safe” as the cleared areas to get a like-for-like exchange. I recommend that the planting proposal accounts for minimising bird strike.

118. Appendix 6.C puts aside the assessment of operational effects, such as sediment laden and heavy-metal stormwater run-off, stating that these can be addressed at the time of considering the resource consents. I have some concern with the approach, as it leaves uncertainty as to whether there is sufficient room in the proposed NOR corridor to provide scope for those effects to be addressed through best practise design and mitigation measures.

6 Consideration of alternative sites, routes or methods

Comment on level of consideration given to long list options

119. In the discussion of the short listing of alternative options, page 66 of the AEE observes that "… specialists were able to rate an option as 'fatally flawed', where a potential effect for a specific environmental and social criterion was so serious that, in the opinion of the specialist carrying out the analysis, an alignment through that option would have an unacceptable level of effect and was **unable to be mitigated**." I have assumed that the potential to apply offsets was excluded by NZTA in this analysis as they are not mitigations.

120. Six long list options were identified as fatally flawed under the heading Natural Environment in the shortlisting of the alternative options. The key reason given is "…unacceptable impacts on ecology…" but there is no detailed description of the possible effects. It is not clear what is meant by "unacceptable". Some regard is likely to have been given to the EIANZ (2018) guidelines. Indeed, Dr Forbes (2018) has relied in his evidence (paragraph 38) on the recommendations of the EIANZ (2018) guidelines for occasions where very high adverse may be anticipated. Effects under the 'Very High adverse' category are unlikely to be acceptable on ecological grounds alone (even with compensation proposals) and activities having this level of effect are suggested by the EIANZ guidelines to be avoided.

121. In describing the potential effects of the projected alignment on the very high value ecosystems within the NOR, Dr Forbes (2018) identifies that there are no available options to avoid Very High adverse effects (e.g. paragraphs 62 and 63). The solutions posed are to limit effects as much as possible, and offset the residual effects. While I support this response, the fact that the projected alignment has an unacceptable level

of effect which is unable to be mitigated, raises the question in my mind as to why this would not have resulted in the projected alignment being judged "fatally flawed" in terms of original option selection. In particular, the QEII Covenant protection status should have indicated the presence of significant ecological assets within the proposed NOR corridor.[11]

122. I raise the question of alternatives due to the significant adverse effect (even after mitigation) in terms of the aerial loss of vegetation and associated fauna values. In my opinion, this level of effect necessitated (and does necessitate) a very robust assessment of alternatives in considering how the irreplaceability of vulnerable habitats, and other severe ecological effects, could be addressed through option selection at both the long list and short list stage.

123. In this regard, the AEE does not adequately identify the degree to which the other long list options (fatally flawed or otherwise) may have had to address the challenges faced by the irreplaceability of vulnerable habitats, or other severe ecological effects that could not otherwise be offset for net-gain.

Comment of level of consideration of options to limit effects on habitats in the Western Rise and Western QEII

124. Dr Forbes presents a very credible and well-reasoned approach to assessing alternative designs that limit the effect as much as possible within the Western Rise. This includes analysis of alternative sub- alignments to avoid very high valued ecosystems and re-design of the viaduct / bridge to reduce the level of effect. I accept that all of the sub-alignment options and earlier bridge and abutment options present potentially heavier habitat losses than that presented to us in the proposal. I believe Forbes explores all options available and presents a preference for the least-effects outcome.

125. With regard to the Western QEII, Dr Forbes has found after exploring a range of methods, that it is not possible to reduce the magnitude of effect from Very High.

[11] While the QEII protection status itself is not a useful criterion for the assessment of ecological significance, the QEII status is indicative that these areas were highly likely to contain forests of high or very high ecological values.

Faced with this conclusion I would have expected NZTA to consider design changes that avoid the Western QEII by going further up the ridge, or as I have discussed above, to explore the other corridor options more deeply to check that this NOR corridor sufficiently addresses the ecological constraints. Instead, it appears a decision by NZTA has been made to directly chase an offsetting strategy.

126. However, as I discuss in Mitigations and Environmental Offsetting below the offsetting plan in my opinion has yet to demonstrate feasibility "beyond reasonable doubt" as posed by Pilgrim (reported in Appendix 6.A [Appendix 6.A, Figure 6.A.8]). It is difficult to ascertain where on the spectrum of relationship between conservation concern and likelihood of offset success the proposed offset for the Western QEII sits. Based on the position the site sits with respect to vulnerability and irreplaceability [Appendix 6.C., Figure 6.A.7], (high level of irreplaceability and very high level of vulnerability), the offset proposal has the burden of a very high level of proof (beyond reasonable doubt).

127. The only "proof" we have that there is a net-gain is that NZTA are offering up a 10:1 ECR. This is a net-gain in areal extent only, and only if it can be achieved. Ecological equivalence is yet to be demonstrated for effects on bats and lizards because of the reliance on management plans, and the proof offered for invertebrates is at best, hypothetical. Given sites for restoration are yet to be secured, likely involve third parties, and may already be in environments where pests are well managed, there are some real doubts as to whether the offsets can be implemented (noting that an offset needs to be beyond reasonable doubt when considering potentially irreplaceable habitats [per Appendix 6.A, Figure 6.A.8].

7 Mitigation and environmental offsetting

128. Despite avoidance and minimisation measures incorporated into the Project, the alignment will still have significant adverse ecological effects. This section of my evidence addresses the ability for NZTA to sufficiently mitigate or offset those short term, long term and potentially permanent effects.

129. Dr Forbes (2018) has adopted the principles in EIANZ (2018) and New Zealand Government's Guidance on Good Practice Offsetting (DOC, 2014) when developing the offsetting package for the Project.

130. While I take no issue with the guidance documents relied on by Dr Forbes, I have preferentially used *Biodiversity Offsetting under the RMA* (Maseyk *et al*. 2018) in my assessment of the proposed biodiversity mitigations and offsets. This is due to the more specific application Maseyk *et al*. (2018) makes of offsetting under the RMA effects management hierarchy. This approach assumes particular importance when dealing with the One Plan policy framework, which is constructed in a manner where offsetting is dealt with separately and last in the RMA hierarchy after measures to avoid, remedy, or mitigate significant adverse effects have been exhausted.

131. Maseyk *et al*. (2018) is consistent with the standards developed by the internationally recognised Business and Biodiversity Offsets Programme ("**BBOP**") and the DOC (2014) guidelines. It is authored by a team of leading biodiversity offsetting experts, with expertise spanning the legal, technical, policy and regulatory aspects of offsetting, with a view to providing assistance to local authorities and consent applicants about mitigation and offsetting programmes.

132. Key messages from Maseyk *et al*. (2018) that are applicable to the development of the Project are;

    a) Biodiversity offsetting is defined as a "*…measurable conservation outcome resulting from actions designed to compensate for residual, adverse biodiversity effects arising from activities after appropriate avoidance, remediation, and mitigation measures have been applied. The goal of a biodiversity offset is to achieve no-net-loss, and preferably a net-gain, of indigenous biodiversity values*";

    b) There is a continuum of responses to effects management. The risk to biodiversity increases at each step along the effects management hierarchy from the most certain and least risky (avoidance) to the least certain and most risky (compensation);

    c) A net-gain offset is demonstrated where gains of target biodiversity generated by the offset action are greater than the losses of target biodiversity due to the

development[12]. The offsets must achieve biodiversity benefits above and beyond that which might be achieved if the offset has not taken place (i.e. the offsets must be additional to the anticipated outcomes of the actions of other agencies or natural regeneration processes);

d) Mitigation and biodiversity offsetting are not the same thing. Mitigations address the severity of an adverse effect at the point of impact, whereas biodiversity offsets for net-gain seek to provide a positive effect greater than the residual biodiversity losses somewhere else. Conditions on mitigation can be required by a decision-maker but an applicant cannot be required to provide an offset or environmental compensation; and

e) There are limits to which offsets can be used. In situations where the residual impacts cannot be fully compensated for because of the irreplaceability or vulnerability of the biodiversity affected, or where there are no technically feasible or socially acceptable options by which to secure gains within acceptable timeframes, an offset would be inappropriate.

133. A number of these points assume significance when considering Policy 13-4 of the One Plan, which requires, among other things, a net-gain biodiversity outcome in response to a proposal's more than minor adverse effects in rare and threatened habitats.

134. NZTA have offered a condition requiring offsetting to achieve a net indigenous biological diversity gain, with reference to Policy 13-4. However, for that condition to be sufficiently certain (in its effect to prevent the Project alignment from triggering avoidance policies under the One Plan) regard must be had to the appropriateness of offsetting when accounting for the irreplaceability or vulnerability of the biodiversity affected. This inevitably involves an assessment of whether the effects can be fully offset due to the nature of the biodiversity affected (i.e. can the irreplaceable be offset on the facts of this case), and the certainty of the offset package (bearing in mind the extent of conservation concern) in terms of feasibility of outcome.

[12] My preference to focus on net-gain instead of no-net-loss is because the One Plan policy (Policy 13-4) on terrestrial biodiversity only provides for offsetting for net-gain.

135. Dr Forbes (2018) suggests that the net-gain position will be achieved through replacing the lost habitat area in a like-for-like manner and with an additional area to address the time lag and uncertainties associated with establishing a native forest successional trajectory [paragraph 86]. Dr Forbes also suggested that ecological integrity (condition) can be gained by undertaking pest management initiatives, as well as legal and physical protection (in perpetuity) of forests.

136. I have reviewed the components of the biodiversity offset package that Dr Forbes has canvassed in his evidence with reference to Maseyk *et al*. (2018) and the requirements of Policy 13-4(d) of the One Plan. Including matters like:

a) The need for ecological equivalence in biodiversity exchange,

b) Additionality - conservation gains beyond what would be achieved by ongoing or panned activities that are not part of the offset); and

c) Feasibility and permanence – the likelihood of being achieved and maintained in the long term and preferable in perpetuity.

137. While these and other matters will all be assessed in greater detail at the time regional council consents are sought for the Project, I am of the view (as I have already stated) that there needs to be some surety at this stage that significant adverse effects can be offset in a manner which meets the One Plan (and therefore the condition that is being offered up for the NOR) or, at the very least, that the NOR corridor can accommodate an alignment which avoids the irreplaceable and vulnerable significant habitat(s).

138. For this reason, I have undertaken a high-level review of the merits of the offsetting proposal (Mitigation and Offset quantities) put forward by Dr Forbes and others. This review does not presuppose any position that may be reached on review of the final design as part of any resource consenting process.

Ecological Equivalence

139. Maseyk *et al*. (2018) describes ecological equivalence as the "*…the degree of similarity in biodiversity values between impact and offset sites across type of biodiversity; amount of biodiversity; equivalence over time, and spatial context (Figure 5).*" I have relied on these four factors of ecological equivalence to check appropriateness and feasibility of the proposed biodiversity offsets.

140. Maseyk *et al*. (2018) Figure 5 is reproduced below (Figure 1):

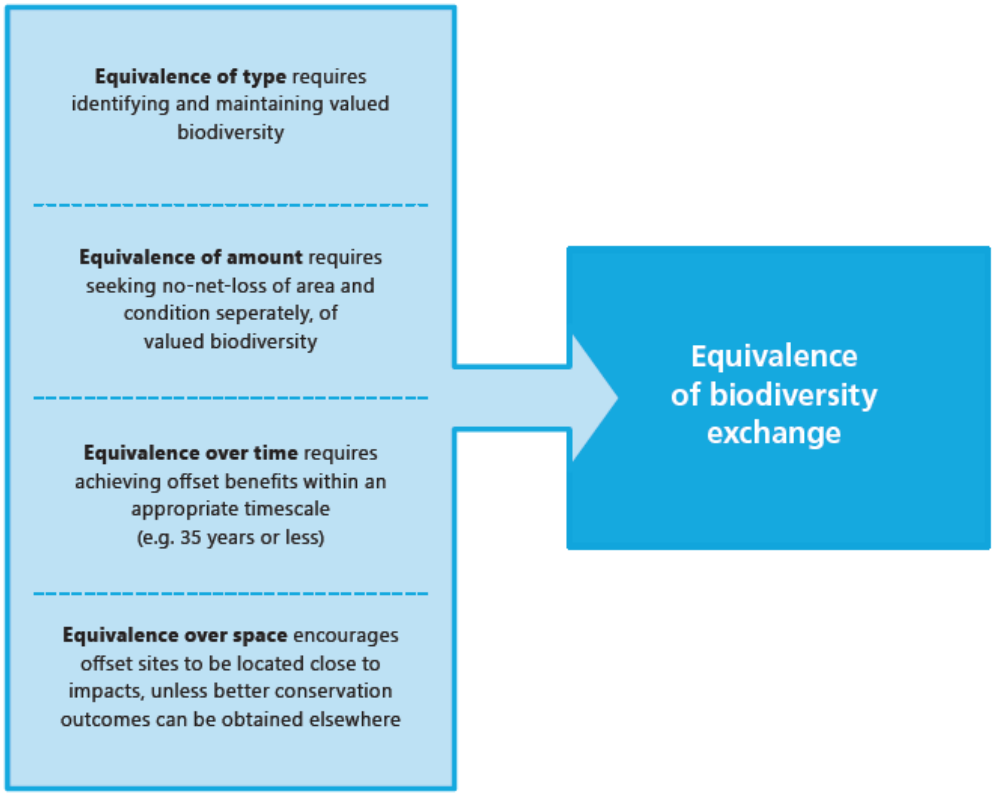

Figure 1: Factors contributing to equivalence in biodiversity exchange (trading up)

Trading-up

141. The re-introduction of rare species to the Manawatū Gorge Scenic Reserve as a type of offset. This is actually termed "trading-up" in the world of offsetting and has potential to provide better conservation outcomes when species of a higher conservation priority are used to offset and effect on species of a lower priority. The reason I introduce the concept in evidence is that it is likely that any response to terrestrial invertebrate diversity will result in some kind of trade in the relative abundance of invertebrate species, and it has been suggested by some submitters that species introduction be considered.

142. Maseyk *et. al.* (2018) described trading-up as an out-of-kind exchange of one type of biodiversity for a different type of biodiversity. Where this exchange involves

exchanging the loss of biodiversity of lesser conservation concern for biodiversity of greater conservation concern (e.g. exchanging non-threatened species for a gain in a nationally threatened species), it is a form of offsetting.

143. However, due to the current lack of metrics and rules to evaluate trading-up, the offset is subjective, and it can difficult to prove net-gain [Maseyk et. al. (2018)]. Uncertainty increases as the dissimilarity between the elements of biodiversity being traded increases. With respect to terrestrial invertebrates (for instance), the trading of a community of invertebrates adapted to the conditions of old-growth forest for a community of invertebrates adapted to re-generating forest potentially lacks ecological equivalence, and so a net-gain is difficult to demonstrate.

144. Maseyk *et al*. (2018) recommends that "*…where out-of-kind exchanges do not trade-up, or trade between Threatened Classifications (e.g. trading great spotted kiwi (Nationally Vulnerable) for bittern (Nationally Critical)) they are not considered offsets but environmental compensation*." How far such compensation goes toward demonstrating net-gain is highly subjective.

Assessment of mitigations and offsets for Terrestrial and Wetland Indigenous vegetation / plant communities including rare plants

145. Dr Forbes recommends a bespoke package of mitigation and offsetting in his evidence. The package forgoes the use of existing methodologies due to concern that they do not capture the complexity of issues and solutions required to manage the habitats within the Western Rise of the Project area, where the old-growth forest, raupo wetland, and the stand of swamp maire are all in very close proximity to one another.

146. I am comfortable with the decision to design a bespoke system. The design of appropriate ecological compensation ratios is still in its infancy in New Zealand and acceptable solutions rely on expert opinion based on experience. I also note Dr Forbes' design has been peer reviewed.

147. The consideration of mitigations or offsets in Appendix 6.A is at step 6 (Calculate losses and gains and offset prescription) of Maseyk *et al*. (2018). Putting aside my concern that more should have been done to demonstrate that the effects on QEII sites are unavoidable and notwithstanding other concerns I have about the offsets demonstrating ecological equivalency, it is acceptable at this stage to begin to capture

the offset prescription in the conditions of consent as a means of accounting for and offsetting for the loss in areal extent of habitat types.

148. The offset proposal still has a long way to go yet in terms of meeting other guideline requirements such as stakeholder participation, transparency, traditional knowledge, and equity. I recommend a condition to include stakeholders on a community liaison group involved in assessing the merit of the offsetting proposal.

149. ***Equivalence of type***. It is Dr Forbes' intent that "…*Replacement planting mitigation treatments* would *be like-for-like in terms of the sites selected and the compositions chosen for planting* [Appendix 6.A. page 63].

150. It is feasible that like-for-like equivalence in species composition can be achieved in 25 years. This is the case even for the "old growth" forest type so long as there is very careful planning, monitoring, and successional planting (to advance forests through their early succession stages to reach the desired type much faster than they would naturally).

151. It would not be feasible to replicate all of the forest structure components in like-for-like equivalence – components such as canopy height, epiphyte load, the forest floor ecosystem, and dead wood load in old growth forests take generations to achieve. I am of the view that this shortfall can be managed through a planting plan that strives for like-for-like in canopy species composition and provides sufficient structure and complexity to replace lost habitats for birds and lizards. I do not consider that it would be sufficient to see a like-for-like habitat replacement for bats (which require aged trees to roost in) or terrestrial invertebrates that rely on a high dead wood load on the forest floor. I discuss this in greater detail below.

152. The need for equivalence of type is not adequately captured in the proposed conditions. I recommend the addition of another bullet point to Condition 17) a) 3) H) which requires that the EMP specify a programme of planting that achieves like-for-like replacement of canopy species composition. For greater certainty in outcome, the draft EMP should include a tentative 25-year plan that describes the anticipated species composition ratios as milestones for each habitat.

153. ***Equivalence of amount***. The ECRs are scaled to deliver the same (for habitats of lesser value) or significantly more (for vulnerable habitats) areal extent of each habitat type. I

am satisfied a net-gain in areal extent of habitats has been demonstrated even when having regard to the near-irreplaceability of old growth forests and wetlands. This is due to the effects envelopes approach having had regard to avoiding effects down to a point where offsetting the areal extent of loss is technically very feasible.

154. *Equivalence over time*. The ECRs are scaled on the basis of vulnerability with the intent that the higher ratios also compensate for time-lag. I believe the offset benefits to birds (naturally) and lizards (via transfers) related to increased area are likely to occur in just a few years of habitat re-establishment. I am reasonably satisfied the offset caters for time-lag effects on birds and lizards. Some kind of trade potentially occurs for bats (if they are present) and definitely occurs for terrestrial invertebrates as the types of invertebrates found in old growth forests are likely to be different from those found in young restored forests of the same canopy composition. The type of trade in invertebrates cannot yet be estimated as the invertebrate species composition is not known.

155. *Equivalence over space*. At this stage, I am reasonably satisfied that there is sufficient space to attain the anticipated like-for-like equivalence of landscape context. However, I remain concerned that the success of the offsetting proposal rests on the perpetual cooperation of the owners of that land.

156. A related concern is whether there is enough area of wet land available for restoration planting of seepage wetlands. The restorative planting of exotic-dominant wetlands can offset the loss, but requires perpetual occupier cooperation. With respect to the improvement of existing indigenous-dominated wetlands, there is a point beyond which an indigenous-dominant ecosystem (defined as a system that has at least 50% indigenous cover) needs intensive intervention or just a bit of targeted pest plant control. For instance, the quality of the wetland at Ashhurst Domain can be improved with pest plant control but there is very little wetland space left that is not already greater than 90% indigenous cover. It is therefore unclear whether replanting in this area will demonstrate the necessary net-gain.

157. To demonstrate spatial equivalence, maps will be required to show precisely where each of the vegetation types will be situated within the designation. Maps at this next stage could be posed "by way of example" if negotiations with land owners / occupiers are yet to be concluded. However, I am of the view that these maps should form part

of the Ecological Management Plan, and for review as part of any related outline plan process.

158. To comment on the difference between the "mitigation" planting and offsets - the difference between the two is a matter of ecological equivalency in space. The general intent for the "mitigation" plantings outlined in revised Table 6.A.1 [Forbes (2019), letter to Wildlands, page 26] is to join existing areas of habitat. They can be considered mitigations rather than offsets as they are close to point of impact and there is high ecological connection retained. The use of Ashhurst Domain as a site for planting, while is close enough for some ecological connection (for example, the genetic exchange of material between forests through bee pollination), it is not close to point of impact and is too far away (for instance, for *Peripatus*) to be considered fully ecologically connected.

159. ***Ecological Equivalence - habitats - conclusion***. I am reasonably satisfied that the vegetation offsetting prescription of Dr Forbes achieves a net-gain in terms of replacing the communities of canopy species and endangered flora affected by the Project. There is some doubt over feasibility of the offsetting outcomes given the uncertainty over land owner/occupier cooperation. That uncertainty will only be removed on further consultation and development of planting plans. The habitat replacement is likely to result in a net-gain for birds and lizards. The habitat replacement is likely to be some kind of trade for bats and terrestrial invertebrates. I discuss the suitability of that trade below.

Assessment of mitigations and offsets for native birds

160. Blaney and Sievwright (2018) conclude with regard to 6.B.7.5 Avifauna [Appendix 6.B, section 6.B.7.5, page. 67]: "*…the following actions or periods of action are recommended to be* avoided *where practicable.* ***None of the following are required*** [my emphasis] *(because of the assessed values) avoidance, but are methods to reduce effects and present opportunities to avoid effects…*"

161. I find this conclusion confusing. Blaney and Sievwright go on to say "…implementation *of these avoidance and mitigation actions (as well as the general recommendations for all fauna) will result in the proposed designation corridor having a* ***Negligible*** *to* ***Low*** *magnitude of effect on avifauna present (or potentially present) across the site."*. [Appendix 6.B, section 6.B.7.5.1, page 67.]

162. In my opinion, the avoidance measures will be necessary to ensure the effects remain at a low magnitude. The measures have been included in the avifauna management plan and I recommend they are kept within the plan, rather than dismissed as optional. The exception is herding nestling dotterel or moving nests – both of which (in my opinion) will be likely to result in mortality.

163. Blaney and Sievwright may have intended to confirm that an offset is not required because the avoidance and mitigation actions result in negligible to low effects on native birds. I would agree with this conclusion except for the lack of attention given to the operational effect of bird strike.

164. I have therefore reviewed the proposed offset with regard to the effect of bird strike. Relevantly, when considering offsetting, I note that Blaney and Sievwright agree: "…*In the long term, as a result of increased habitat availability and potential predator control improving habitat value and ecological health, there is likely to be a net-gain in terms of the ecological value of avifauna within the wider* area." [Appendix 6.B, section 6.B.7.5.1, page 69].

165. As discussed under Existing Environment above, the possum RTC index is likely to be below 5% in both the habitats to be replaced and in the recipient areas. In my opinion, there is little potential for NZTA to use possum control as a tool for (and proxy demonstration of) net-gain. On the other hand, rat and other predator populations may begin to increase in restored habitats as the habitats get better for them. This may be able to be managed through the collaborative actions of stakeholders but this is yet to be established. I recommend a condition addressing the inclusion of stakeholders (in the form of the Community Liaison Group) to discuss offsets.

166. **Equivalence of type**. In my opinion, the species of birds likely to inhabit restored areas – particularly areas planted close to the MGSR - will be as listed in Appendix 6.B. The only significant difference I note is the increased risk of bird strike in habitats planted / remaining close to the road. The effect arising from planted habitats can be addressed by a condition that the planting plan layout give consideration to reducing the risk of bird strike (i.e. that the planting does not induce birds to move through traffic). However, it does not address effects from the remaining habitat that has a road through or next to it.

167. **Equivalence of amount**. There is a gross assumption that a greater area of new habitat should result in a greater number of birds. It is unclear how each species will adjust to the opportunity, however. There may be an inappropriate trade (e.g. a few less whitehead for a lot more fantail) but this will not be known until post-operational monitoring of the key indicator species

168. The "incentive" identified in the AEE to further reduce vegetation clearance caused by the ECRs works against habitat replacement being a mitigation or offset for bird strike. That is, the smaller the area NZTA needs to re-plant and control pest in, the less likely the restored and managed habitats contribute to mitigating the effect of bird strike. This is because the basic effect of bird strike is caused by the introduction of traffic to the environment, and is not an effect directly linked to habitat loss. In my opinion, the logical ecological connection between losses to bird strike and the gain in areal extent of habitat has not been properly established in the AEE. The only way to establish the significance of bird strike and the appropriateness of the response is to undertake post-construction operational monitoring of key indicator species.

169. At this stage, I do not believe the re-introduction of a species missing from MGSR (such as North Island robin, weka, or kiwi) is necessary to demonstrate a net-gain offset. However, should construction activities be confirmed as resulting in the mortality of dotterel, pipit, or whitehead, or should post-construction monitoring of avifauna in restored habitats show key species are absent, then species re-introduction might be an appropriate follow-up response.

170. Any species re-introduction will need to clearly demonstrate how (for example) the loss of a few individuals of dotterel, whitehead, or pipit for the return of North Island robin (for instance), is a "trade up". The re-introduction of whitehead into the Ashhurst Domain restored habitats in 25 years' time – if they do not get there by themselves – represents a good example of a species re-introduction that demonstrates ecological equivalence of type and amount and would, in my opinion, result in a net-gain. The opportunity to explore avian species re-introductions as a response option still available and could arise through Community Liaison Group discussions or the consultation with DOC and tangata whenua.

171. **Equivalence over time.** It can be expected that there will be some lag between the restoration of habitats and the utilisation of them by native birds. The lag depends on

equivalency over space and habitat structure, as well as what the birds are using the habitat for. It may be reasonably assumed that habitats restored in close proximity to the QEII areas and the MGSR will begin to be utilised for food and nesting very early on (within 5 years). I am reasonably confident the ECRs give equivalency over time for most bird species found in the affected habitats.

172. Whether whitehead already utilise existing habitat at Ashhurst Domain has not been established. Assuming they are not there presently, it may take the full 25 years (or longer) before the replaced alluvial forest is mature enough to support the habitat requirements for this species. The degree to which the ECRs compensate for the lag for whitehead is not really possible to demonstrate. It requires good information on the rate of re-establishment of this key indicator species (and there is none that I am aware of).

173. It is important then that the avian management plan seek to avoid whitehead mortality rather than compensate for it. Should whitehead (or other bird) mortalities be detected and should the replacement habitats fail to provide for this species, a whitehead re-introduction project might be a suitable way to re-dress the effects and demonstrate a net-gain. The same applies for marsh crake in the wetlands.

174. Equivalence over space. Restored sites closest to the point of impact have a very high equivalency over space. Subject to third-party perpetual cooperation (which is not certain), I am comfortable that this requisite could be met. Ashhurst Domain presents the furthest opportunity for birds presently in the Western Rise and QEII areas to utilise restored habitats placed here. Ashhurst Domain is about 5km from the Western Rise and it may be reasonably assumed that birds such as tui and bellbird will travel between the sites, particularly if there is replaced habitat between them.

175. Note concerning birds and predator management. Possums, rats, mustelids, and cats as predators of indigenous fauna, particularly birds, is a well-established fact. However, New Zealand bird species exhibit complex responses to the varied and sustained management effort – some positive (e.g. larger species such as kaka and kereru) and some negative (e.g. fantail numbers tend to drop) (Fea, 2018). Therefore, the general conclusion linking the proposed possum and rat management targets to a net-gain in biodiversity from the avian perspective lacks ecological context. Objectives

to maintain possum and rat RTCs to<5%, or to increase the predator trapping effort in and of itself may not result in the gains generally assumed.

176. **Ecological Equivalence – birds - conclusion.** I am reasonably satisfied that the vegetation offsetting prescription of Forbes could achieve a net-gain for birds affected by the Project. Emphasis is placed on the avian management plan to avoid effects in the first instance.

177. The habitat offset can be reasonably expected to address residual operational effects arising from bird strike as long as vegetation restoration plans take the risk into consideration. Predator control might very well also mitigate the risk of bird strike and mortalities associated with construction, but further investigation is need as to pest densities and bird community response before concluding pest management will result in net-gain.

Assessment of mitigations and offsets for bats

178. The need to demonstrate net-gain with respect to bats does not yet exist. Further survey work is still to be completed. The avoidance of a direct effect of construction activity on bats is otherwise achievable through the proposed concept of a bat management plan, and I support the use of such a plan to quantify immediate effects and manage their remediation.

179. As discussed under Existing Environment above, possums and rats are already being managed by DOC in the MGSR, and the possum RTC in the old growth QEII forests may be below 5% as the results of MWRC efforts. In my opinion, there is little potential for NZTA to use possum and rat control as a tool for (and proxy demonstration of) net-gain for bats.

180. **Equivalence of type.** Blaney and Sievwright describe the preferred characteristics of bat roosts [Appendix 6.B, section 6.b.2.1.3, pages 5-6] which I summarise as big, old trees in intact forest. The habitat restoration offset proposal simply cannot emulate this outcome in 25 years. Therefore there is no equivalency in type. This is a critical observation whether bats are actually present or not in the habitat affected by the alignment. The old-growth habitat presents future opportunity and potential for bats to re-establish if other biodiversity restoration activities by other agencies are successful. The opportunity is removed by the proposed activity and not replaced.

181. **Equivalence of amount**. While the proposed areal extent of replacement forests may be similar in the signature species composition of old growth forest, the amount of "old" will be severely lacking. The ECRs are aimed at the irreplaceability of habitats on the basis of extent, not age.

182. **Equivalence over time**. It may be assumed that the restored habitats will eventually reach an age old enough to be useful roosting habitat for bats. As the ECRs are aimed at the irreplaceability of habitats on the basis of extent, not age, it cannot be assumed that the significant time-lag will be offset.

183. **Equivalence over space**. I am of the opinion that the observed "non-detection" of bats in the MGSR is a good indication that bats are struggling to move around the last remaining remnants of habitat in the Tararua and Manawatū Districts. Restorative planting that is not immediately adjacent to the affected areas is unlikely to offer significant gains in habitat as it will be too far away to be useful.

184. **Ecological Equivalence - bats – conclusion**. I question the overall conclusion [Appendix 6.B, 6.B.8, page 69] that implies that the proposed habitat restoration and pest management regimes will result in a net-gain for bats. The conclusion is not linked to the main observed effects (i.e. loss of old growth roosting habitat requires replacement with old growth trees, not young forest) and pest control may not provide the anticipated habitat quality gains.

185. If the need for an offset particularly tailored to bats arises, then it is my opinion that it may be very difficult to demonstrate that net-gain is achievable. If bats are found in or near the old-growth forest habitats posed for clearance during the next tranche of monitoring, or during the site walkovers, destruction of those habitats must, in my opinion, be avoided. Management through plans will not suffice in those cases.

Assessment of mitigation and offsets for lizards and frogs

186. I find the approach for managing effects on lizards well-reasoned. The avoidance or remedy of a direct construction effect is achievable through the proposed lizard management plan. It is difficult at this stage to identify whether there are existing recipient sites to be absolutely confident that the plan will be successful, but based on the information collected so far, it appears there is likely to be capacity within existing habitats to take on translocated lizards.

187. As the suitability of the recipient sites (which I assume includes assessing capacity to accommodate additional lizards and predator-free status) is a consideration in the lizard management plan, I am comfortable with the conclusion that the effects are likely to be minor. Subject to spatial equivalency, habitat improvement aspirations, and predator control, the lizard management plan approach is more aligned with effects hierarchy, than being an offset / compensation response to the habitat loss.

188. It is correct that pest management initiatives resulting in improvement in habitat quality (browser removal) and reduced predation (particularly cat and rat removal) will benefit lizards. Putting aside possums as a significant browser and the problem NZTA has with demonstrating that possum control leads to a net-gain; fencing to exclude ungulate browsers, targeted cat and rat control in existing lizard habitats and recipient sites, and establishment of additional new habitat though the offset planting are actions that very likely to result in a net-gain for lizards over the long term (25 years of offset maturity).

189. The EMP / Lizard management plan however needs to be very specific about these management actions and how they are linked to the herpetological response.

190. As the ECRs incentivises NZTA to do less damage it may result in less habitat to be replaced and therefore a smaller net-benefit being demonstrated. However, as I consider the response for lizards to sit more on the remedy/mitigation end of the spectrum of effects management, the need to demonstrate gain through offsetting less important.

191. Given the extreme rarity and limited distributions of New Zealand native frogs, if any native frogs are detected in any habitat within the designation area, I am of the view that the alignment must avoid the native frogs.

192. **Equivalence of type.** From a lizard perspective, the offset and mitigation plantings would result in equivalency for cover-types and food sources fairly early within the restoration process (within five years). In my opinion, it can be reasonably assumed that there will eventually be equivalency in invertebrates as food sources (within 25 years). This is despite my concern over invertebrate species composition and rarity, which I discuss later in my report. For lizards, the invertebrate food supply suitability is about having sufficient biomass of suitable prey items, rather than equivalency in species composition.

193. **Equivalence of amount**. It is accepted that the areal extent of the proposed habitat leads to an increase in lizard habitat and lizard populations.

194. **Equivalence over time**. As long as the lizard management plan objective is to repatriate lizards into suitable sites which have existing vacancy, there will be no time lag. There will be a lag before restored offset habitats are "ready" but this could be as early as 5 years. It is my opinion the ECRs sufficiently cater for the time lag (in terms of habitat readiness) for lizards.

195. **Equivalence over space**. As long as the lizard management plan objective is to repatriate lizards into suitable habitats very near the point of effect, the outcome can be seen as a remedy for the direct effect on lizards.

Assessment of mitigation and offsets for invertebrates

196. I have identified that there is a contradiction between the observation about the response of invertebrates to newly restored habitats in Appendix 6.B and the general conclusion that the increase in areal extent of habitat and pest control will equate to a net-gain in terrestrial invertebrate diversity.

197. In my opinion the ecological attribution of pest control and habitat improvement in the "replacement planting" areas (which aim to improve the existing habitat to benefit invertebrates in old-growth forests in-situ) needs to be considered separately from the "offset planting" and pest control in brand new habitats (which offers increased area for new invertebrate communities to exist, but these communities are unlikely to replicate those of habitats lost).

198. **All forms of equivalence**. The ECRs for the "replacement planting" (i.e. existing habitat to be improved through inter-planting, reduction of edge effects, browser control, and predator control) offer an increased area of higher quality habitat, within close proximity to the point of impact. This best serves the invertebrates *in-situ*. However, as the evaluation system used habitat quality as a proxy, these habitats are not the habitats assumed to likely contain rare or vulnerable invertebrate fauna. So while it may result in a net-gain in some invertebrates, it fails to deliver on gains for the invertebrates most at risk.

199. The ECRs for offset planting, while larger than the area lost, are unlikely to lead to the replacement of the same community when measured as a similar species relative abundance. This community dissimilarity might even be at higher levels (than species) of biodiversity measurement such as community structure (which can be expressed in terms of "guilds" based on their main roles in ecosystem function; for example, "predator", "herbivore", "detritivore", "nectivore" / "pollinator") or rarity, or vulnerability of key species. The ECRs calculation does not give any account specifically related to different invertebrate dispersal mechanisms (which are a spatial equivalence and a time-lag problem) and the need for aged woody detritus on the forest floor to support the forest floor invertebrate community.

200. In my opinion, there is likely to be some kind of trade in the form of habitats that create a greater diversity and quantity of common invertebrates (particularly flying insects) for an unknown loss of rare or slow dispersing invertebrates. What is exactly being traded is not known at this stage and there is no demonstration of ecological equivalence at all levels.

201. I do not agree with the general conclusion that there will be net-gain in the invertebrate community.

202. The absence of any net-gain for invertebrates poses a problem when considering Policy 13-4 of the One Plan. A solution may lie with some further qualitative assessment of indices of invertebrate community health, such as species relative abundance, species richness, functional guild richness, and size classes, and/or the identification of presence of rare species or species with slow disperal in the high value habitats using pitfal trapping, malaise trapping and/or other suitably recognised invertebrate collection methods. This information may be used to benchmark the trajectory of invertebrate communities in replaced, restored, and rehabilitated habitats, with strategic milestones and responses to facilitate a net-gain in invertebrate community diversity over 25 years. This would necessitate the development of an invertebrate management plan to ensure that these matters were addressed.

Assessment of mitigations for natural character

203. While I feel more should have been done to relate the observations from Appendix 6.A to Policy 6-8 to derive the natural character attributes assessment, I am comfortable with Dr Forbes' riparian assessment captured in Appendix 4.A. However, the

assessment approach applies to the areal extent of the riparian margin (hectares or square metres affected)), not to stream length. It is then difficult to extract this as a length of stream to be enhanced. In my opinion this adds further support to the proposition that the effects envelopes and the net-gain achieved by biodiversity offsetting does not readily translate into the avoidance, remedy, or mitigation of the effects on natural character.

204. This then calls into question whether the assessed reduction in natural character of stream margin attributes is actually correct. As the assessments parallel the biodiversity effects assessment (**with offsets**), it would appear the biodiversity **offset** has also been included in the natural character effects assessment. This would be an incorrect application of the offset with reference to One Plan Objective 6-2 where the effects are to be avoided, remedied, or mitigated (without any offsetting provision).

205. For wetlands, I believe the relationship is simple, but this will be due to my opinion that the character of indigenous vegetation is a primary indicator of the persistence of indigenous ecological processes in wetlands. The replacement of larger areas of exotic-dominated wetland margin with indigenous-dominated wetland margin, to my mind, will increase the natural character of these sites.

8 Review of submissions

206. To address the submission points relating to the effect of the proposal on terrestrial, wetland, and aquatic ecosystems these efficiently, I have grouped by the topics of: Indigenous Vegetation and Habitats; Freshwater Values; and Ecological Offsetting and Mitigation.

Indigenous Vegetation and Habitats:

207. The concerns expressed by DOC appear to be largely addressed in the more recent response of Forbes (2019). As I have already stated, I concur with the approach to map all areas of indigenous vegetation and exotic-dominated seepages. Otherwise matters such as freshwater ecology will be matters for further scrutiny at the resource consent stage.

208. The very general concerns expressed by the New Zealand Royal Forest & Bird Society ("**Forest and Bird**") regarding the adequacy of the ecological assessments to detect the

full extent of indigenous fauna and flora lack enough specificity for me to adequately respond. As expressed in my assessment of ecological equivalencies, I agree there has been insufficient quantification of some of the key aspects of biodiversity to be certain that the proposed offsets will achieve a net-gain in biological diversity. However, I do refrain from suggesting that the entire indigenous diversity (which includes soil microbia, fungi, and forest floor flora) of the NOR be assessed for reasons of impracticality.

209. As canvassed earlier in my report, I remain concerned about the level of consideration given to invertebrate values and I find that the response of Forbes (2019) inadequately addresses the issue of demonstrating ecological equivalence for invertebrates. While invertebrate values could have been overlooked or placed into the gamut of "impractical" along with soil microbia and fungi, I believe that the near "irreplaceability" of certain habitat types increases the level of scrutiny "down the list" of biota that are difficult to enumerate.

210. I have concerns that there is insufficient consideration of alternatives to crossing the QEII Open Space Covenant Areas for the same reasons expressed by the QEII National Trust (QEII).

211. QEII also challenges the adequacy of the AEE when having regard to the proximity of the corridor to four other covenanted blocks on the Bolton property. I assume these effects refer to operational effects associated with bird strike and/or the disposal of stormwater run-off. I agree these matters could be better addressed and I have, in particular, queried bird strike.

212. That DOC and QEII opposes the proposal bears relevance the assessment of the feasibility of the offset (particularly in circumstances where it is to address high conservation concern). Their opposition creates doubt over whether NZTA will successfully gain the third-party cooperation needed for implementing some of the proposed offsets (e.g. gap planting, extension of QEII covenant over re-planted areas in affected catchments, pest management in the MGSR). As I have already indicated my preference is for the requisite legal agreements and authorisations to be in place before any work commences.

Freshwater Values - Habitats, flora and fauna

213. Forest and Bird are concerned that there will be a significant impact on resident native species, riparian margins, and riverine/in-stream habitat. Forest and Bird disagree with the assessment in Appendix 6.C (freshwater ecological impact report) that the downstream reaches of the Manawatū River and tributaries are unlikely to be directly affected. While these are matters that Mr Brown attends to in his report, the concerns expressed by Forest and Bird mirror my own with respect to accounting for effects on the natural character of the riparian margin of streams. Forest and Bird's submission voices concern that there may not be an area of stream large enough to accommodate the riparian planting proposed. I agree.

Ecological Offsetting and Mitigation – proposed concept

214. Submitters Rachel Keedwell, Brent Barrett, Manawatū River Source to Sea, Forest and Bird, and DOC all express concern over the lack of clarity about where mitigations and offsets will take place, and whether they will be commensurable to the loss of habitat predicted by NZTA. The Manawatū Gorge Governance Group (the "**MGGG**") anticipates that the Project will result in a net-gain for the biodiversity of the area. However, the MGGG requests to be further involved in the design of management plans and desires the "*…opportunity to further understand how the net-gain will be measured and achieved…*"

215. In my opinion, all of these submissions, whether from concerned, neutral, or positive submitters, indicate there is insufficient certainty in the proposal. Certainty and clarity are key expectations of any biodiversity offsetting proposal, and to my mind, NZTA has not yet demonstrated that the proposal will achieve a net-gain in irreplaceable habitats to the necessary standard of proof as per Appendix 6.A. [Figure 6.A.8. page.62].

216. To meet expectations of equity, further opportunity should be given for agencies, relevant conservation stakeholder groups, and affected land occupiers to participate in the design of the offsetting package. NZTA also needs to demonstrate that the proposed contribution in biodiversity gain is above the contributions already made by these groups within the anticipated offset area.

Ecological offsetting and mitigation - pest management

217. Brent Barrett considers it appropriate for impacts on biodiversity and the environment from physical buildings and operation to be offset by establishing the Manawatū Gorge as a predator free zone. Forest and Bird go as far to identify a specific target (5% RTC) for possums and rats. Rachel Keedwell also identifies that extensive predator control would be a suitable mitigation, though does not specify targets or areas.

218. The Manawatū Gorge could be a potential recipient site for offset pest control but as canvassed earlier in my report, the outcome indices of pest control entirely attributable as on offset would need to demonstrate a substantive difference between the existing environment pest index and a target pest index that will produce greater biodiversity benefits. It will be harder to demonstrate this gain in the MGSR independently of the efforts of other agencies, compared to achieving the same gain in areas not presently under predator management.

219. Certainly, the suggestion of the Forest and Bird to reduce tracking indices to 5% RTC is unlikely to be over and above the effort already achieved and therefore cannot be construed as a net-gain. Also "predator free" (which I understand means no predators of any kind) is not likely to be an achievable objective as the Manawatū Gorge will be subject to the continued invasion of cats and mustelids from the surrounding landscape.

220. I note the concern of Forest and Bird that the old road will become a conduit for pests. The extent to which this is likely to happen is pest-specific, and with respect to ungulates, rats, and possums, I would surmise will be very low given the pest management activity already occurring on the south side of the gorge. Cats and mustelids may be preferentially using the road now more than when it was operating, but to be concerned about the road being a conduit of these pests assumes that they are not already in either Woodville or Ashhurst. Weeds will become a problem – not so much though the gorge as a conduit (there is not weed transporting mechanism) – but as an increasing source of seed that could affect the indigenous habitats of the gorge. Restoration of the road surface into indigenous habitat through planting would reduce the problem to a manageable extent. However, whether this is NZTAs problem to resolve as part of the NOR designation is something of a side issue.

Ecological offsetting and mitigation - Re-introduction of species missing from the Te Āpiti area

221. Brent Barrett identifies that it is appropriate that impacts on biodiversity and the environment caused by physical building and operation are offset by re-introducing rare native birds and animals to the Manawatū Gorge.

222. As explained above, while the re-introduction of missing species would be a net increase in faunal diversity, NZTA would need to objectively demonstrate the "trade up" to show that this is a net-gain in biodiversity and commensurate with the loss of habitat. Species re-introductions may be a way NZTA can prove net-gain beyond reasonable doubt if the ECRs by themselves do not.

Ecological offsetting and mitigation - Areal extent of offset habitats to be planted

223. Brent Barrett identifies that area for area replacement of lost habitat with new plantings insufficiently accounts for the ecological values inherent to mature forest and supports an alternative approach. As discussed in [mitigation and environmental offsetting above] the proposed offset / mitigation planting does more than replace areal extent like-for-like with ECRs that compensate more-for-like to attempt to account for an compensate for the ecological values inherent to mature forest. Subject to the issues I have identified, ecological equivalence (over the long-term) may be achievable.

224. Meridian's opposition to the identification of the windfarm as an opportunity for revegetation has been addressed in the "Mitigations Workshop" response dated 15 February 2019. NZTA's response to Meridian's opposition highlights the concern I have with depicting the potential areas without consideration of occupier cooperation.

Effects on dotterel

225. Forest and Bird note that Condition provision 16. c) iii. B. states "*if nesting dotterels are present, require… the relocation (by herding) of the dotterels*…". I agree with Forest and Bird's observation that the response is unreasonable and is likely to cause harm rather than avoid effects.

9 Draft Requirement conditions

226. The effects envelopes are put forward as a means of avoiding effects. It is very important then that these envelopes are reflected in the conditions. However, there is a problem that the presence of bat roosts would increase the irreplaceability of the habitat to the point the habitat should be avoided (and so the envelope should be zero). Also, it may be necessary to avoid clearance of some areas where the effects on lizards or nesting birds must be avoided. Therefore, any condition for envelope/areal extent on the designation needs to cater for the possibility of reducing area sizes subject to the species management plans / specific effects on fauna.

227. Conditioning the ECRs is a useful way to give some certainty to offsetting the loss of areal extent. It also incentivises NZTA to avoid habitat reduction. It would be useful if the proposed ECR and offsetting regime was supported by a prescriptive offset planting plan that specifically identifies the areas where offsets are to occur, and details of the species mix, timing, plant spacing and layout, and size of the plants at time of planting. The plan should include specifications for ongoing maintenance and management of planted areas including pest management, and other technical considerations such as planting times and staging where planting needs to occur over a period of time, planting methods, including ground preparation, mulching and any trials.

228. The planting plan can capture the ecological considerations expressed by Dr Forbes and others that are highlighted in the AEE such as species genetic source and propagation, and also detail where the sites would be subject to translocation of other species necessary for that ecosystem type. Translocations could include (but are not limited to) lizards, birds, and invertebrates.

229. There should be a condition with details of legal protection to ensure long term protection of offset areas, and detail of fencing and other physical works necessary to protect planted areas should be included in a planting plan.

230. The planting plan should consider how plantings close to the road can be done in a way that reduces the potential for bird strike. The planting plan should also explain how the mitigation and offset planting meets the Department of Conservation Offsetting Guidance and Maseyk et al. (2018), with having particular regard for

ecological equivalence, and the vulnerability, rarity, and irreplaceability of the affected habitats.

231. Any conditions on avifauna management plans should remove reference to permitting the disturbance of nests, nestlings, and fledgling birds. As stated, I believe this will result in mortality and the nests should be avoided.

232. Similarly, any condition regarding bat management plans should remove reference to permitting the removal of bat roosts. Bat roosts should be avoided and measures put in place to retain any active bat roost.

233. I believe an invertebrate management plan, styled on the avian or lizard plan should be considered as a condition. This plan should set out the methodologies, and timing of invertebrate surveys and specify indices of invertebrate community and rarity that can then be used to track (and if necessarily enhance) the invertebrate community composition in offset sites. Indices might include (but are not restricted to) functional guild, species diversity at higher taxonomic levels (division, class, order, family etc.), and/or size class diversity.

234. An invertebrate management plan needs to note the observed presence of rare or at-risk species and cater for their restoration in offset sites where necessary, or cater for their habitat improvement in mitigation sites in a manner that effectively mitigates for the loss of habitat though vegetation clearance.

235. To improve the social equity of proposed offsets, I recommend that any condition relating to the establishment of a community liaison group facilitate stakeholder input into the offset design. In addition to the recognition of DOC and tangata whenua as affected parties, the occupiers of land subject to the offsets and the QEII Trust should also be invited to the group.

James Stuart Lambie

1 March 2019