

BEFORE THE HEARINGS COMMITTEE

IN THE MATTER of hearings on submissions
concerning the proposed One Plan
notified by the Manawatu-
Wanganui Regional Council

**Evidence and
Supplementary Recommendations
of Fleur Maseyk
for the Biodiversity hearing**

INTRODUCTION

1. I have prepared this report as supplementary to my Section 42A report. It has been compiled in response to evidence received, issues raised during pre-hearing meetings, and during expert caucusing. During the course of these meetings, and in considering the expert evidence received, I have revised some of my recommendations as they appeared in my Section 42A Report. These revised recommendations are presented here.
2. I have read, and comment on here, the technical evidence of the following ecological and planning experts:
 - Matiu Park (Boffa Miskell for Trust Power Ltd. and Meridian Energy)
 - William Shaw (Wildland Consultants Ltd. for Mighty River Power)
 - Amy Hawcroft (Department of Conservation)
 - Graeme La Cock (Department of Conservation)
 - Richard Matthews (Mitchell Partnerships for Genesis Energy)
3. I organised and participated in expert caucusing with meetings held on 16 July, 5 August and 11 August 2008. I also attended three pre-hearing meetings, and was present for part of the two expert caucusing sessions between Regional Council and District Council planners. Issues and resolutions tabled at these meetings have been incorporated into this supplementary evidence.

EXECUTIVE SUMMARY OF SUPPLEMENTARY EVIDENCE AND REVISED RECOMMENDATIONS

4. After consideration of the technical expert evidence, and subsequent discussions during, or in association with, caucusing and pre-hearing meetings, I have revised some of my recommendations as presented in my Section 42A Report.
5. There are a number (10) of recommendations put forward through this process that I agree with. Other issues (6) have been resolved prior to the Hearing and the outcomes are presented within this report. There remains only one area of disagreement, the reasons why are also discussed within this report.
6. A summary of the issues raised, the outcome, and the reasons for the agreement or otherwise are presented in Table 1 (issues raised by the technical experts within evidence or during meetings), and Table 2 (issues raised by submitters during pre-hearing meetings). Further explanation for recommendations on respective issues is provided where required below each table.
7. The focus of submissions and evidence was on the content and presentation of Schedule E, rather than the methodologies and framework upon which Schedule E was developed. Therefore, I have not discussed further my evidence (as presented in my Section 42A Report) regarding the development of Schedule E within this report.
8. However, Schedule E has been considerably reworked in terms of content and structure over the last months, and a revised version is presented here (Appendix 1). Due to the nature of the changes I considered it to be unhelpful to present the revised Schedule E with 'track changes'. Instead, I discuss in detail the changes made to Schedule E. I have also indicated within Table 1 and Table 2 where the revised

recommendation has been incorporated into the revised Schedule E. The revised Schedule E is presented as an appendix to this report.

9. This report is presented in four parts:
 - i. Matters raised by technical experts
 - ii. Matters raised by submitters during pre-hearing meetings
 - iii. Revision of Schedule E
 - iv. Other Matters (the question of significance)
10. Key issues raised and addressed within this report are:
 - **Clarity, content and usability of Schedule E** The revised Schedule E as presented in my Section 42A report was largely supported by experts and submitters. However a number of areas were highlighted where further improvement could be made. Such changes include:
 - clarity of habitat type definitions;
 - more detailed habitat type descriptions;
 - improved use of references; and
 - general lay-out.
 - **The addition of habitat types to Schedule E** (Table E.1) Habitat types have been recommended for addition to Table E.1 to more completely represent the important habitat types present in the Region. Specifically, the addition of:
 - Threatened habitat type: 'kowhai-broadleaved forest';
 - At Risk habitat types: habitat supporting divaricating plant species, 'tussocklands below the treeline', forest supporting *Powelliphanta* land snails; and
 - Rare habitat types: 'karst systems', and 'scree and boulderfields'.
 - **The addition or refinement of inclusion (Table E.2(a)) or exclusion (Table E.2(b)) criteria:**
 - inclusion of additional criteria relating to recommended additional habitat types;
 - deletion of unnecessary criteria; and
 - refinement of some criteria for purposes of clarity and accuracy.
 - **A more effective approach to provide protection for threatened species** (Table E.3). This was achieved by:
 - the inclusion of specific habitat types to provide for habitat that supports significant fauna (see above);
 - clarity within certain habitat types already in Schedule E to indicate that they provide habitat for threatened species; and
 - the removal of the Proposed Table E.3.
 - **Assessment criteria** for determining the ecological value of areas of habitat. The criteria used to assess an area of habitat type included in Schedule E (Table E.4) has been re-presented in light of:
 - a need for further clarity regarding what each criterion incorporates;
 - the equivalence between Schedule E, and areas that would be considered significant under Section 6 of the Resource Management Act; and
 - the placement and weighting of the assessment criteria within the Plan (as per Helen Marr's report).

11. Areas of agreement regarding the Notified Schedule E as indicated in the evidence presented to the Hearing Panel by the technical experts are not discussed here.
12. I am happy to assist the Panel with further discussion around any of my initial or revised recommendations.

PART I: MATTERS RAISED BY TECHNICAL EXPERTS

Table 1: Summary table of matters raised by technical experts in evidence, during expert caucusing or at pre-hearing meetings on the biodiversity provisions of the Notified Proposed One Plan (specifically Schedule E).

AH = Amy Hawcroft (Department of Conservation), GLC = Graeme La Cock (Department of Conservation); RM = Richard Matthews (Mitchell Partnerships for Genesis Energy); MP/TP = Matiu Park (Boffa Miskell for Trust Power Ltd.); MP/ME = Matiu Park (Boffa Miskell for Meridian Energy); WS = William Shaw (Wildland Consultants Ltd. for Mighty River Power)

Text recommended for addition is shown in underline, with text recommended for deletion is shown in ~~strike through~~.

Plan heading	Matter raised	Expert	Expert recommendation	Degree of agreement	Explanation / Outcome
Schedule E	Definition of coastal dune habitat and the recognition of dunes as a active system and a threatened habitat type.		Amend definition of Rare or Threatened or At Risk habitat types to read: "Rare or Threatened or At Risk habitat types are areas of indigenous vegetation <u>and/or physical substrate</u> of a type identified in Table E1 as being "Rare" or "Threatened" or "At Risk" and which meets any of the criteria in Table E2(a) for determining whether an area of indigenous vegetation <u>and/or physical substrate</u> constitutes a "habitat" for the purposes of this Plan and does not meet any of the criteria in Table E2(b) for excluding the area from consideration as "habitat".	Agree	This amendment will recognise the mosaic of vegetation and bare substrate that commonly occur within, and that are a vital component of, dune ecosystems. Bare substrate, occurring in association with vegetation, is also a common feature of other Rare habitat types. In these instances the both the substrate and vegetative cover create the ecosystem as defined by the habitat types listed in Schedule E. <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
Schedule E Table E.1	Description of Active dunelands.	GLC	Change the emphasis of the description/definition of Active dunelands to give greater emphasis to physical substrate and physical processes by a) changing the wording to read: "Active dunelands comprise areas of raw coastal sand in the form of dunes and dune hollows and slacks interspersed with indigenous and non-indigenous vegetation (invasive or planted). Includes mosaics of raw unstable sands, grassland, sedgeland, scrub, tussockland, low-growing or semi-woody herbs, small trees, together with dune slack wetlands". And b) Deleting the following habitat types: i. Grassland and sedgeland on active dunelands ii. Dune slack	Resolved	Resolved as part of larger agreement around the provision for duneland habitat. The recommendation for duneland habitat type as listed in the Notified Proposed Schedule E stands, with increased emphasis on non-regulatory methods to more adequately address the protection needs of duneland habitat (paragraphs 44 -54). NB: The resolution of the collective issues raised by GLC regarding duneland habitat is dependent on implementation of non-regulatory methods. If this recommendation is not adopted and reflected in sustained funding, these issues will remain unresolved. <i>Discussed and agreed. No change required.</i>
Schedule E Table E.1	Addition of habitat type	AH	Add "Tussockland below the treeline" as a At Risk habitat type in Table E.1	Agree	Tussockland contributes to the biodiversity of the Region and has not been adequately protected within Schedule E.

Plan heading	Matter raised	Expert	Expert recommendation	Degree of agreement	Explanation / Outcome
					<p>'Tussockland below the treeline' habitat type has been added to Table E.1 and classified as At Risk.</p> <p>I consider that protection of this habitat type is appropriate, as discussed in paragraphs 20 - 27.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
	Addition of habitat type		Add riparian and river terrace broad-leaf forest or scrub dominated by kowhai and other semi-deciduous species habitat type to Table E.1	Agree	<p>This habitat type contributes to the biodiversity of the Region and has not been adequately protected by Schedule E. 'Kowhai-broadleaved forest' habitat type has been added to Table E.1 and classified as Threatened.</p> <p>I consider that protection of this habitat type is appropriate, as discussed in paragraphs 28 and 29 of this report.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
Schedule E Table E.1	Addition of rare habitat type	AH	Add 'Karst landforms', 'Cliffs, scarps and tors', 'Coastal Cliffs', and 'Screes and boulderfields' as Rare habitat types to Table E.1	Agree	<p>These Rare habitat types are present within the Region, and their absence from Schedule E is an oversight. It is in keeping with the framework of Schedule E to include all known Rare habitat type that occurs in the Region.</p> <p>'Karst landforms' and 'Screes and boulderfields' have been added to Table E.1.</p> <p>The Rare habitat type 'Lichenfield, tussockland, herbfield, shrubland, scrub on Sillicic-intermediate rock' has been renamed as 'Cliffs, scarps and tors' and incorporates all Rare cliff habitat type.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
Schedule E Table E.2 (a) (Inclusion criteria)	Add new criteria to include areas of 'Active duneland habitat'	GLC	Add criteria to Table E.2 (a) "Areas of active duneland covering at least 0.1 ha".	Resolved	<p>Resolved as part of larger agreement around the provision for duneland habitat.</p> <p>The recommendation for duneland habitat type as listed in the Notified Proposed Schedule E stands, with increased emphasis on non-regulatory methods to provide more adequately address the protection needs of duneland habitat. (paragraphs 44 - 54).</p> <p>NB: The resolution of the collective issues raised by GLC</p>

Plan heading	Matter raised	Expert	Expert recommendation	Degree of agreement	Explanation / Outcome
					regarding duneland habitat is dependent on implementation of non-regulatory methods. If this recommendation is not adopted and reflected in sustained funding, these issues will remain unresolved. <i>Discussed and agreed. No change required.</i>
Schedule E Table E.2 (a)	Add criterion	AH	Add the criterion "Areas of indigenous vegetation and/or naturally occurring bare substrate that form part of a rare habitat type covering at least 0.05 ha".	Agree	Rare habitat types are by nature small and constitute a mosaic of vegetation and bare substrate. I consider this criterion to be appropriate and necessary to ensure all Rare habitat type of concern will be incorporated into the provisions of the plan. <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
	Add criterion		Add the criterion "Areas of naturally occurring bare substrate, lichenfield, herbfield or mossfield on flat or gently sloping topography within 20 m of coastal cliffs".	Resolved	This definition can be incorporated into the definition of 'Cliffs, scarps and tors' habitat type. Therefore, an additional criterion in Table E.2 is not required. The reference to "flat or gently sloping topography within 20 m of coastal cliffs" is not necessary and has been omitted from the habitat type definition. <i>Discussed and agreed. No change required.</i>
Schedule E Table E.2 (a)	Add criterion	AH	Add a size criterion in Table E.2 targeted at the 'Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species' habitat type.	Agree	The Notified criteria in Table E.2 did not account for this habitat type. A size threshold of this magnitude is fitting for this habitat type as it comprises smaller tree species than the other forest types. In addition, this habitat type is typically remnant in the landscape in small, fragmented areas and therefore this size threshold is appropriate. The following criterion has been added to Table E.2: <i>xi. <u>Areas containing <i>Olearia gardnerii</i>, <i>Pittosporum obcordatum</i>, <i>Coprosma obconica</i>, <i>Coprosma wallii</i>, <i>Melicytus flexuosus</i>, <i>Pseudopanax ferox</i> or <i>Discaria toumatou</i> covering at least 0.1 ha.</u></i> <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
Schedule E Table E.2 (b) Exclusion	Add new criteria to exclude areas from 'Active duneland habitat' definitions	GLC	Add criteria to Table E.2 (b) "i. Existing established areas of forestry planted for commercial production purposes on active dunelands (if not already included	Resolved	Resolved as part of larger agreement around the provision for duneland habitat. The recommendation for duneland habitat type as listed in the

Plan heading	Matter raised	Expert	Expert recommendation	Degree of agreement	Explanation / Outcome
criteria			<p>as 'treeland' or 'woodlots')</p> <p>ii. Existing established areas cultivated and planted as pastoral grassland for farming purposes.</p> <p>iii. Urban areas and other areas where active dunelands have been irreversibly modified (such as car parks)</p> <p>iv. Formed roads and other existing infrastructure sites and corridors.</p> <p>v. Any area more than 600 metres inland of the boundary of the coastal marine area.</p>		<p>Notified Proposed Schedule E stands, with increased emphasis on non-regulatory methods to more adequately address the protection needs of duneland habitat (paragraphs 44 - 54).</p> <p>NB: The resolution of the collective issues raised by GLC regarding duneland habitat is dependent on implementation of non-regulatory methods. If this recommendation is not adopted and reflected in sustained funding, these issues will remain unresolved.</p>
Schedule E Table E.2(b)	Exclusion criteria for habitat associated with hydroelectric power generation	RM	<p>Amend exclusion criteria to read: <u>“Habitat created and maintained in association with or as part of any hydroelectric power generation scheme, or in relation to the implementation of any resource consent conditions or agreements relating to the operation of any hydroelectric power scheme”</u></p> <p>With a footnote or explanatory note to specifically exclude Lakes Otamangakau, Te Whaiiau and Moawhango</p>	Agree (in part)	<p>It is not the intention of Schedule E to include habitats associated with hydroelectric power schemes. The suggested wording provides clarity regarding this</p> <p>It is not considered necessary to specifically exclude the Lakes in Table E.2(b) as the suggested wording for the exclusion criterion is explicit enough.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
Schedule E Table E.4 (Assessment Criteria)	Expand Table E.4	AH	Expand Table E.4 to include consideration of distributional limits, disjunct populations, and type localities of species.	Agree (in part)	<p>The criteria for assessing ecological significance as presented in the Notified Schedule E warrants expansion for clarity and certainty. This is addressed in detail below (paragraphs 55 ,Table 2).</p> <p>Type localities of species are not considered to warrant consideration as a site value of ecological significance.</p> <p>NB: Post notification it was considered that Table E.4 was better placed within the Policy as Table 7.1. This is reflected in Helen Marr's Section 42A Hearing Report.</p> <p><i>Amendments have been made to the Chapter 7, Table 7.1 (see Helen Marr's report).</i></p>
Schedule E Table E.4 (Assessment Criteria)	Definition of assessment criterion 'ecological context'.	WS	<p>The definition of the assessment criteria "ecological context" requires clarification to indicate that it applies to indigenous habitats.</p> <p>Suggested wording: <u>“The site is indigenous vegetation or habitat that provides connectivity between two or more ecologically significant areas of indigenous habitat”.</u></p>	Agree (in part)	<p>The definitions of the assessment criteria have been expanded on for purposes of clarity. On the whole it is agreed with WS that the definition of 'ecological context' applies to indigenous vegetation, with an exception for areas providing ecological buffering (as presented in Table 2).</p> <p>NB: Post notification it was considered that Table E.4 was better placed within the Policy as Table 7.1. This is reflected in Helen Marr's Section 42A Hearing Report. The placement within the</p>

Plan heading	Matter raised	Expert	Expert recommendation	Degree of agreement	Explanation / Outcome
					<p>plan of the assessment criteria is further addressed in Helen Marr's Supplementary Evidence.</p> <p><i>Amendments have been made to the Chapter 7, Table 7.1 (see Helen Marr's report).</i></p>
Schedule E Table E.3	Retention of threatened species in Table E.3	AH	Retain 12 species in Table E.3 (as listed in Appendix 3 of AH's expert evidence).	Resolved	<p>Resolved via expert caucusing. It is recommended that the Notified Table E.3 be removed from Schedule E (paragraph 73).</p> <p>NB: if this recommendation is not adopted, the issue of adequate regulatory protection of the threatened species listed in AH's expert evidence remains.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
Schedule E Table E.3	Removal of threatened species in Table E.3	AH	Remove 141 species from Table E.3 (as listed in Appendix 4 of AH's expert evidence)	Agreed	<p>Removal of species from the Notified version of Table E.3 was agreed on during early expert caucusing. Further refinement of provision for threatened species was achieved during consequent meetings.</p> <p>It is recommended that the Notified Table E.3 be removed from Schedule E (paragraph 73).</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>
Schedule E	Schedule E in general.	All experts	Improvements to Schedule E including clarity of habitat type definitions, improved habitat type descriptions, correction of terminology, improved use of references, and general lay-out.	Resolved	<p>Schedule E has been further revised. See paragraph 73 for a full explanation of areas of revision, and Appendix 1 for the revised Schedule E.</p> <p><i>Amendments have been made to the revised Schedule E (Appendix 1).</i></p>

FURTHER EXPLANATION OF ISSUES RAISED BY TECHNICAL EXPERTS

13. By way of assistance to the committee, I have provided below additional explanation for my recommendation on the more substantial issues where I consider explanation beneficial.
14. I have separated this section into three sections for clarity:
 - (a) points of agreement
 - (b) issues resolved
 - (c) points of disagreement

POINTS OF AGREEMENT

RECOMMENDED ADDITION OF HABITAT TYPES TO TABLE E.1

15. Predictive models, such as those used to identify the majority of habitat types listed in Schedule E have some inherent limitations. These limitations have been discussed in my technical report (Maseyk, 2007), my section 42A Report and in expert evidence (eg. A. Hawcroft paragraph 70).
16. Predictive models, while a useful and robust tool in the most part (particularly at the broad scale), are less useful in predictions of local differences, uncharacteristic plant communities (eg. unusual compositions, distributions or abundances of species), non-climax forest communities (such as those in various stages of successional development following natural disturbance), and non-forest habitats. However, these areas also contribute greatly to the Region's biodiversity by contributing to diversity of habitat type and diversity of species. The distribution of such habitat types also contributes to biodiversity pattern across the Region.
17. To overcome this limitation and ensure adequate protection is provided to the full representation of the Region's biodiversity, an additional habitat type (kanuka forest) had been identified by expert opinion and listed in the Notified Schedule E. During the course of expert caucusing over the past months, a further three habitat types were identified and described. These three habitat types are:
 - Tussockland below the treeline
 - Kowhai-broadleaved forest
 - Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species
19. Habitat type that specifically provided habitat for threatened species has also been described. As such habitat types tended to be geographically restricted, this provided more certainty within Schedule E regarding where threatened species might be expected to be present. Further this rationale provides robust protection for habitat types providing habitat for threatened species or regionally uncommon species. This is particularly true for those species that are regional endemics, have their national stronghold within the Region, or contribute to distinctive distributional patterns. Habitat types added under this framework are:
 - Lowland forest supporting *Powelliphanta* land snails
 - Mid-altitudinal forest supporting *Powelliphanta* land snails
 - (Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species, distinctive habitat type in its own

right (see above) also specifically provides habitat for a number of threatened species).

19. Further discussion on each of these habitat types is provided below.

'TUSSOCKLAND BELOW THE TREELINE'

20. Tussockland below the treeline contributes to the diversity of vegetation pattern across the Region, and is characteristic of the Moawhango Ecological District (Rogers, 1993) – (Figure 1) I agree with the evidence of Amy Hawcroft pertaining to the importance of this habitat type within the Manawatu-Wanganui Region.
21. An estimated 11 800 ha of tussockland below the treeline is present on private land with a further 44 850 ha present within the Ministry of Defence land (Rogers, 1993). This habitat type is known in the Region only from the Moawhango Ecological District, which falls into the Rang_1, Rang_2a, Rang_2b, Rang_2c, Rang_2d, Rang_2e and Rang_2f Water Management Sub-zones (Figure 1).
22. This habitat type was not identified by the predictive modelling methods used to identify other habitat types listed in the Notified Table E.1. This is an illustration of the limitation of the methodology rather than an indication of lack of biodiversity value of this habitat type. I agree with the evidence provided by Amy Hawcroft in paragraph 70 of her evidence regarding the limitations of predictive modelling.
23. Tussockland below the treeline contribute to the biodiversity of the Region and provide habitat for species in compositions and associations not found in other habitat types and threatened species (eg. hookgrass *Uncinia strictissima*).
24. Published literature (Rogers, 1993) on the extent of tussockland indicates that 34% of former cover (at 1840) of tussockland in the Moawhango Ecological District remain. Habitat types with between 20 – 50% remaining are classified as 'At Risk' habitat type under the framework that Schedule E is based upon, as outlined in my Section 42A report.
25. The definition of this habitat type includes areas of seral¹ tussockland that occur in the landscape as the result of human-induced fire. This is because the presence of non-forested areas below the treeline dominated by tussockland is entirely due to human rather than natural disturbance (Rogers, 1994). There is no evidence that tussockland dominated naturally non-forested sites below the treeline, rather these areas were dominated by woody shrub species (Rogers, 1994). Tussockland species were however an important component of such shrubland communities.
26. As much of the naturally occurring habitat for tussockland species has been lost, I consider that it is appropriate to protect induced tussockland habitat as refuge for these species. Provisions for the persistence of tussockland habitat in the landscape (but not active prevention of natural invasion processes) will also provide for the persistence of an important stage in natural successional processes (disturbance event to climax shrub or forest communities).

¹ Intermediary habitat occurring at a given point in time during the successional process from disturbance to climax.

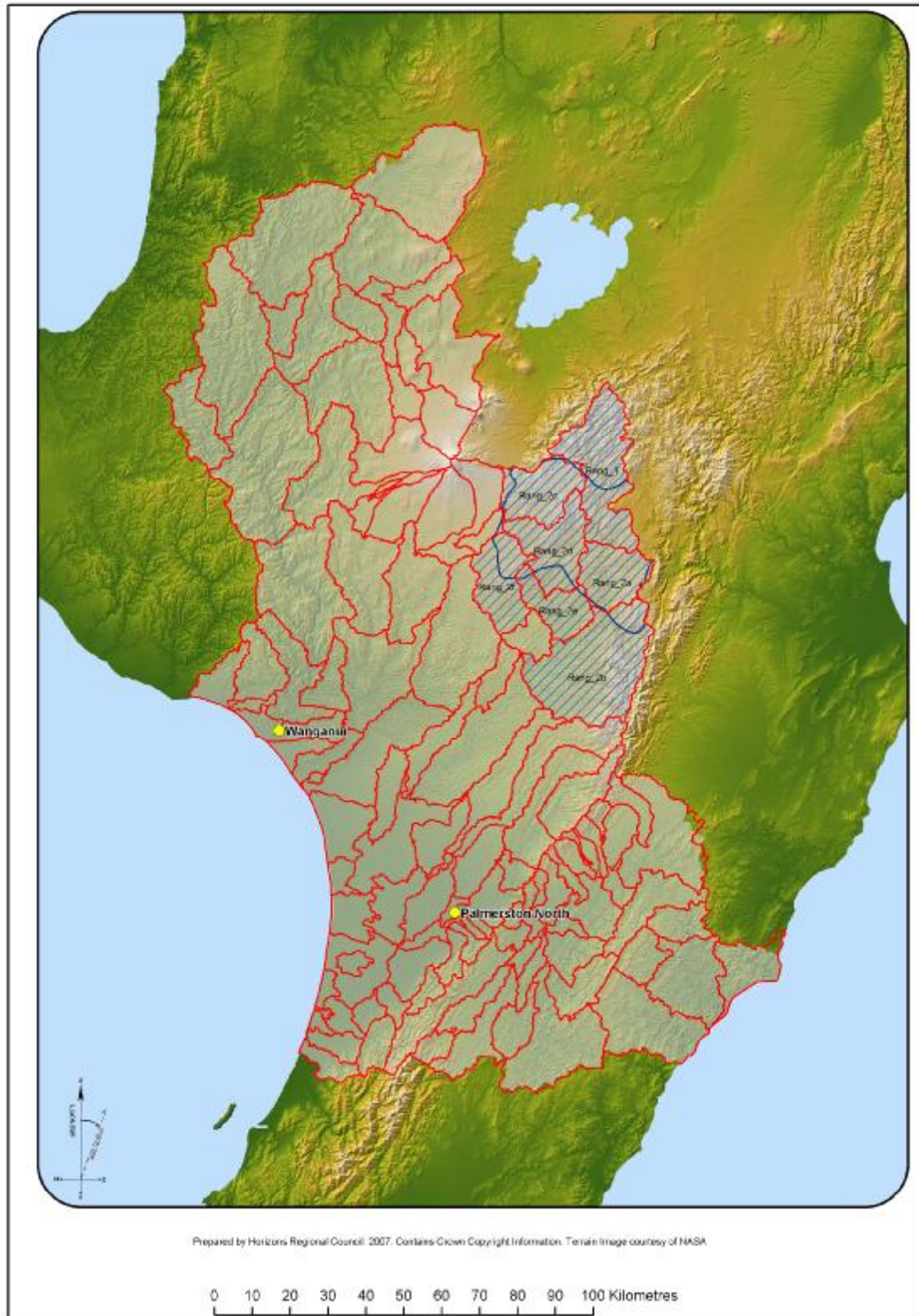


Figure 1: The distribution of the habitat type ‘Tussockland below the treeline’ (shown in blue shading). Water Management Sub-Zone boundaries are indicated in red. This habitat type occurs at areas of frequent disturbance, high water tables and/or temperature inversions within the Water Management Sub-zones indicated in black. It does not occur everywhere within these Water Management Sub-zones. The extent of the Moawhango Ecological District is indicated by the blue dotted line.

27. Table E.2 of Schedule E provides a list of (a) inclusion and (b) exclusion criteria to rationalise the patches of habitat that will be captured by the Plan. A habitat type specific inclusion criterion for this habitat type was considered necessary. As tussockland communities are smaller (in size and structure), it is appropriate that the threshold for inclusion of tussockland habitat be generally smaller than those for forest habitat types.

Tussockland below the treeline is a regionally important habitat type and It is my recommendation that:

- The habitat type 'Tussockland below the treeline' is added to Table E.1 of Schedule E and classified as At Risk.
- An inclusion criterion of 0.5 ha be added to Table E.2 of Schedule E.

'KOWHAI-BROADLEAVED FOREST'

28. Amy Hawcroft in her expert evidence (paragraphs 76 – 79)) has described the nature and biodiversity value of 'Kowhai-broadleaved forest'. I agree with, and have therefore not reiterated here, the evidence presented by Amy Hawcroft, specifically:

- a description of the forest type, it's seral nature and the associated physical environment;
- the presence of the western endemic kowhai *Sophora godleyi* within this forest type;
- the recognition of this forest type in the Survey Report for the Protected Natural Areas Programme for the Rangitikei Ecological Region (Lake & Whaley, 1995), and the Eastern Wairarapa Ecological District (Beadel, 2004);
- this habitat type comprises species that characterise dry, eastern forests but which could not be predicted (Leathwick, 2001) in the forest prediction (LVPT) model (Leathwick *et al.*, 2005); and
- that the Rangitikei has an affinity with eastern environments (and forest types) of the Region.

The known distribution of this habitat type is shown in Figure 2.

29. This habitat type has seen a substantial reduction in extent, and importantly has limited opportunity for perpetual establishment due to human-induced interruptions of ecological processes (such as natural disturbance and successional processes). This is particularly important for seral communities (such as Kowhai-broadleaved forest), which rely on frequent disturbance to establish. Expert opinion is that this habitat type should be classified as Threatened.

Kowhai-broadleaved forest is characteristic of the bluffs, river terraces, river risers and riparian areas of the Rangitikei and Tararua Districts. It is a distinctive habitat type, easily identified, with a limited environmental and geographical distribution. It is my recommendation that

- 'Kowhai-broadleaved forest' be added to Table E.1 of Schedule E and be classified as Threatened.

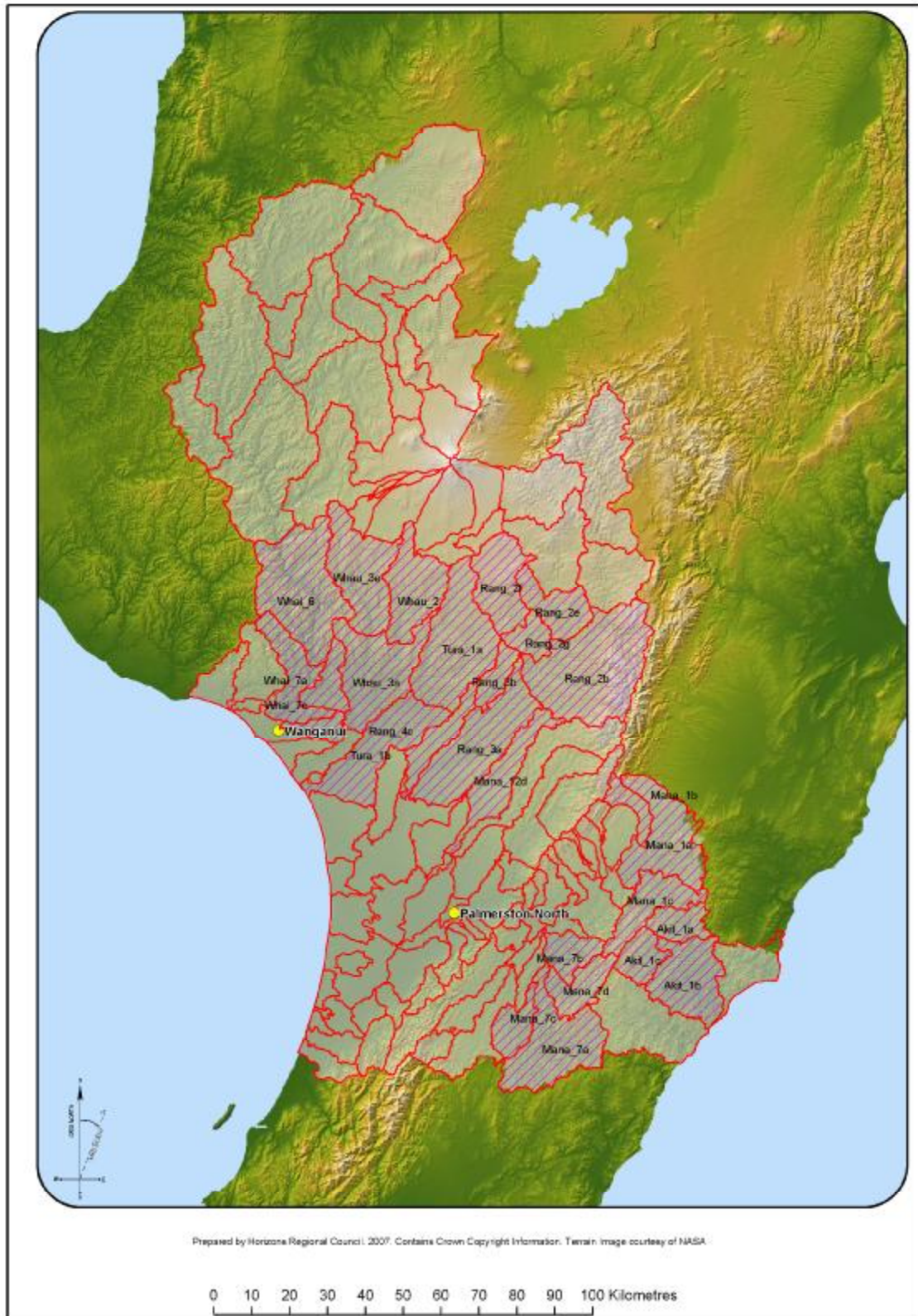


Figure 2: The distribution of the habitat type 'Kowhai-broadleaved forest' (shown in purple shading). Water Management Sub-Zone boundaries are indicated in red. This habitat type occurs in association with bluffs, river terraces, river risers and riparian areas within the Water Management Sub-zones indicated in black. It does not occur everywhere within these Water Management Sub-zones.

'FOREST OR SCRUB HABITAT ON ALLUVIAL TERRACE, FLOODPLAINS, SHINGLE FANS OR SAND DUNES SUPPORTING DIVARICATING PLANT SPECIES'

30. A floristic gap² has been described for the lower North Island (Rogers, 1989), defined by a disjunct in species distribution, and a cluster of regional endemism (Roger, 1989).
31. The boundaries of the floristic gap can be defined by the reoccurrence of the disjunct species (those missing from the floristic gap). The area known as the Central North Island (as defined in Rogers, 1989, Appendix 2) provides the northern boundary of the lower North Island floristic gap. Rogers (1989) attributed occurrence of the floristic gap to the tectonic alteration of the lower North Island, in particular, fault displacement of large land masses, obliteration of habitats by marine transgression and the regionally differential effects of mountain building.
32. A particular feature of the species distribution patterns associated with the floristic gap and its boundaries, is the high number of divaricating plant species. Divaricating plants are characterised by interlacing branches and few, small, well-separated leaves. Species can express more or less divaricating traits during their life-cycle. Divaricating species are typically species of seral environments³, requiring high light levels and disturbance to establish.
33. This cluster of diversity in divaricating plant species (shrubs and trees) is highly characteristic of, and unique to, this area of the Region, and thus contributes to the biodiversity patterns across the Region. The assemblage of such a high number of divaricating shrub species is unique within itself (providing diversity of habitat type and diversity of species) Further, this proposed habitat type comprises a number of threatened or regionally uncommon species (Table 1) adding to the biodiversity value of this habitat type to the Region.

Table 1: Threatened and regionally uncommon species found within habitat type supporting divaricating plant species. (as per the New Zealand Threat Classification System (Molloy *et al.*, 2002) and threatened species lists (Hitchmough *et al.*, 2005). NB: A revised threat system (Townsend *et al.*, 2008) has been published with the revised threatened species lists expected shortly. In the interim, the previous lists are referenced here. ** Rogers, 1989.)

Species	Threat Classification*	Comment
<i>Olearia gardnerii</i> Gardner's tree daisy	Nationally Critical	Species stronghold occurs in the upper Rangitikei. This species is commonly found on private land.
<i>Pittosporum obcordatum</i> Heart-leaved kohuhu	Nationally Endangered	Distribution of this species within the Region is local and is clustered around Taihape.
<i>Coprosma obconica</i>	Gradual Decline	Confined to a small area in the central North Island. One of the species which defines the lower North Island floristic gap.**
<i>Coprosma wallii</i>	Gradual Decline	One of the species which defines the lower North Island floristic gap.**
<i>Melicytus flexuosus</i>	Gradual Decline	One of the species which defines the lower North Island floristic gap.**
<i>Pseudopanax ferox</i> Fierce lancewood	Sparse Regionally Uncommon	One of the species which defines the lower North Island floristic gap.**
<i>Discaria toumatou</i> Matagouri	Regionally Uncommon	Uncommon in the north with an unusual distribution. Known from the sand dunes of the west and scattered in the east of the Region.

34. Forest or scrub habitat supporting divaricating plant species in the parts of the Region which fall into the Central North Island (Rogers, 1989) provides a representation of the

² A floristic gap occurs when species which would otherwise be expected to be present (eg. climatic and geographical conditions are suitable), are absent.

³ Disturbed sites providing the opportunity for early and intermediate stages of ecological succession, and providing habitat for early successional, disturbance and/or light requiring species.

end product of past disturbance events and tectonic activity (Rogers, 1989) This habitat type provides a biogeographical link to past biodiversity pattern, a contemporary representation of ecosystem dynamics through time and contemporary biodiversity value.

35. Habitat comprising matagouri incorporates distinctively unusual distributional patterns of a species uncommon in the lower North Island but common in the South Island. Matagouri is largely confined to the sand dunes in the west, and the east coast of the of the Region, although it is also known (with a local distribution) from the central North Island.
36. Plant communities characterised by divaricating species are highly distinctive and the structure, composition, and associated environment (alluvial terraces or floodplains prone to summer drought and water-logging and frost during winter) of such habitat can be explicitly defined. This habitat type has a restricted geographical distribution (Figure 3). A high level of clarity regarding this habitat type enables targeted protection.
37. It is the opinion of the experts that this habitat type be classified as At Risk. This classification is considered appropriate for the level of loss experienced by this habitat type, and the interruption to the ecological processes that it relies on for establishment through time and space (eg. natural processes of disturbance and succession).
38. By incorporating this habitat type into Table E.1, the seven species listed in Table 1 would no longer need to be listed in Table E.3 of Schedule E (paragraph 73).
39. Table E.2 of Schedule E provides a list of (a) inclusion and (b) exclusion criteria to rationalise the patches of habitat that will be captured by the Plan. Due to the inherent structure and habit (eg. smaller trees, more open habitat, commonly found in clearings and forest edges) of the divaricating species habitat type, the generic inclusion criteria for forest habitat type listed in Table E.2(a) (0.25 ha and greater) is considered too large to encapsulate all the remaining areas of this habitat type which warrant protection. Therefore, an additional criterion specific to this habitat type is required. It is considered that 0.1 ha is a more appropriate threshold.

Given the high value (in terms of biodiversity pattern and species diversity) of the habitat, and the precision with which it can be defined, I recommend that:

- The habitat 'Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species' is added to Table E.1 of Schedule E and classified as an At Risk habitat type.
- A habitat type specific inclusion criterion of 0.1 ha be added to Table E.2 of Schedule E.
- *Olearia gardnerii*, *Pittosporum obcordatum*, *Coprosma obconica*, *Coprosma wallii*, *Melicytus flexuosus*, *Pseudopanax ferox*, and *Discaria toumatou* be removed from Table E.3 (if the previous two recommendations are accepted).

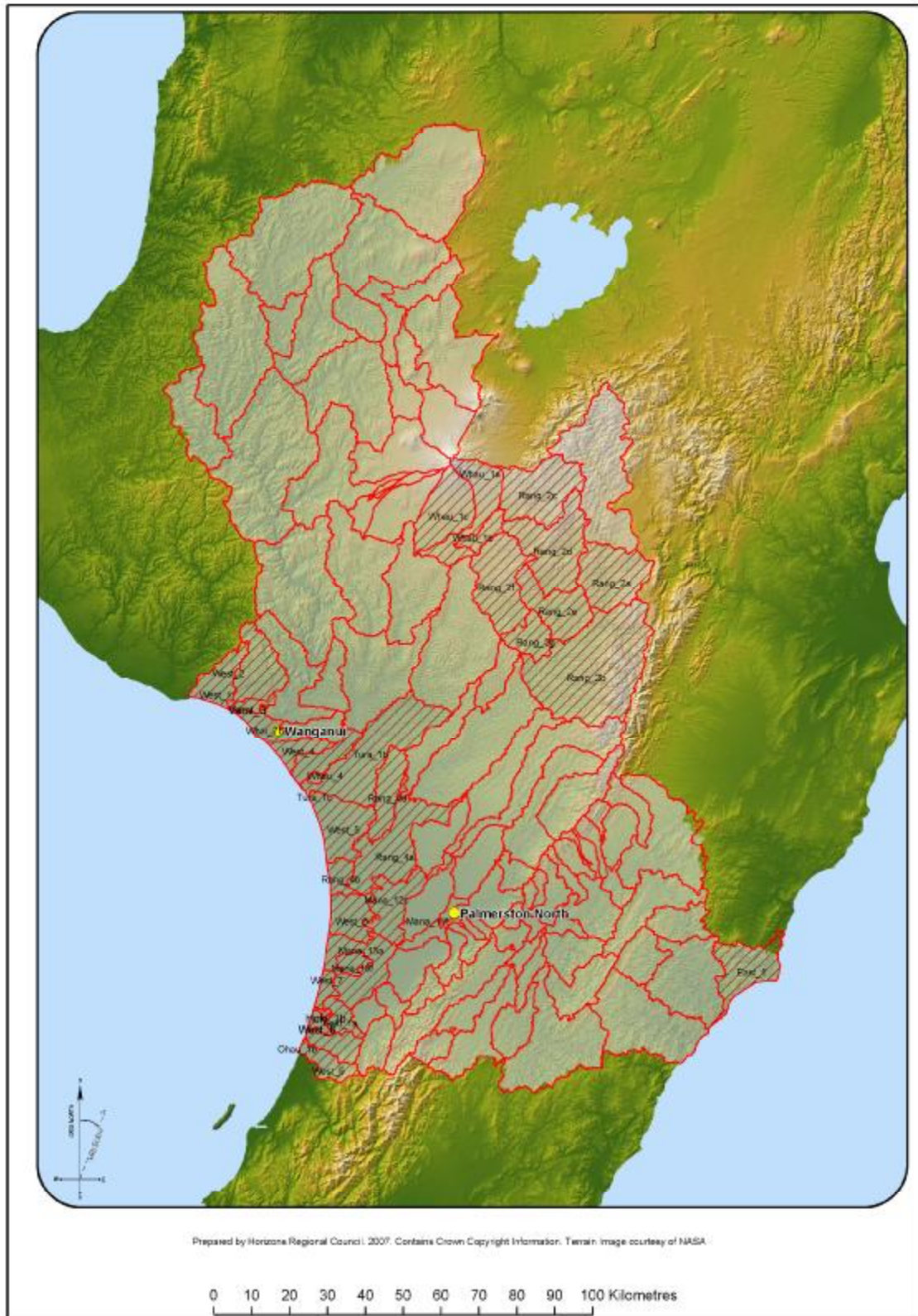


Figure 3: The distribution of the habitat type Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species (shown in brown shading). Water Management Sub-Zone boundaries are indicated in red. This habitat type occurs on alluvial terraces, floodplains, shingle fans, or sand dunes within the Water Management Sub-zones indicated in black. It does not occur everywhere within these Water Management Sub-zones.

‘LOWLAND FOREST SUPPORTING *POWELLIPHANTA* LAND SNAILS’ AND ‘MID-ALTITUDINAL FOREST SUPPORTING *POWELLIPHANTA* LAND SNAILS’

40. The two land snail species *Powelliphanta traversi traversi* and *P. traversi tararuaensis* are regional endemic species with a very limited distribution in the Horowhenua District (Figure 4 & Figure 5).
41. In keeping with the initial classification of habitat for threatened species, these two habitat types have been classified as At Risk. It is my opinion that this classification reflects the protection requirements for the snails.
42. The snail species were removed from Table E.4 in my Section 42A Report on the grounds that the snail habitat was adequately protected (either by the Department of Conservation (DoC) or other legal protection such as Queen Elizabeth II Covenant). This was an incorrect conclusion, and DoC have advised that the two snail species are likely to occur in currently unknown localities on unprotected private land. The habitat requirements of the two species are specific and have been well described in Walker (2003).
43. Even within suitable habitat, the snail distribution does not follow consistent patterns. The snails can be found within very small and discrete areas within suitable habitat. Therefore, a meaningful size threshold could not be determined without risking the unintentional exclusion of snail habitat. Consequently, it is recommended that a criterion be added to Table E.2 (a) that specifies there is no size restriction for these two habitat types. The area of impact of such an inclusion is in reality not large, and I considered it to be appropriate that all populations of these two threatened regional endemics be protected.

Given the high conservation status of the two snail species, and the precision with which the habitat type can be, I recommend that:

- The habitats ‘Lowland forest supporting *Powelliphanta* land snails’ and ‘Mid-altitudinal forest supporting *Powelliphanta* land snails’ are added to Table E.1 of Schedule E and classified as an At Risk habitat types.
- A habitat type specific inclusion criterion reading ‘An area of indigenous vegetation of any size containing *Powelliphanta* land snails’ be added to Table E.2(a) of Schedule E.
- If these two recommendations are accepted, *Powelliphanta traversi traversi* and *P. traversi tararuaensis* will not need to be incorporated in Schedule E via inclusion in Table E.4.

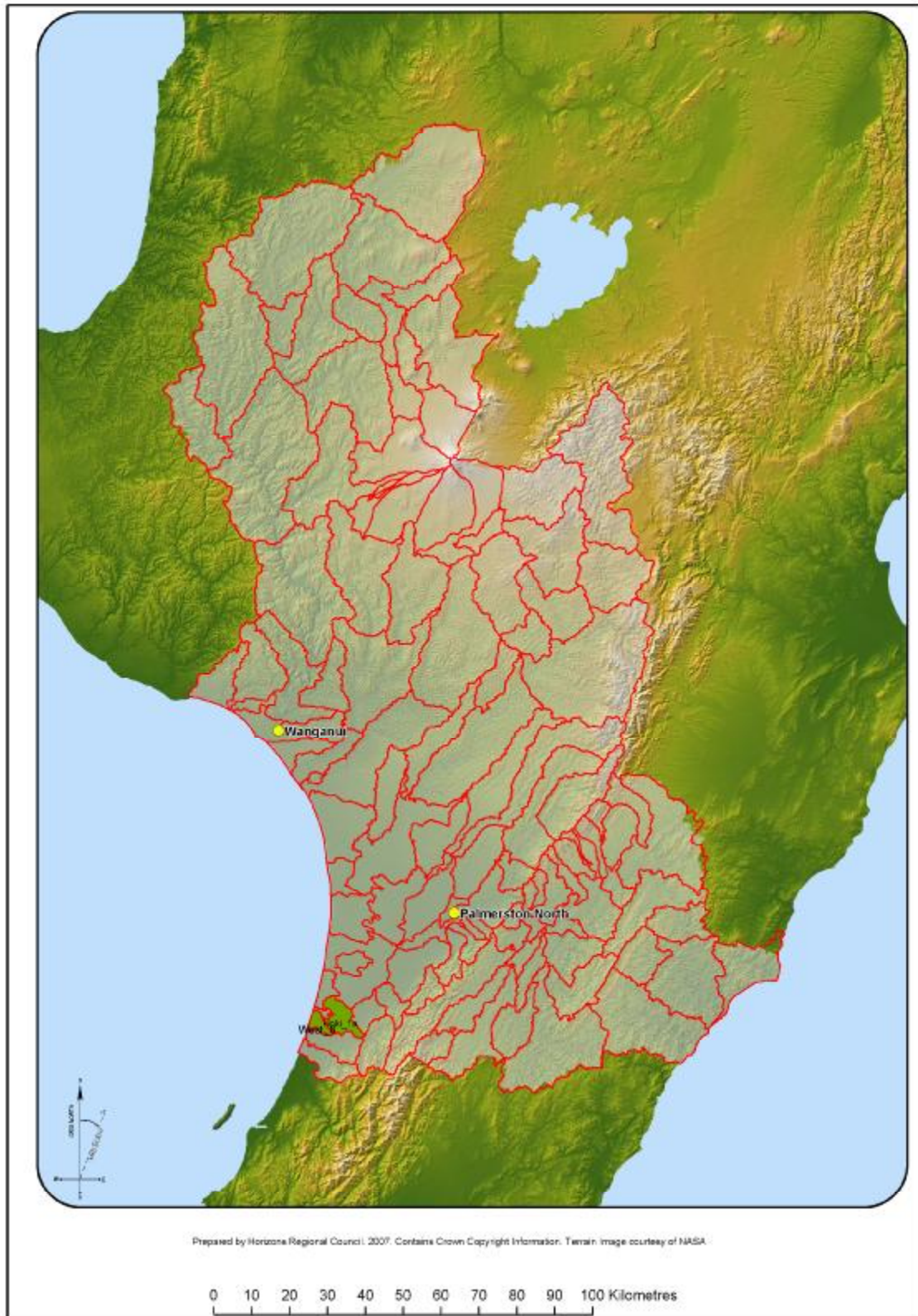


Figure 4: The distribution of the habitat type Lowland forest supporting *Powelliphanta* land snails (indicated in green). Water Management Sub-Zone boundaries are indicated in red. This habitat type occurs suitable forest fragments within the Water Management Sub-zones indicated in black. It does not occur everywhere within these Water Management Sub-zones.

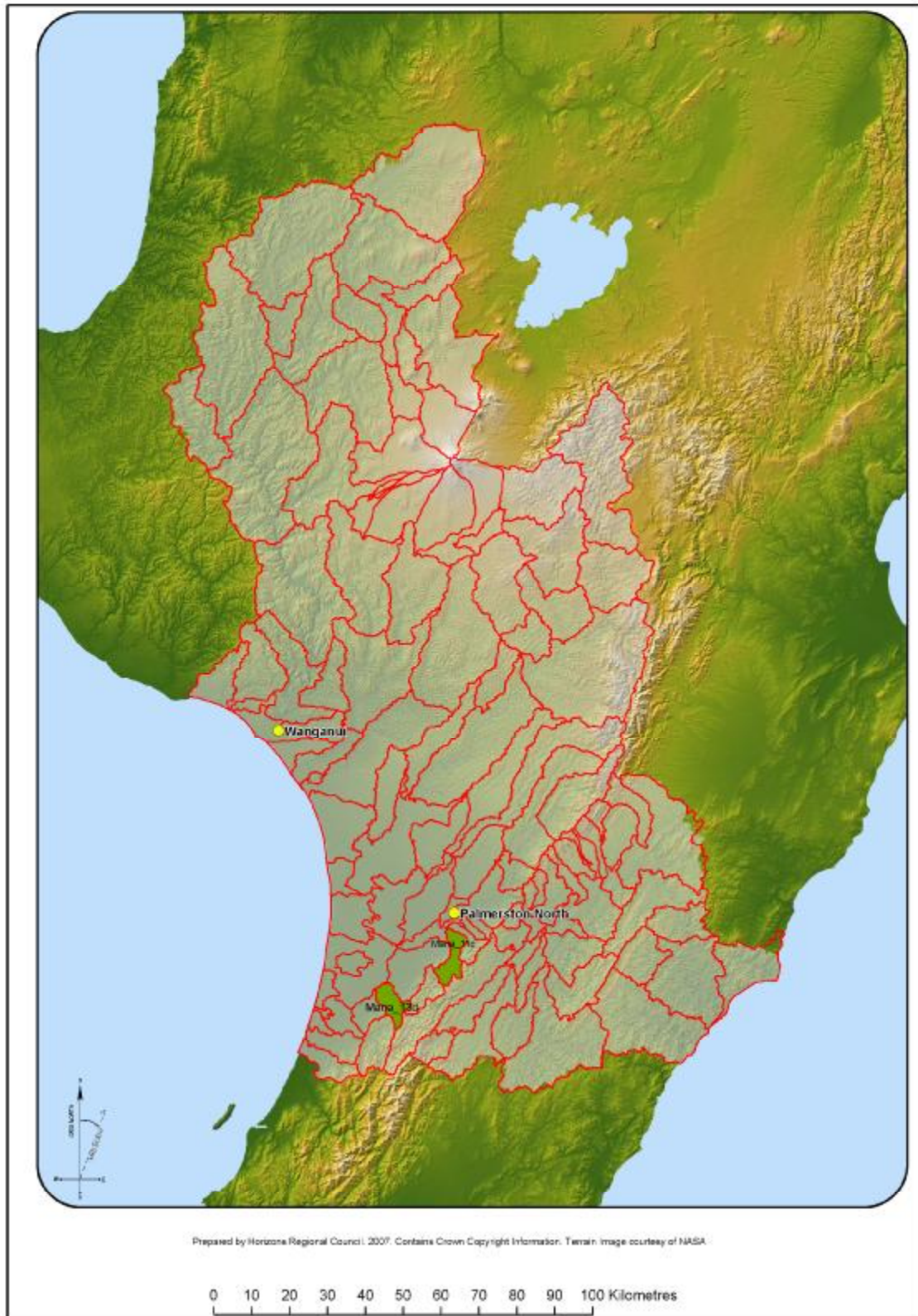


Figure 5: The distribution of the habitat type Mid-altitudinal forest supporting *Powelliphanta* land snails (indicated in green). Water Management Sub-Zone boundaries are indicated in red. This habitat type occurs suitable forest fragments within the Water Management Sub-zones indicated in black. It does not occur everywhere within these Water Management Sub-zones.

ISSUES RESOLVED

DUNELAND HABITAT

44. The west coast of the Region (Figure 6) is characterised by the most extensive transgressive parabolic dunefield in New Zealand (Muckersie & Shepherd, 1995). This dunefield has been active and migrating for the last 6500 years (Hilton *et al.*, 2000).

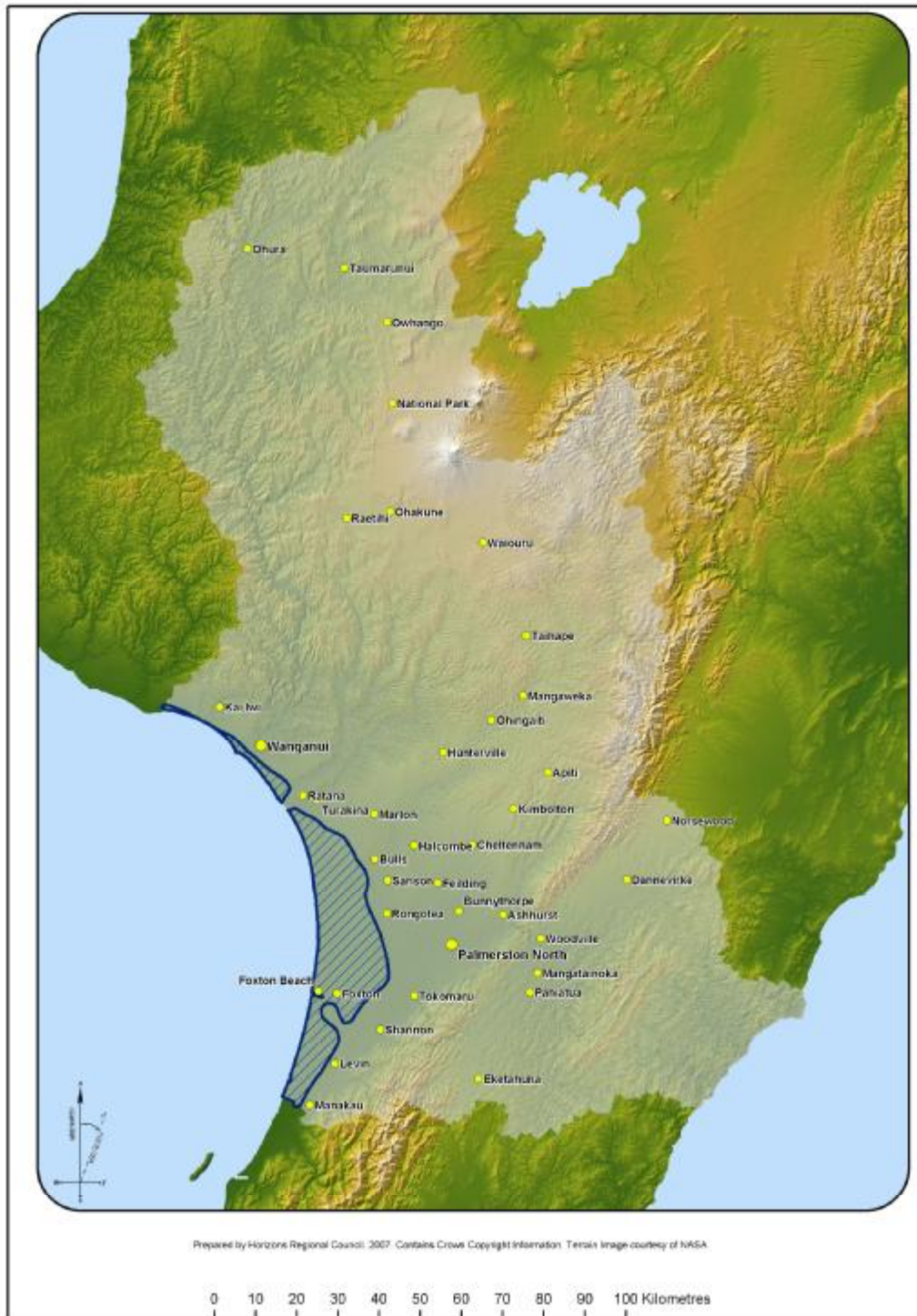


Figure 6: The distribution of the transgressive parabolic dunefield on the west coast of the Region (shown in blue shading).

45. Parabolic dunes are U-shaped (when viewed from above) dunes, characterised by short to elongate trailing ridges which terminate in U-shaped sand deposits downwind. Dunes are wind formed landforms which provide specialised habitats for plants and animal species (Hesp, 2000).
46. The natural dune-building phases which are an inherent process within the dunefield ecosystem played an important role in the disturbance history of the Region prior to human settlement and dune-building phases played a considerable part in the natural loss of forest cover (Cowie, 1963; Muckersie & Shepherd, 1995)
47. The dynamic process of this environment drive the nature of the vegetation characteristic of the dunelands. The distinctiveness of the duneland environment is translated into a unique pattern of vegetation communities. The uniqueness of the duneland strongly contributes to a sense of place as these habitat types are like no other, and accordingly they comprise assemblages of species found no where else.
48. Dunelands provide habitat for a number of threatened species, including some species whose national strongholds occur within the Region (eg. *Eleocharis neozelandica*), and regionally endemic species (eg. *Selliera rotundifolia*, and *Pimelea* 'Turakina'). Further, the contribution to national indigenous biodiversity (by virtue of being found nowhere else in New Zealand) should not be overlooked.
49. I agree with the Department of Conservation's (DoC) evidence (in particular that of Graeme La Cock and Julian Watts) regarding the ecological value of the Region's dunelands and the vegetation communities and species this environment supports.
50. The Notified Schedule E does provide some protection for duneland habitat types. Active duneland, stable duneland, inland duneland, dune slack wetland, and ephemeral wetland have been identified as nationally originally rare environments (Williams *et al.*, 2006 & Williams *et al.*, 2007). Consequently, where these environments support indigenous vegetation they have been classified within Schedule E as Rare habitat types (Schedule E, Maseyk, 2007). The Rare habitat types associated with duneland support a diverse range of vegetation communities (such as tussockland, herbfield, flaxland, shrubland, scrub, and forest) and therefore a diverse range of species. Further, dune lake wetland systems are classified as Threatened in Schedule E.
51. Strong regulatory protection is proposed for habitat types classified in Schedule E as 'Rare' or 'Threatened' habitat types. However, Schedule E does not account for the ecological processes.
52. The importance of ecological processes (eg. presence and movement of bare sand) is well identified in Graeme La Cock's expert evidence. I agree with Graeme La Cock that these ecological processes that drive the dune system are a crucial component of the system, and any method for protection of duneland habitat needs to address this. Consequently, the protection of indigenous vegetation supported by the duneland environment should not be considered in isolation of the connection between vegetation and bare substrate (in this case exposed and mobile sand).
53. In response to Graeme La Cock's evidence, I undertook analysis of the aerial photography covering the west coast of the Region and test application of the criteria (as presented in Graeme La Cock's evidence, paragraph 35) for 'Active duneland' habitat. This analysis was repeated during a caucusing meeting between myself and Graeme La Cock on 5 August 2008. This process confirmed that:

- (a) The last remaining area of functioning duneland habitat that remains in private ownership is the area between Himatangi and Foxton known as the Foxtangi RAP. This area (280 ha) sits within one land parcel and currently has one owner.
 - (b) Other areas of ecologically important duneland habitat are already under legal protection administered by DoC (eg. Whitiua and Tawhirihoe Scientific Reserves and Moana Roa Conservation Area).
 - (c) Foxtangi and the DoC reserves were the only key areas that met the criteria (Graeme La Cock, paragraph 35)
54. Contemporary threats to these areas are primarily vehicles, rubbish and green waste dumping, and pest plants and animals. Where other threats to which a regulatory response would be more fitting (such as land conversion and land disturbance) are occurring, much of the value of the duneland has already been lost.

In light of the discrete and relatively small areas of relatively unmodified, functioning duneland, and the nature of the contemporary threats to these areas it is my recommendation that:

- The most appropriate way to provide further protection for the remaining areas of functioning duneland is via the non-regulatory methods as provided for within the Notified plan.
- Listing “Active duneland” (as defined in Graeme La Cock’s expert evidence) in Table E.1 will not increase the protection currently afforded to indigenous habitat types supported by duneland.
- Therefore, the one inclusion criterion, and six exclusion criteria suggested for addition to Table E.2 by Graeme La Cock are not necessary.
- Grassland and sedgeland communities on active duneland should be retained within Table E.1 in keeping with the national originally rare ecosystems framework (Williams *et al.*, 2006; Williams *et al.*, 2007).
- Dune slack wetland should be retained within Table E.1, listed as a specific wetland type in keeping with the identified wetland types of New Zealand (Johnson & Gerbeaux, 2004) and the national originally rare ecosystems framework (Williams *et al.*, 2006; Williams *et al.*, 2007).

POINTS OF DISAGREEMENT

ASSESSMENT CRITERIA

- 55. Although largely in agreement, in regards criteria used to assess the value of a site, there remains some disagreement amongst the experts over additional criteria which could be incorporated into the list of criteria used to determine the significance of a given site. . It is essentially a question of where to place the thresholds by which to determine ecological significance.
- 56. I have expanded the definitions of the assessment criteria (Table 2) to be incorporated into the Plan to more explicitly state what aspects of ecological value a site assessment is based on. While these aspects were inherent in the criteria as Notified, the revised table (Table 2) provides more clarity.

57. Type locality⁴ (as recommended by A. Hawcroft paragraph 134) was not considered to be a valid definition under the ‘rarity and distinctiveness’ criterion. This was because the type locality of a species is dependent on the location of where the plant sample was taken from. Thus it is a human-construct. The cultural and scientific interest of the site containing type specimens is acknowledged however.

Table 2: Criteria for assessing the value of a site⁵

Criteria	Explanation
Representativeness	<ul style="list-style-type: none"> The site comprises habitat type that is under-represented (20% or less of known or likely former cover). LENZ land environments, national spatial databases and predictive models will be used to assess representativeness.
Rarity and Distinctiveness	<ul style="list-style-type: none"> The site supports one or more indigenous species that are classified as threatened (as determined by the current New Zealand Threat Classification System and Lists); or The site supports an indigenous species, or community of indigenous species, that is distinctive to the Manawatu-Wanganui Region; or The site supports an indigenous species, or community of indigenous species, that is at a natural distributional limit; or The site supports an indigenous species, or community of indigenous species, that forms a natural disjunct defining a floristic gap; or The site supports an indigenous species, or community of indigenous species, that is uncommon within the area; or The site comprises indigenous vegetation or habitat (which can include physical substrate) that was originally (pre-human) uncommon in New Zealand.
Ecological Context	<ul style="list-style-type: none"> The site provides connectivity (physical or process connections) between two or more areas of indigenous habitat; or The site provides an ecological buffer (provides protection) to an adjacent ecological significant habitat, including aquatic habitat; or The site is an area of indigenous habitat that forms part of an indigenous ecological sequence (connectivity between different habitat types across a gradient (eg. altitudinal or hydrological); or The site provides important breeding areas, seasonal food sources, or is an important component of a migration path; or The site is an area of indigenous vegetation that provides habitat for indigenous species that are dependent on large and contiguous habitat; or The site is an area of indigenous vegetation that is large relative to other sites in the area, comprises indigenous species diversity typical of its habitat type and exhibits functioning ecosystem processes.
Previously Assessed Sites	<ul style="list-style-type: none"> Any site assessed at a previous time, or by a previous agency, on criteria in keeping with the policies, objectives and criteria of this plan, to be of ecological significance; or Any site that is legally protected by the Queen Elizabeth II Trust, the Nature Heritage Trust, Nga Whenua Rahui, Territorial Local Authority Reserve or Covenant, or Department of Conservation Covenant unless it can be proven to not meet any of the other criteria in this table.

58. There are two stages of assessing a site:
1. the ecological value(s) (or significance) of the site; and
 2. the likely impacts of the proposed activity on the identified values.

⁴ The type locality is the place where a type (the specimen from which the plant is named) specimen was sampled from.

⁵ This criteria appears as Table E.4 of Schedule E in the Notified Plan. Helen Marr’s Section 42A report recommends the table be removed from Schedule E and be renamed Table 7.1, with her supplementary evidence providing further comment on the best way to present the assessment criteria.

59. The first stage of assessment should be guided by criteria (Table 2). The second stage can incorporate consideration of wider issues, for example, the condition and current state of the site (grazing history, pest plant and animal impacts etc), the size of the site, and mitigation options. This is sensible for informed decision making, but in my opinion, should not determine value (or lack of value) in the first instance.
60. Matiu Park, in his evidence (pg 8 of Trustpower evidence and pg 10 of Meridian evidence) suggests that a site not only met any of the criteria in Table E.2 (representativeness, rarity and distinctiveness, ecological context, or previously assessed sites), but also meets a secondary qualifier of 'inherent ecological viability/long-term sustainability'. This concept is also discussed in Norton & Roper-Lindsay (2004).
61. To meet this requires that a site be "working normally" (Norton & Roper-Lindsay, 2004), although it can include the consideration of appropriate management and intervention for this to occur. Given, the highly modified and fragmented nature of much of the Region's remaining indigenous biodiversity, I consider that for a site to be "working normally", is placing an overly high threshold on the assessment of significance. This is particularly so in light of incomplete knowledge of what "normally" is for all the ecosystems that are present and all the ecological processes that occur within the Region.
62. Further, very small, or very degraded sites are excluded from the Plan by way of criteria listed in Table E.2. These criteria effectively exclude obviously 'non-functioning' sites without the need of doing a site assessment (or obtaining a Resource Consent).
63. Other potential risks with this approach, is the possibility of interpreting sustainability of a site as its ability to sustain itself in the same form into the future. For example, a kahikatea dominated fragment isolated from flooding regimes could be argued to lack inherent viability and long-term sustainability, as over time such a fragment is likely to change in composition from kahikatea (which requires disturbance caused by flooding to regenerate) (Burns *et al.*, 2000) to dry land forest such as that dominated by tawa.
64. Further, naturally occurring dynamics through time does not provide justification for lack of contemporary protection, especially in the case of seral communities or areas of habitat at various stages of a successional process. Without the starting points, the natural dynamics can not occur, and the climax communities will not be arrived at.
65. It is my opinion that consideration of size, shape and sustainability of a patch of habitat can be incorporated when considering impacts by a proposed activity on the values of any given patch. However, much of the remaining biodiversity of the Region remains in small and irregularly shaped patches of habitat, which are modified and require intervention for long-term persistence. These factors should not exclude them from protection in the short or middle term. The risks to indigenous biodiversity of using high thresholds and qualifiers (such as those suggested by Matiu Park) to assess value of sites are discussed at length in Walker *et al.*, (2008).
66. Even where they exist in various states of degradation, modified patches of vegetation cover continue to provide habitat for species, and in many cases represent the last refugia of species previously common across the landscape (Smale *et al.*, 2008). Even heavily modified sites are capable of recovery and management intervention can reverse trends of decline. Patches can continue to provide connections ('ecological stepping stones') and seed sources. Importantly, they provide *insurance* for the future. Recognition if the value of this sites is important for persistence in the landscape over

time and is aimed to work in tandem with the non-regulatory methods (ie. prevention of clearing in the interim, fencing and pest control in the medium to long-term).

67. It is my opinion that incorporating the qualifier “inherent viability/sustainability” into the assessment criteria will not adequately provide for protection of the Region’s biodiversity or indeed prevent further decline. Rather, such an approach will in effect potentially place value only on the very best sites remaining within the Region.

There are continued difficulties and debate in agreeing how ecological values (significance) should be assessed. For an outcome of the protection of indigenous biodiversity within the Manawatu-Wanganui Region, it is my recommendation that

- The definitions of assessment criteria to be expanded as provided in Table 2.
- The criterion “inherent viability/sustainability” not be used in assessing the *value* of a site, but be incorporated in the consideration of the *impact* of any given proposed activity.

PART II: MATTERS RAISED BY SUBMITTERS

Table 2: Summary table of matters raised by submitters at pre-hearing meetings on the biodiversity provisions of the Notified Proposed One Plan (specifically Schedule E).

FFNZ = Federated Farmers; HNZ = Horticulture New Zealand, FG = Fish and Game Council (Wellington).

Text recommended for addition is shown in underline, with text recommended for deletion is shown in ~~strike through~~.

Plan heading	Matter raised	Submitter	Submitter recommendation	Degree of agreement	Explanation
Schedule E Table E.2 (a)	Inclusion criteria for “Discontinuous indigenous vegetation present within 50 m of an area of continuous vegetation covering at least 0.5 m”	FFNZ	Request for (unspecified) size indication for area of “Discontinuous indigenous vegetation”	Agree	Clarity required, criteria now reads: “Discontinuous indigenous vegetation <u>covering at least 1 ha</u> present within 50 m of an area of continuous vegetation covering at least 0.5 m”. NB: the area of discontinuous vegetation needs to be of a habitat type listed in Table E.1 to be captured by this criterion. <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
Schedule E Table E.2 (b)	Stock water/water storage ponds	FFNZ FG	Request for clarity around excluding areas of open water created for stock water or water storage (FFNZ). Request that exclusion on stock water/water storage ponds do not exclude wetland habitat of importance (FG).	Agree	The suggested wording improves the clarity of the intention of this criterion. Areas of open water Ponds less than 0.5 ha created for the purposes of stock watering, or water storage for the purposes of irrigation, (including old gravel pits (but excluding lakes and areas of open water associated with <u>indigenous wetland habitat, or wetland habitat that meets Criterion (a) xix</u>)). <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
	Sediment traps	HNZ	Indigenous wetland species are increasingly being used by the industry as part of ‘best practice’ sediment trap mechanisms. Such areas will require ongoing manipulation. A criterion is needed in Table E.2 (b) to exclude sediment traps from consideration as wetland habitat.	Agree	It is not the intention of Schedule E to capture sediment traps. Revised wording provides more certainty regarding exclusion of use of indigenous vegetation for such purposes. It is recommended that a further criterion be added to Table E.2(b) that reads: ix. <u>Habitat created and maintained for the purposes of sediment control</u> <i>Amendments have been made to the revised Schedule E (Appendix 1).</i>
Schedule E Table E.2	Minor formatting change	FFNZ	Increase readability with minor changes in lay-out.	Agree	<i>Amendments have been made to the revised Schedule E (Appendix 1).</i>

PART III: AMENDMENTS TO SCHEDULE E

68. There are three renditions to Schedule E each associated with a stage in the Plan development:
- (a) the version in the Notified Proposed One Plan;
 - (b) the version presented in my Section 42A Report; and
 - (c) the version presented to the Hearing Panel as an Appendix to this report (Appendix 1).
69. Each version represents an improvement of Schedule E, an evolutionary process that has developed alongside consideration of expert and submitter evidence, discussions held at pre-hearing meetings, and Horizons own review of the Schedule.
70. The focus of each change has been to:
- (a) increase certainty, clarity and usability of the Schedule;
 - (b) maintain consistency with the overriding framework of the Schedule; and
 - (c) keep the Schedule in-line with the desired outcome of maintaining indigenous vegetation within the Region.
71. Changes between the Notified version of Schedule E and the version presented in my Section 42A report are discussed in that report, and are not presented again here.
72. The revised version as it appeared in my Section 42A Report was largely supported (eg. Forest and Bird and Forest and Game, pre-hearing meeting No. 24, and as discussed within expert evidence reports). However, although supported in principal, it was collectively considered that the Schedule required further work. The nature of these improvements was collectively identified by experts, submitters and Horizons staff.
73. This last round of improvements has been incorporated into a revised Schedule E as presented in Appendix 1 and discussed below:

1. Additional habitat types (Table E.1)

As discussed in paragraphs previously, five habitat types have been added to Table E.1. This has gone some way to addressing the short-comings of predictive models and more fully account for the diversity of habitat types present within the Region.

The addition of three of these habitat types (the two snail habitat types and the habitat type supporting divaricating plant species) has enabled seven species to be removed from Table E.3.

2. Adding, deleting or refining inclusion / exclusion criteria (Table E.2)

Table E.2 is a crucial component of Schedule E, as it describes the size and condition thresholds for the habitat types listed in Table E.1. This determines which patches of any given habitat type fall within the framework of Schedule E and which don't.

Changes have been made to Table E.2(a) and (b) to:

- amend thresholds which were considered to be ineffectual in capturing or excluding areas of interest;
- consolidate criteria where appropriate (eg. for Rare habitat types);
- delete criteria no longer required due to other changes within Schedule E, (eg. removal of Table E.4 (see below);

- add criteria in association with the recommended additional habitat types are discussed above;
- amend inclusion criteria to more explicitly describe areas of vegetation to be included in Schedule E; and
- add or amend exclusion criteria to more explicitly describe areas of vegetation to be excluded from Schedule E.

3. Species lists (Table E.3)

The first revision of Table E.3 (Section 42A report) had substantially reduced the list of threatened species included in the Notified version Table E.3. The species recommended for removal from Table E.3 are indeed threatened and present within the Region, but it was considered that their protection was either:

- (a) protected by way of inclusion of habitat type in Table E.1 (eg. wetland habitat);
- (b) found largely within Public Conservation Land and thus protected by the Department of Conservation (DoC); or
- (c) it was considered that regulatory mechanisms were not the best method of protection for these species (eg. those species where the primary threat was, for example, predation not habitat loss).

This left a total of six threatened plant species in Table E.3, all of which are plant species which are either regional endemics or the Region contains the national stronghold for the species. This first revision was considered more workable, and received support from some quarters but continued reservation from other quarters. In particular, the DoC experts were not satisfied an appropriate level of protection had been afforded to all the threatened species that required protection. For example, the two threatened snail species that are discussed in paragraphs 40 -43.

Threatened species are crucial to the protection of regional biodiversity. Continued decline in the population of these species will ultimately result in regional extinctions, and consequently contribute to the likelihood of national extinctions. Therefore, it is appropriate that Schedule E continues to give consideration to the protection of habitat type supporting threatened species.

Having concluded that Table E.3 was not an overly effective (or as efficient) mechanism for threatened species protection further caucusing was undertaken to come develop an alternative. It was consequently determined that if the habitat types that supported threatened species could be defined, they could be added to Table E.1, and the remainder of Table E.3 removed from Schedule E.

Therefore, effort was focused on accurate description of habitat type comprising the threatened species of concern, and the distribution of these defined habitat types. Advice and data was solicited from DoC (including field staff). This input has ensured a more robust description, and I am confident this process has achieved a high level of accuracy.

Reference to possible presence of threatened species was also added to descriptions of habitat types already listed in Table E.1 where appropriate.

4. Habitat type definitions and descriptions

One of the main limitations of the Notified and revised (version in the Section 42A Report) Schedule E was the manner by which habitat types were defined and described. Generally, (in the most recent revision) the content has not changed but

has been moved between columns to ensure more robust and accurate habitat type definitions and more informative descriptions.

More distribution information was included in the habitat type descriptions, with particular reference to Water Management Sub-zones and elevations.

Other minor changes made to improve clarity and usability of Schedule E include:

- the inclusion of a brief glossary (as it was highlighted during the review process that some of the terms used were of a technical nature);
- inclusion of the possible presence of threatened plant species within habitat type descriptions where appropriate;
- updating of references used;
- column heading changes;
- rearrangement of the order of habitat types (to more consistently place like with like); and
- insertion of subheadings to make the Table E.1 easier to read, and which link to the subheadings that have been inserted into Table E.2.

These changes are reflected in the revised Schedule E presented in Appendix 1. Expert caucusing has been a constructive process, with a strong focus on a collaborative input to improve Schedule E. I am of the opinion that this revised version provides a more comprehensive list of the regionally important habitat types and species for which protection is appropriate. Clarity in presentation and intent has been improved and as a result the current Schedule E is more workable than previous versions. Therefore it is my recommendation:

- To accept the changes to Schedule E as presented in Appendix 1 in their entirety.

PART IV: OTHER MATTERS: THE QUESTION OF-SIGNIFICANCE

FURTHER COMMENT ON A COMPARISON OF THE PROPOSED FRAMEWORK WITH ASSESSMENT OF 'ECOLOGICAL SIGNIFICANCE'

74. Section 9 of my 42A Report compares the proposed framework of Schedule E with traditional (site by site) assessments of ecological significance. This topic was continued throughout pre-hearing meetings.
75. Schedule E provides a list of habitat types that are considered to be significant (as per Section 6(c) of the RMA). It defines what these habitat types look like and the physical environments with which they are associated. Further information on species composition and likely distribution is also provided. More traditional methods of identifying sites of significance have involved site by site assessment and the resultant list of known significant sites. The reasons for preference for the approach as presented in the Plan is discussed within my technical report (Maseyk, 2007), my Section 42A Report and Helen Marr's reports. Further, the technical experts have supported this framework as proposed.
76. However, some submitters have continued to raise the question as to whether Schedule E includes more areas of habitat than that which would be assessed as significant. Other submitters raise the question of whether Schedule E will in fact exclude areas of habitat than that which would be considered as significant if an assessment was done.

77. All patches of habitat types that are described in Table E.1 and met criteria in Table E.2 of Schedule E will fall under a requirement to obtain a resource consent. Thereafter, an assessment (Table 2, this report) will determine both the value of the patch of habitat type in question, and evaluate the impacts of the proposed activity on the identified values.
78. Schedule E incorporates well habitat types that would be assessed as 'representative' under the assessment criteria (Table 2). There can be a high level of confidence that sites (eg. Rare habitat types, habitat types supporting threatened species or unusual distributions) that would be considered significant under the 'rarity and distinctiveness' criteria (Table 2) are also well covered by Schedule E. This is because generally the habitat types within which such sites would fall are listed in Table E.1, and thresholds for criteria in Table E.2 are set at levels that are targeted for the inclusion of important sites.
79. Sites previously assessed to be significant (another criterion) have already been determined to be significant. It is stipulated within the definition of this criterion that such sites need to be assessed against criteria which are in accordance with those listed in the Plan (Table 2 of this report). Likewise, sites which are legally protected can be assumed to be of ecological significance on the grounds that the sites have been afforded legal protection on the basis of their inherent ecological value (significance).
80. In consideration of the remaining assessment criterion (ecological context), it is likely that the majority of the sites that would be encapsulated by Schedule E would meet one or more of the definitions of this criterion. Some sites will not. However, inclusion in Schedule E does not prevent activities, but it does protect indigenous biodiversity from the detrimental impacts of activities. If a site was assessed to have no values, there would be no detrimental impacts, and a proposed activity will not be unduly prevented or conditioned.
81. It is acknowledged, however, that these sites will still be drawn into the resource consent process in the first instance. It has been suggested (by way of submission and in the course of meetings) that by listing At Risk habitat types in Table E.1, the likelihood of including non-significant sites is increased. The risk of getting it 'wrong' (a non significant site) are much less than the likelihood of getting it 'right' (a significant site).
82. The eight habitat types classified as At Risk are vulnerable to continued decline as a result of direct human activity. Three of these habitat types support threatened species (and thus will be considered significant under the 'rarity and distinctiveness' criteria (Table 2)). One habitat type (riparian margin) will be considered significant under the 'ecological context' criteria (Table E.2) as this habitat type provides an ecological buffer for other sites of significance (in this case, threatened fish species).
83. The remaining four habitat types have less than 35% of former cover (Table 3).

Table 3: Percentage cover remaining of former extent for four At Risk habitat types. (Maseyk, 2007, Rogers, 1993).

Habitat type name	Percent of former cover remaining (%)
Podocarp/kamahi forest	31.6
Hall's totara/broadleaf forest	29.7
Mountain beech forest	21.5
Tussockland below the treeline	34

84. Table E.2 of Schedule E provides a second set of thresholds which in effect ensures non-significant sites are likely to be filtered out, by providing criteria that considers size, degree of fragmentation, grazing pressure and position in the landscape.
85. It is my opinion that the risk of undue restriction to the individual is small, while the risk of the alternative, (the lack of protection) is great, the cost of which is borne by the regional community and would result in the continued decline in indigenous biodiversity.
86. Like any framework, the proposed approach is not perfect. Some patches of ecologically significant indigenous vegetation will not be picked up by the proposed framework. It is difficult to quantify or estimate the extent of this risk. However, I consider that it is a more comprehensive and robust approach than more traditional schedules of sites, and that the non-regulatory methods of the Plan have the potential to compensate for any short-falls.

Fleur Maseyk
3 November 2008

REFERENCES

- Beadel, S.M., Bibby, C.J., Perfect, A.J, Rebergen, A., Sawyer, J. 2004. Eastern Wairarapa Ecological District. Survey Report for the Protected Natural Areas Programme. *Contract No. 221*. Department of Conservation, Wellington.
- Burns, B., Barker, G.M., Harris, R., & Innes, J. 2000. Conifers and cows: forest survival in a New Zealand dairy landscape. Chapter 9 in *Nature Conservation 5: Nature Conservation in Production Environments: Managing the Matrix*. Craig, J., Mitchell, N., & Saunders, A. (eds). Surrey Beatty & Sons.
- Cowie, J.D. 1963. Dune-building phases in the Manawatu District, New Zealand. *New Zealand Journal of Geology and Geophysics* 6:268-280.
- Hesp, P.A.. 2000. Coastal sand dunes: form and function. *Coastal Dune Vegetation Network Technical Bulletin No.4*. Forest Research (Coastal Dune Vegetation Network), Rotorua.
- Hilton, M., Macauley, U., & Henderson, R. 2000. Inventory of New Zealand's active dunelands. *Science for Conservation* 157. Department of Conservation, Wellington.
- Hitchmough, R., Bull, L., Cromarty, P. 2005. *New Zealand Threat Classification System Lists*. Science and Technical Publishing No. 236. Department of Conservation, Wellington.
- Johnson, P. & Gerbeaux, P. 2004. *Wetland Types in New Zealand*. Department of Conservation, Wellington.
- Lake, C.M. & Whaley, K. J. 1995. Rangitikei Ecological Region. Survey Report for the Protected Natural Areas Programme. *Protected Natural Areas Programme No. 32*. Department of Conservation. Wanganui.
- Leathwick, J.R. 2001. New Zealand's potential forest pattern as predicted from current species-environment relationships. *New Zealand Journal of Botany* 39: 447-464.
- Leathwick, J., McGlone, M., Walker, S., and Briggs, C. 2005. *New Zealand's Potential Vegetation Pattern*. Landcare Research Ltd. Lincoln New Zealand, Manaaki Whenua Press.
- Maseyk, F.J.F. 2007. Past and current indigenous vegetation cover and the justification for the protection of terrestrial biodiversity within the Manawatu-Wanganui Region. Technical Report to Support Policy Development. *Horizons Regional Council Report No. 2007/Ext/790*.
- Molloy, J., Bell, B., Clout, M., de Lange, P., Gibbs, G., Given, D., Norton, D., Smith, N., & Stephens, T. 2002. *Classifying Species According to Threat of Extinction*. Biodiversity Recovery Unit, Department of Conservation, Wellington.
- Muckersie, C., & Shepherd, M.J. 1995. Dune phases as time-regressive phenomena, Manawatu, New Zealand. *Quaternary International*. 26: 61-67.
- Norton, D.A., & Roper-Lindsay, J. 2004. Assessing significance for biodiversity conservation on private land in New Zealand. *New Zealand Journal of Ecology* 28(2): 295-305.

- Rogers, G.M. 1994. North Island seral tussockland 1. Origins and land-use history. *New Zealand Journal of Botany* 32:271-286.
- Rogers, G.M. 1993. Moawhango Ecological Region. Survey Report for the Protected Natural Areas Programme. *New Zealand Protected Natural Areas Programme No. 27*. Department of Conservation, Wanganui.
- Rogers, G.M. 1989. The nature of the lower North Island floristic gap. *New Zealand Journal of Botany*. 27:221-241.
- Smale, M.C., Dodd, M.B., Burns, B.R., & Power, I.L. 2008. Long-term impacts of grazing on indigenous forest remnants on North Island hill country, New Zealand. *New Zealand Journal of Ecology* 32(1): 57-66.
- Townsend, A.J., de Lange, P.J., Duffy, C.A.J., Miskelly, C.M., Molloy, J., Norton, D.A. 2008. *New Zealand Threat Classification System manual*. Science & Technical Publishing. Department of Conservation. Wellington.
- Walker, K. J. 2003. Recovery Plans for *Powelliphanta* land snails 2003 – 2013. *Threatened Species Recovery Plan 49*. Department of Conservation, Wellington.
- Walker, S., Brower, A.L., Clarkson, B., Lee, W.G., Myers, S.C., Shaw, W.,B., & Stephens, R.T.T. 2008. Halting indigenous biodiversity decline: ambiguity, equity, and outcomes in RMA assessment of significance. *New Zealand Journal of Ecology* 32(2): 0-0 Published on-line 27 August 2008.
- Williams, P.A., Wiser, S., Clarkson, B., Stanley, M. 2006. A physical and physiognomic framework for defining and naming originally rare terrestrial ecosystems: first approximation. *Landcare Research Internal Report: LCO506/185*. Landcare Research New Zealand Ltd.
- Williams, P.A., Wiser, S., Clarkson, B., Stanley, M. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. *New Zealand Journal of Ecology* 31(2): 119-128.

APPENDIX 1: REVISED SCHEDULE E

SCHEDULE E: INDIGENOUS BIOLOGICAL DIVERSITY

Rare, Threatened and At Risk habitat types are areas of indigenous vegetation and/or physical substrate of a type identified in Table E1 as being “Rare”, “Threatened” or “At Risk” respectively, and which meet the criteria described in Table E2 for determining whether an area of indigenous vegetation and/or physical substrate constitutes a “habitat” for the purposes of this Plan.

Indigenous vegetation refers to an assemblage of species that co-exist together and which provide resources for other species. Indigenous habitat is habitat comprised primarily of indigenous species, but which can include exotic species.

It is recommended that a suitably qualified expert is engaged for assistance with implementing Schedule E. This could be:

- (a) a consultant ecologist
- (b) Horizons staff (who will provide this service, including advice and a site visit where required in the first instance. It may be that following this initial provision of information, the proposal will require an Assessment of Ecological Effects to be provided as a component of the consent application. In such instances it is recommended that a consultant ecologist be engaged to conduct the assessment).

Horizons can in all cases, provide any spatial data and existing site information where available as relevant to the site and the proposed activity. References referred to in this schedule are available on the internet or from Horizons on request.

Interpreting Schedule E:

Q.1 Do I need a resource consent?

YES IF:

A. The area of vegetation and/or physical substrate is determined to be habitat type classified as ‘Rare’, ‘Threatened’ or ‘At Risk’ as described in Table E.1 **AND** meets any criteria in section (a) of Table E.2.

NO IF:

A. The area of vegetation and/or physical substrate is determined to be habitat type that is not classified in Table E.1
OR

B. The area of vegetation and/or physical substrate is determined to be habitat type classified as ‘Rare’, ‘Threatened’ or ‘At Risk’ in Table E.1 but **does not** meet any criteria in section (a) of Table E.2, or **does** meet any criteria in section (b) of Table E.2.

Q.2 What rule stream classification will my proposal be assessed under?

Does the proposed activity impact on habitat type that is classified (Table E.1) as any of the following?

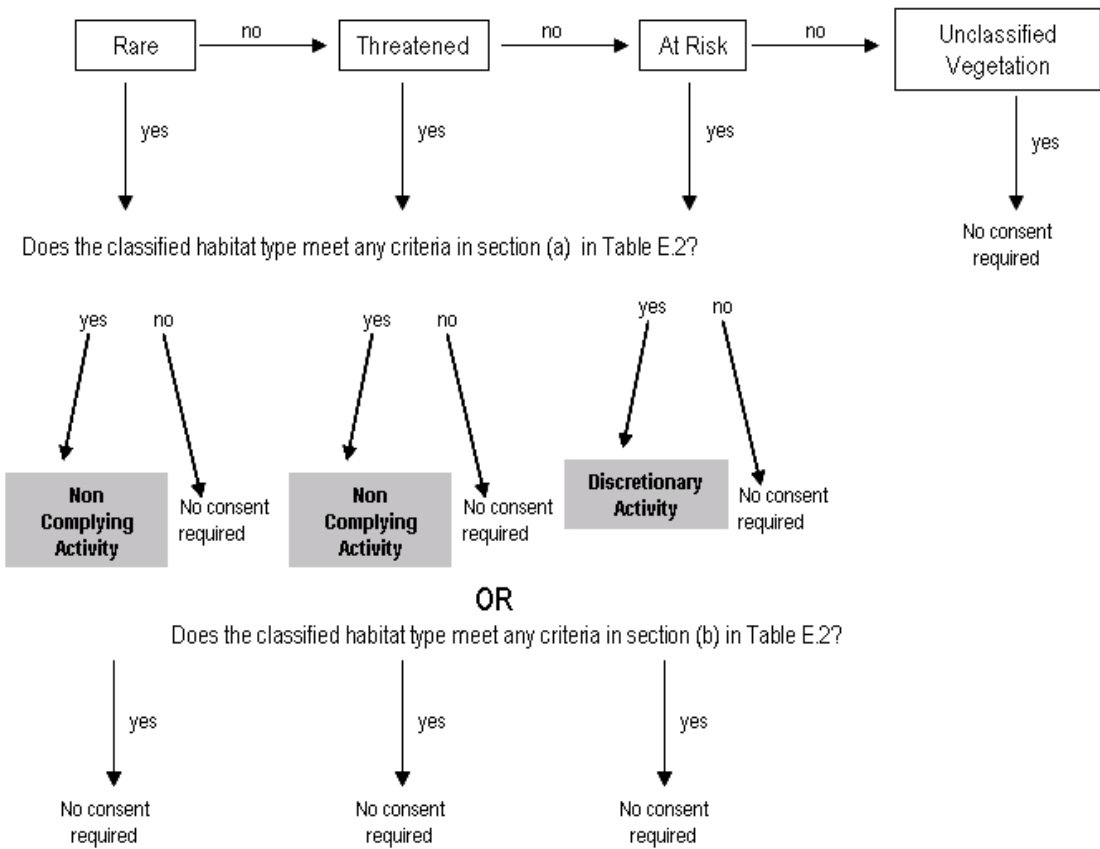


Table E.1:

NOTE: This table describes characteristics of habitat types as they are expressed at the regional scale. Patches of any given habitat type may not exhibit all elements considered characteristic of that habitat type. The descriptions are not exhaustive. Some species listed may not be present, or be present in different abundances than indicated. Other species not listed here can also be present. Sites of the same habitat type can exhibit differences to each other. Further, there will likely be differences in predicted composition and actual composition on the ground, particularly as a result of site modification and pest impacts.

The first twelve habitat type names listed in Table E.1 have been taken from Leathwick et al., 2005¹, although some names have been modified for clarity and applicability to the Manawatu-Wanganui Region.

Water Management Zones and Sub-zones are described in Schedule D and mapped in Figure E.1. Words followed by an asterisk (*) are defined in the glossary at the end of the Schedule.

Habitat Type Name	Defined As	Classification	Further Description
Forest Habitat Type			
Hardwood/broadleaved forest	<p>Tawa forest in association with broadleaved species.</p> <p>Hardwood/broadleaved forest is described as Kauri/taraire-kohekohe-tawa forest in Leathwick et al. 2005¹</p>	Threatened	<p>Kamahi, hinau and black maire are likely to be common*. Podocarp species such as kahikatea, rimu or totara may be emergent. Titoki, rewarewa or northern rata may also be a feature. The subcanopy is likely to comprise common broadleaved species.</p> <p>This habitat type is found in hillcountry north of Wanganui and the east coast at elevations of 0 - 150 m asl.</p>
Kahikatea-pukatea-tawa forest	<p>Kahikatea dominated forest on lowland alluvium and floodplains commonly found in association with pukatea and tawa.</p> <p>Kahikatea-pukatea-tawa forest is described in Leathwick et al. 2005¹</p>	Threatened	<p>This habitat type is likely to be characterised by the presence of the swamp forest species kahikatea and pukatea. Tawa will be common on the drier, better drained or raised areas. Matai, rimu and totara can be present but are restricted to areas of better-drained soils. Titoki is also likely to be common.</p> <p>Kahikatea-pukatea-tawa forest is found on alluvial soils throughout the Region predominantly at elevations between 0 – 350 m but also up to 650 m asl.</p>
Podocarp forest	<p>Podocarp forest dominated by matai, kahikatea or totara.</p> <p>Podocarp forest is described as Matai-kahikatea-totara forest in Leathwick et al., 2005¹</p>	Threatened	<p>The dominance of any of these species is dependent on the drainage capability of the soil and history of past disturbance. Totara and matai are likely to be more abundant on free-draining soils, with kahikatea likely to be dominant on poorly-drained soils. Broadleaved species (for example titoki, tawa, maire and fuchsia) are likely to be found in association with the podocarp species, but will be less abundant than the podocarp species.</p> <p>Podocarp forest is mostly confined to the Wanganui, Rangitikei and Ruapehu Districts from sea level to 900 m asl.</p>

Habitat Type Name	Defined As	Classification	Further Description
Podocarp/broadleaf-fuchsia forest	<p>Dominated by podocarp species (matai, totara, kahikatea or rimu to varying degrees) over a subcanopy of broadleaf and fuchsia.</p> <p>Podocarp/broadleaf-fuchsia forest is described as Matai-totara-kahikatea-rimu/broadleaf-fuchsia forest in Leathwick et al., 2005¹</p>	Threatened	<p>This habitat type tends to favour adequately drained and reasonably fertile soils. Although typically a feature of this habitat type, fuchsia is favoured by possums and may be uncommon in many areas. Broadleaf (<i>Griselinia</i>), climbers and epiphytes are also likely to be common. Kamahi may also be present but typical broadleaved species may be lacking.</p> <p>This habitat is largely confined to small isolated areas in high rainfall areas of the hillcountry in Ruapehu, Wanganui, Tararua and Manawatu Districts from 400 – 900 m asl.</p>
Podocarp/tawa-mahoe forest	<p>Tawa and mahoe dominated forest.</p> <p>Podocarp/tawa-mahoe forest is described as Kahikatea-matai/tawa-mahoe forest in Leathwick et al., 2005¹</p>	Threatened	<p>Kahikatea and/or matai trees are likely to be present in the canopy or as emergent trees. Rimu and totara may also be present in low numbers. Titoki, hinau, mairie or pukatea may also be present. The subcanopy is likely to comprise common broadleaved species.</p> <p>This habitat type is found on dry dune land and low hillcountry (from sea level to 750 m asl)</p>
Rimu/tawa-kamahi forest	<p>Tawa and kamahi dominated forest.</p> <p>Rimu/tawa-kamahi forest is described in Leathwick et al., 2005¹.</p>	Threatened	<p>Hinau, rewarewa or mahoe are likely to be common. Rimu may be a feature of this habitat type, although its frequency will be dependent on the history of disturbance of the site. Miro and totara may also be present with kahikatea and matai likely to be less common. Pukatea is commonly likely to be present, particularly in valleys. Black beech may be locally common on dry ridges in hillcountry (eg. inland from Wanganui). Common broadleaved species are also likely to be present in the understorey.</p> <p>Rimu/tawa-kamahi forest can be found in all Districts of the Region from sea level to 800 m asl.</p>

Habitat Type Name	Defined As	Classification	Further Description
Podocarp/kamahi forest	<p>Podocarp forest dominated by rimu, miro, kahikatea, matai or totara in varying dominance over abundant kamahi.</p> <p>Podocarp/kamahi forest is described as Rimu-matai-miro-totara/kamahi forest and Rimu-miro-totara/kamahi forest in Leathwick et al., 2005¹</p>	At Risk	<p>The degree of dominance of each of the podocarp species will be dependent on soil drainage and past disturbance history. Totara, miro and matai are likely to be more abundant on free-draining soils, with kahikatea likely to be dominant on poorly-drained soils. Rimu will likely dominant in areas of high rainfall. Tawa, northern rata, hinau, black and white mairie, fuchsia and/or mahoe may also be present.</p> <p>Podocarp/kamahi forest can be found throughout the region, excluding the western lowland area, predominately at elevations between 150 – 900 m asl. However, Podocarp/kamahi forest can be found between 50 – 1100 m asl.</p>
Hall's totara/broadleaf forest	<p>Hall's totara and broadleaf dominant forest found in montane sites lacking beech.</p> <p>Hall's totara/broadleaf forest is described in Leathwick et al., 2005¹</p>	At Risk	<p>Pahautea can be co-dominant in this habitat type, but is absent from the northern Tararua Ranges, where mountain toatoa is likely to be locally common. Matai and miro can be present at the lower altitudes of the range of this habitat type. Kamahi can also be a component of this habitat type, and will be more common in wetter climates. Rimu is not a feature of this habitat type as Hall's totara/broadleaf forest is mostly found above the altitudinal limit of rimu.</p> <p>Hall's totara/broadleaf forest is the dominant habitat type above 800 m asl where beech is absent, but can also be found to elevations as low as 450 m asl.</p>
Podocarp/red beech-kamahi-tawa forest	<p>Red beech, kamahi and tawa dominated forest found at mid-altitude zones (400 – 700 m asl).</p> <p>Podocarp/red-beech-kamahi-tawa forest is described as Rimu-miro/tawari-red beech-kamahi-tawa forest in Leathwick et al., 2005¹</p>	Threatened	<p>Podocarp species such as rimu, Hall's totara, and miro may be present scattered through the canopy, or as emergent trees. Broadleaved species may also be present in the subcanopy and understorey. At the higher altitudes of the range of this habitat type, silver beech becomes increasingly dominant.</p> <p>Podocarp/red beech-kamahi-tawa forest is largely confined to the Rang_2b Water Management Sub-zone and can be found from 400 – 700 m asl.</p>
Podocarp/black beech/mountain beech forest	<p>Black beech and mountain beech dominated forest found at mid-altitudinal zones (400 – 1250 m asl).</p> <p>Podocarp/black beech/mountain beech forest is described as Matai-totara/black beech/mountain beech forest in Leathwick et al., 2005¹</p>	Threatened	<p>Emergent podocarp species (eg. matai, totara, kahikatea, rimu or miro) can be present as emergent trees, but are not dominant. Small broadleaf trees are also likely to be present.</p> <p>This habitat type can be found mostly at mid-altitudinal zones, (with a range of between 400 – 1250 m asl) in dry climates, on free draining, relatively fertile soils.</p>

Habitat Type Name	Defined As	Classification	Further Description
Hall's totara/silver beech-kamahi forest	<p>Silver beech forest commonly in association with a high abundance of kamahi.</p> <p>Hall's totara/silver beech-kamahi forest is described as Hall's totara/silver beech-kamahi-southern rata in Leathwick et al. 2005¹</p>	Threatened	<p>Podocarp species such as Hall's totara, pahautea, totara, rimu and miro are likely to be emergent at lower elevations of the range of this habitat type, where the silver beech is less dominant. Northern rata may be scattered throughout, although its presence will be strongly influenced by the presence (current or historic) of possum.</p> <p>This habitat type is found at high elevations (750 – 1400 m asl) in the montane areas of the Rangitikei and Manawatu Districts.</p>
Mountain beech forest	<p>Mountain beech forest is dominated by mountain beech, often occurring without many other tree species.</p> <p>Mountain beech forest is described in Leathwick et al, 2005¹</p>	At Risk	<p>Mountain conifers (eg. Hall's totara, pahautea, and mountain toatoa) and other species (eg. silver beech, broadleaf) may be present (but not common) in places, especially at lower elevations or where rainfall is higher. The understorey of mountain beech forest is typically sparse. Mountain beech can tolerate cold temperatures, dry winds, and thinner, less fertile soils.</p> <p>Mountain beech forest can be dominant at higher altitudes (650 – 1450 m asl), especially on eastern sites and in areas of harsh (stress-prone) environmental conditions.</p>
Kowhai-broadleaved forest	<p>Forest dominated by kowhai growing on river terraces, river risers or cliffs and bluffs associated with rivers.</p>	Threatened	<p>Kowhai-broadleaf forest is typically low-growing forest often with a mixture of small tree species and shrubs including lacebark, ribbonwood, kanuka and divaricating shrubs.</p> <p>The absence of a dense canopy of tawa or kamahi from these forest is notable.</p> <p>This habitat type is found in the central area of the Region, within the following Water Management Sub-zones: Akit_1a, Akit_1b, Akit_1c, Mana_1a, Mana_1b, Mana_1c, Mana_7a, Mana_7b, Mana_7c, Mana_7d, Mana_12d, Rang_2b, Rang_2e, Rang_2f, Rang_2g, Rang_3a, Rang_3b, Rang_4c, Whai_6, Whai_7a, Whai_7c, Whai_7d, Whau_2, Whau_3a, Whau_3e, Tura_1a, Tura_1b.</p>
Kanuka forest	<p>Kanuka forest is dominated by almost pure stands of well-developed kanuka. Kanuka forest can be differentiated from kanuka scrub by size (greater than 4.5 m tall or 20 cm diameter (taken at diameter at breast height (dbh)).</p>	Threatened	<p>Manuka and common broadleaved species can also be present scattered through the canopy or understorey but will not be dominant.</p>

Habitat Type Name	Defined As	Classification	Further Description
Forest or scrub habitat on alluvial terrace, floodplains, shingle fans or sand dunes supporting divaricating plant species	<p>Forest or scrub growing on alluvial terraces or floodplains in areas prone to summer drought and water-logging and frost during winter that provides habitat for any of the following: Gardners tree daisy (<i>Olearia gardnerii</i>), heart-leaved kohuhu (<i>Pittosporum obcordatum</i>), <i>Coprosma obconica</i>, <i>Coprosma wallii</i>, <i>Meliclytus flexuosus</i>, fierce lancewood (<i>Pseudopanax ferox</i>),</p> <p>OR</p> <p>Forest or scrub growing on freely draining shingle fans, river terraces and sand dunes that provides habitat to matagouri (<i>Discaria toumatou</i>).</p>	At Risk	<p>This habitat type supports threatened or regionally uncommon divaricating plant species.</p> <p>This habitat type may be disturbed (naturally or human induced), contain exotic species, or other divaricating species than those listed here, or be found in association with another habitat type (eg. Podocarp-broadleaf forest). Although these species may occur together or in isolation throughout the Region, this habitat type is mostly found in the Middle Rangitikei Water Management Zone (Rang_2), with matagouri mostly found on sand country of the west coast of the Region, the East Coast Management Zone (East_1) and the Upper Whangaehu (Whau_1).</p>
Lowland forest supporting <i>Powelliphanta</i> land snails	<p>Lowland forests occurring on deep moist soils of the Horowhenua Plains containing land snails (<i>Powelliphanta traversi traversi</i>). This forest is dominated by pukatea, kahikatea, and maire tawaki in wet areas, and tawa, kohekohe, karaka, and totara in drier areas.</p> <p>This habitat type is described in Walker, 2003²</p>	At Risk	<p>This habitat type supports the threatened land snail which can be found under leaf litter.</p> <p>This species of land snail is known from the Lake Papaitonga (West_8) and Lake Horowhenua (Hoki_1a) Water Management Sub-zones, and may be present in even small and modified fragments of this habitat type.</p>
Mid-altitudinal forest supporting <i>Powelliphanta</i> land snails	<p>Mid-altitudinal (460-610 m asl) forest dominated by rimu and miro with rewarewa and pigeonwood, OR low-growing scrub dominated by the tree fern wheki that contains land snails (<i>Powelliphanta traversi tararuaensis</i>).</p> <p>This habitat type is described in Walker, 2003²</p>	At Risk	<p>This habitat supports the threatened land snail, which can be found under leaf litter and bush rice grass in areas where seepages are common and fertile alluvial soils or litter have accumulated.</p> <p>This species of land snail occurs in the Kahuterawa (Mana_11c) and Mangaore (Mana_13d) Water Management Sub-zones, and may be present in even small and modified fragments of this habitat type.</p>
Riparian Habitat Type			
Riparian margin	Any vegetation (whether indigenous or not, and including classified elsewhere in Schedule E) within 20 m of an area as identified in Schedule D as being a Site of Significance-Aquatic.	At Risk	Riparian margin vegetation can comprise indigenous vegetation, exotic vegetation or a combination of both and of any structure ³ . This habitat type will vary greatly between patches in both structure and composition, and might be highly modified, contain artificial assemblages of species or include deliberately planted species (indigenous or exotic).

Habitat Type Name	Defined As	Classification	Further Description
Tussockland Habitat Type			
Tussockland below the treeline	Red tussock dominated tussockland ³ below the treeline in areas with frequent disturbance regimes that may be natural or human induced, high water tables and/or temperature inversions.	At Risk	<p>Red tussock will be particularly dominant in humid climates on moist soils. Other tussock species that can be present include silver tussock and blue tussock. Silver tussock (although no longer common) will be more important on higher fertility, frequently disturbed areas. Blue tussock may be uncommonly present as an inter-tussock species.</p> <p>Native and exotic woody species (eg. heather, monoao, Hebe, manuka and kanuka) are likely to be increasingly present as natural successional processes advance.</p> <p>This habitat type can be found in Rang_1, Rang_2a, Rang_2b, Rang_2c, Rang_2d, Rang_2e, and Rang_2f, Water Management Sub-zones.</p>
Wetland Habitat Type			
Dune slack wetland	<p>Dune slack wetlands are found in areas where wind has eroded hollows or depressions, or a topographically low area where water is permanently or seasonally ponded.</p> <p>As per Johnson & Gerbeaux, 2006⁴ and Williams et al., 2006 & Williams et al., 2007⁵</p>	Rare ⁶	Dune slack wetlands typically support herbfields ³ .
Ephemeral wetland	<p>Ephemeral wetlands are usually of moderate fertility, and neutral pH, characterised by a marked seasonal high water table, ponding and drying. Change in water levels can be very dramatic to the point of complete drying and fluctuations between aquatic and terrestrial plant species can occur. Ephemeral wetlands are feed by ground water or a adjacent water body.</p> <p>As per Johnson & Gerbeaux, 2006⁴ and Williams et al., 2006 & Williams et al., 2007⁵</p>	Rare ⁶	Ephemeral wetlands typically support turf habitat (generally < 3 cm tall). Turf habitat contains 62% of New Zealand's threatened or uncommon plants. Ephemeral wetlands can also sometimes support rushland ³ scrub.

Habitat Type Name	Defined As	Classification	Further Description
Pakihi wetland	<p>Pakihi wetlands are often found in association with bogs and fens.</p> <p>Pakihi wetlands are rain-fed systems on mineral or sometimes peat substrate of very low fertility and low pH and can be seasonally dry.</p> <p>As per Johnson & Gerbeaux, 2006⁴ and Williams et al., 2006 & Williams et al., 2007⁵</p>	Rare ⁶	Pakihi can be found on level to rolling or sloping land in areas of high rainfall and old soils. Pakihi can support restiads, sedges, fernland, heathland and shrubland ³ .
Seepage and Spring wetlands	<p>These wetlands are represented by areas of water that have percolated to the surface, with the volume of water present at seepages being less than that at springs. Substrates, nutrient levels and pH can vary from site to site.</p> <p>As per Johnson & Gerbeaux, 2006⁴ and Williams et al., 2006 & Williams et al., 2007⁵</p>	Rare ⁶	Seepages and springs can be found at the point of change of slopes, and places where the water table is raised. These wetlands can support sedgeland, cushionfield, mossfield or scrub. ³
Swamp wetlands	<p>Swamp wetlands are generally of high fertility receiving nutrients and sediment from surface water and groundwater. Substrates are generally a combination of peat and mineral. Standing water and surface channels are often present, with the water table either permanently, or periodically, above much of the ground surface.</p> <p>As per Johnson & Gerbeaux, 2006⁴</p>	Threatened	Swamp wetland can be found on plains, valley floors and basins. Swamps can support sedges, rushes, reeds, flaxland, tall herbs, shrubs scrub and forest ³ .
Bog and fen wetlands	<p>These wetland classes are often found in association with each other.</p> <p>Bogs are formed on peat with rainwater the only source of water. Bogs are nutrient poor, poorly drained and aerated and usually acid. The water table is usually close to or just above the ground surface.</p> <p>Fens are wetlands of low to moderate acidity and fertility with a substrate of predominantly peat. Receives ground water and nutrients from adjacent mineral soils. The water table is usually close to or just below the surface.</p> <p>As per Johnson & Gerbeaux, 2006⁴</p>	Threatened	<p>Bogs can be found on relatively level or gently sloping ground including hill crests, basins, terraces and within other wetland classes. Bogs can support mosses, lichens, cushion plants, sedges, grasses, restiads, ferns, shrubs and trees.</p> <p>Fens can be found on slight slopes (eg. fans), toes of hillsides, on level ground where peat hasn't accumulated much and can grade into swamp. Fens support restiads, sedges, ferns, tall herbs, tussock grasses and scrub.</p>

Habitat Type Name	Defined As	Classification	Further Description
Saltmarsh wetlands	Saltmarsh and associated mudflats occur within areas of tidal and saline influences (tidal and sub-tidal zones). Water sources come from ground water and adjacent saline or brackish waters. As per Johnson & Gerbeaux, 2006 ⁴	Threatened	Saltmarsh can support herbfield, rushland and scrub ³ and occur in association with mudflats. In some places the mudflats can be extensive and are characteristic of estuarine wetland systems.
Lakes and Lagoons and their margins (including dune lakes)	The lakes in the Manawatu-Wanganui Region are associated with dune, river (including ox-bow lakes) and volcanic activities. As per Johnson & Gerbeaux, 2006 ⁵	Threatened	Lakes can exist entirely within a swamp, or have elements of wetland habitat on the lake margins. Lakes can also support terrestrial habitat on the lake margins.
Naturally Rare Habitat Type			
Cliffs, scarps and tors	Where bare substrate, lichenfield, tussockland, herbfield, shrubland or scrub ³ occurs on cliffs (including coastal cliffs), scarps or tors of any rock type. OR Where bare substrate or herbfield ³ dominated by indigenous species occurs on flat land on the top of coastal cliffs. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Vegetation types typically found in this habitat include lichen species, non-woody or low-growing semi woody herbs, tussocks, shrubs and scrub. Species characteristic of these vegetation types include, for example, Pimelea, sea primrose, Selliera, Myosotis, shore puha, flax, toetoe, Astelia, Hebe, daisy species, kawakawa, mahoe and broadleaf.
Karst systems	Where bare substrate, shrubland, tussockland, flaxland, or herbfield ³ , occurs in sinkholes, cave entrances, caves and cracks in karst systems. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Karst systems can be found on limestone, marble, dolomite or calcareous rock, and be subterranean or semi-subterranean. Karst systems are known in the Region from the Whanganui and Pohangina Valleys.
Screes and boulderfields	Where bare substrate, lichenfield, shrubland, scrub or forest ³ occurs on screes or boulderfields of any rock type. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Includes slopes covered in shingle, cobbles or rock (of any rock type) which may or may not support vegetation. Bare substrate is the dominant feature of this habitat type. Screes and boulderfields are often found associated with a larger cliff or slope. They provide habitat for lizards including the threatened small scaled skink (<i>Oligosomia microlepis</i>) which is endemic to the Region.

Habitat Type Name	Defined As	Classification	Further Description
Active duneland	Where grassland or sedgeland ³ occurs on active duneland formed on raw coastal sand. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Active duneland are characterised by unstable sands. This continual instability of sand prevents the formation of soil and therefore the vegetation type that an active duneland can support is limited. Examples are Spinifex grassland and pingao sedgeland. Other indigenous species can also be present eg. sand convolvulus and sand Carex.
Stable duneland	Where grassland, tussockland, herbfield ³ (including <i>Pimelea actea</i> and <i>P. arenaria</i>), or shrubland occurs on stable duneland formed on recent coastal sand. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Vegetation types typically found on stable duneland include; tussocks, low-growing or semi-woody herbs and shrubs. These vegetation types characteristically support, for example, toetoe, <i>Selliera rotundifolia</i> , sand Gunnera, native spinach, sand Coprosma, sand daphne, coastal tree daisy, pohuehue, tauhinu, Coprosma species and hangehange. Exotic invasive species are also a feature of stable duneland. The threatened species <i>Pimelea actea</i> is known from the Tura_1b, West_5, and Whau_4 Water Management Zones.
Inland duneland	Where scrub, tussockland, herbfield or forest ³ occurs on inland duneland formed on raw or recent sands inland. As per Williams et al., 2006 & Williams et al., 2007 ⁵	Rare	Vegetation types typically found on inland duneland include; tussock, low-growing or semi-woody herbs, shrubs, small trees and forest trees. These vegetation types characteristically support, for example, toetoe, flax, native spinach, manuka, kanuka, mahoe, lancewood, five-finger, hangehange, cabbage trees; titoki, akeake, ngaio, tawa, pigeonwood and mahoe.

¹ Leathwick, J., McGlone, M., Walker, S. and Briggs, C. 2005. *New Zealand's Potential Vegetation Pattern*. Landcare Research Ltd. Lincoln New Zealand. Manaaki Whenua Press.

² Walker, K.J. 2003. Recovery plans for *Powelliphanta* land snails 2003 – 2013. *Threatened Species Recovery Plan 49*. Department of Conservation, Wellington.

³ Vegetation structure is defined in Atkinson, I.A.E. 1985. Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany* 23:361-378.

⁴ Johnson, P. & Gerbeaux, P. 2004. *Wetland Types in New Zealand*. Department of Conservation, Wellington.

⁵ Williams, P.A., Wiser, S., Clarkson, B., Stanley, M. 2006. A physical and physiognomic framework for defining and naming originally rare terrestrial ecosystems: first approximation. *Landcare Research Internal Report: LCO506/185*. Landcare Research New Zealand Ltd.

Williams, P.A., Wiser, S., Clarkson, B., Stanley, M. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. *New Zealand Journal of Ecology* 31(2): 119-128.

⁶ Wetland habitat found on active, stable or inland duneland have been identified as Rare habitat type according to Williams et al., 2006.

Table E.2:

(a) An area of any habitat type described in Table E.1, is also required to meet any of the following criteria to be considered habitat for the purposes of this plan:	
	<p>Forest Habitat Type Classified as Threatened or At Risk</p> <p>i. Areas of continuous indigenous vegetation covering at least 0.25 ha within any Water Management Sub-zone coded red (Figure E.1). Or</p> <p>ii. Areas of continuous indigenous vegetation covering at least 1 ha within any Water Management Sub-zone coded orange or yellow (Figure E.1). Or</p> <p>iii. Areas of habitat type classified as Threatened were it occurs as treeland over at least 1 ha. Or</p> <p>iv. Areas of treeland over at least 1 ha within any Water Management Sub-zone coded red (Figure E.1) Or</p> <p>v. Areas of treeland over at least 2 ha within any Water Management Sub-zone coded orange or yellow (Figure E.1) Or</p> <p>vi. Areas of continuous indigenous vegetation covering at least 0.5 ha, where one or more other areas of indigenous habitat (covering at least 0.5 ha), is present up to 500 m away. Or</p> <p>vii. Areas of continuous indigenous vegetation covering at least 0.5 ha that support indigenous understorey vegetation. Or</p> <p>viii. Discontinuous indigenous vegetation covering at least 1 ha present within 50 m of an area of continuous indigenous vegetation covering at least 0.5 ha. Or</p> <p>ix. Areas of indigenous vegetation covering at least 0.5 ha in gully systems. Or</p> <p>x. Areas of continuous indigenous vegetation within 5 m of a river bed and covering at least 0.1 ha and extending at least 100 m along the length of the river. Or</p> <p>xi. Areas containing <i>Olearia gardnerii</i>, <i>Pittosporum obcordatum</i>, <i>Coprosma obconica</i>, <i>Coprosma wallii</i>, <i>Meliccytus flexuosus</i>, <i>Pseudopanax ferox</i> or <i>Discaria toumatou</i> covering at least 0.1 ha. Or</p> <p>xii. An area of indigenous vegetation of any size containing <i>Powelliphanta</i> land snails. Or</p> <p>xiii. Areas of indigenous vegetation that have been established for the purpose of habitat manipulation including habitat creation, restoration and buffering, where such an area covers at least 1 ha as a discrete site or at least 0.5 ha where it is adjacent to an existing area of indigenous habitat. Or</p> <p>Riparian Habitat Type Classified as At Risk</p> <p>xiv. An area of vegetation of any size or species composition (including exotic vegetation) within 20 m of an area identified in Schedule D as being a Site of Significance – Aquatic. Or</p> <p>Grassland Habitat Type Classified as At Risk</p> <p>xv. An area of grassland covering at least 0.5 ha. Or</p> <p>Wetland Habitat Type Classified as Threatened</p> <p>xvi. Open water associated with wetland habitat, excluding stock ponds less than 0.5 ha in area. Or</p> <p>xvii. Areas of naturally occurring indigenous wetland habitat either in association with open water (fresh or estuarine), or excluding open water, covering at least 0.1 ha. Or</p> <p>xviii. Areas of indigenous vegetation that have been established in the course of wetland habitat restoration. Or</p> <p>xix. Areas of artificially created wetland habitat covering at least 0.5 ha excepting areas that met criteria (b)vi, (b)vii, (b)viii or (b)ix. Or</p> <p>Naturally Rare Habitat Type and Wetland Habitat Type Classified as 'Rare'</p> <p>xx. Areas of indigenous vegetation and/or naturally occurring bare substrate that form part of a rare Habitat Type covering at least 0.05 ha. Or</p> <p>xxi. Areas of indigenous habitat created at some time in the course of dune habitat restoration (including dune stabilisation)</p>

(b) An area of any habitat type described in Table E.1, is also required to meet any of the following criteria to not be considered habitat for the purposes of this plan:

Forest Habitat Type Classified as Threatened or At Risk

- i. Areas of treeland excluding sites that meet any of the criteria (a)iii, (a)iv, or (a)v of Table E.2. Or
- ii. Woodlots of indigenous tree species planted for the purposes of timber harvest. Or
- iii. Indigenous vegetation planted for landscaping, horticultural (including shelter belts) or private gardening purposes.

Wetland Habitat Type Classified as Threatened

- iv. Damp gully heads, or paddocks subject to regular ponding, dominated by pasture or exotic species in association with wetland sedge and rush species. Or
- v. Ditches or drains supporting raupo, flax or other wetland species (eg. *Carex* sp., *Isolepis* sp.), or areas of these species in drains or slumps associated with road reserves or rail corridors. Or
- vi. Areas of open water-created for the purposes of stock watering, or water storage for the purposes of irrigation, including old gravel pits (but excluding lakes and areas of open water associated with indigenous wetland habitat, or wetland habitat that meets Criterion (a) xix). Or
- vii. A pond and/or barrier ditch system specifically designed and installed for the treatment of animal effluent Or
- viii. Habitat created and maintained for the purposes of waste water treatment. Or
- ix. Habitat created and maintained for the purposes of sediment control. Or
- x. Habitat created and maintained in association or as part of any hydroelectric power generation scheme, or in relation to the implementation of any resource consent conditions or agreements relating to the operation of any hydroelectric power scheme. Or
- xi. Open water and associated vegetation created for landscaping purposes or amenity values where the planted vegetation is predominately exotic or includes assemblages of species not naturally found in association with each other, on the particular landform or at the geographical location of the created site.

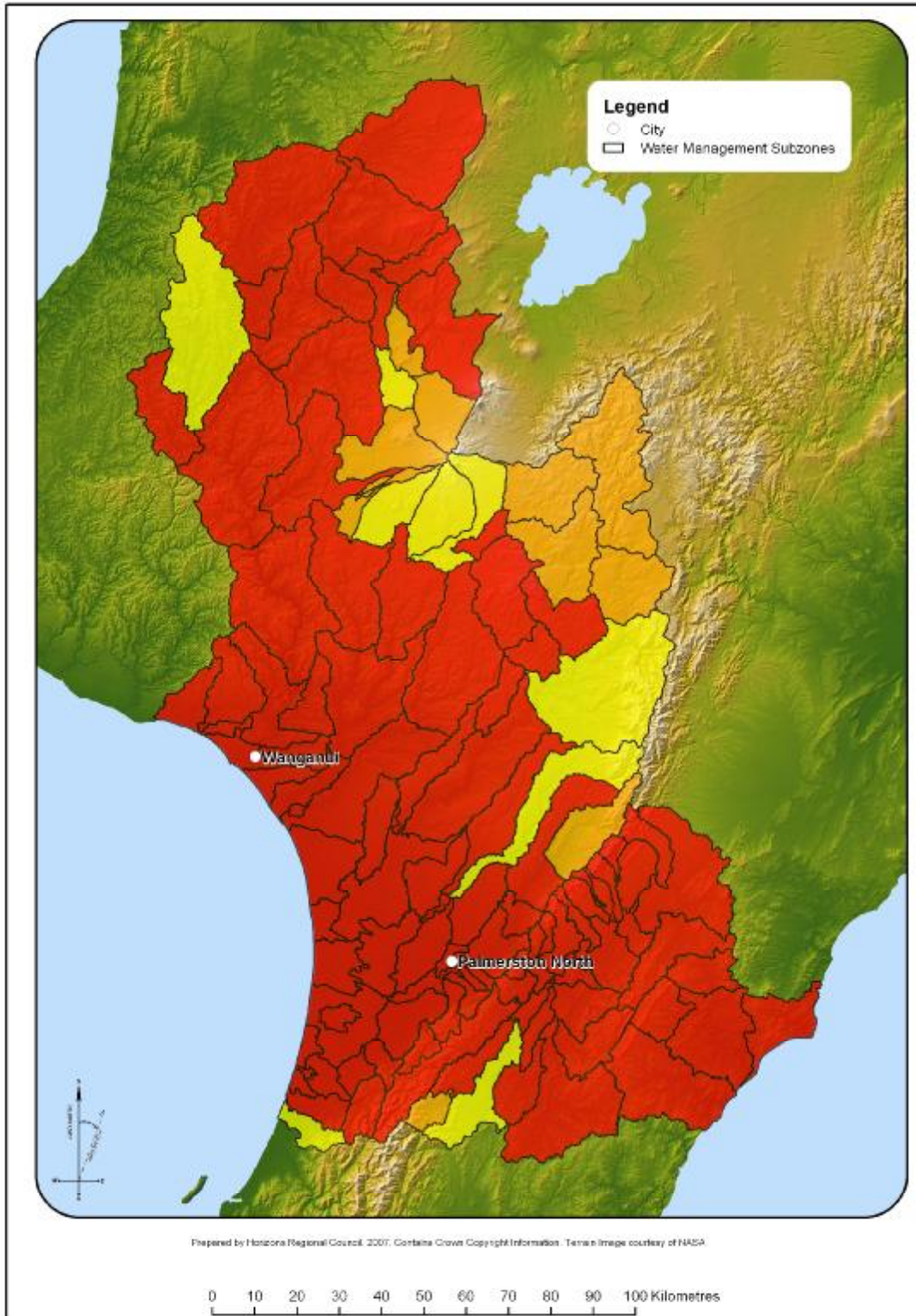


Figure E.1: Map of the Manawatu-Wanganui Region with Water Management Sub-zones coloured according to habitat type classification. Red coloured WMS indicate that where habitat exists within that WMS it is predominately Threatened habitat type. Orange coloured WMS indicate that where habitat exists within that WMS it is predominately Threatened or At Risk habitat type. Yellow coloured WMS indicate that where habitat exists within that WMS it is predominately vegetation not classified by this Schedule. This map is to be read in conjunction with criteria in Table E.2.

Glossary

Abundant¹	Species are considered to be abundant when they contribute more than most other species to the composition of an area of interest, but are not the dominant species.
Association	A species, or group of species, landform or soil type occurring in space together. Such associations can be observed in geographical pattern across the landscape, or in distinctive community groupings.
Broadleaved species	A generic term referring to a wide range of flowering species excluding the beech and conifer species, which can also be applied to dominant hardwood species (eg. tawa). Common examples of species referred to as broadleaved species include (but are not restricted to) kamahi, titoki, fuchsia, maire, hinau, tawa, mahoe, and <i>Coprosma</i> species. The term 'broadleaf' is specific and refers to <i>Griselina littoralis</i> or <i>Griselina lucida</i> .
Common¹	Species are considered to be common when they contribute more than other species, but less than still other species to the composition of an area of interest. Species that are common contribute less to the composition of an area of interest than species which are abundant or dominant.
Dominated/dominant¹	Species are considered to be dominant (or to dominate) when they contribute more than any other species to the composition of an area of interest. Dominant species can be considered the most characteristic species of the area of interest (eg. habitat type).
Duneland	Refers to areas where the landform is characterised by sand dunes (active or stable). Duneland is found in the sand country.
Lowland²	Typically, lowland refers to the elevation between sea level and approximately 300 m asl. However, characteristics of lowland forest (eg. species presence, species composition, diversity) can exhibit itself at higher altitudes (eg. Whanganui National Park comprises lowland forest at elevations greater than 300 m asl).
Hillcountry	Refers to land where the landform is characterised by rolling to steep hills.
Mid-altitudinal²	Refers in general to the areas of land between elevations supporting characteristically lowland vegetation and elevations supporting characteristically montane vegetation. Typically, mid-altitudinal elevations will be in the order of between 400 – 950 m asl, although some variance can be expected.
Occasional¹	Species are considered to be occasional when they contribute more than scattered species, but less than most species to the composition of an area of interest. Species that are occasional contribute considerably less to the composition to an area of interest than species which are common, abundant or dominant and can be expected to be encountered infrequently within the area of interest.
Podocarp	Southern hemisphere conifer which has cones modified into fleshy berry-like structures but do not have flowers. Podocarp species include the totara species, matai, miro, kahikatea and rimu.
Sand country	Refers to land where the dominate substrate is sand (improved or unimproved). In the Manawatu-Wanganui Region, the sand country is defined by the boundaries of the Foxton Ecological District.
Scattered¹	Species are considered to be scattered when they contribute less than most other species to the composition of an area of interest. Species that are scattered contribute considerably less to the composition to an area of interest than species which are occasional, common, abundant or dominant and can be expected to be encountered infrequently, and with a sparse distribution within the area of interest.

¹ This is a measure of the importance of a species in relation to other species in the same area of interest (eg. the same habitat type or forest tier), and is not simply a frequency count (biomass as well as density contribute to the importance of any given species to the area of interest).

² Altitudinal zonations are not fixed and the elevation at the point of change between any two zonations will exhibit variance across the landscape. There are obvious patterns in vegetation cover along an altitudinal gradient, with the change in climatic conditions as altitude increases being reflected in a change in vegetation cover. Specifically, a change in species composition, growth form (eg. trees to shrubs to tussocks) and stature (eg. decreasing in height, or prostrate) is noticeable. Thus, the shift between altitudinal zonations is more defined by the change in vegetation type (eg. lowland forest to montane forest) than it is by elevation.

APPENDIX 2: CENTRAL NORTH ISLAND

Geographical extent of the area defined as the Central North Island. Taken from Rogers, G.M. 1989. The nature of the lower North Island floristic gap. *New Zealand Journal of Botany*. 27:221-241.

