BEFORE A HEARING PANEL
CONSTITUTED BY HORIZONS REGIONAL COUNCIL

IN THE MATTER OF	an application dated 21 December 2020 for regional consents by Grenadier Limited to develop the Douglas Link Golf Course at 765 Muhunoa West Road, Ohau
IN THE MATTER OF	Part 6 of the Resource Management Act 1991

STATEMENT OF EVIDENCE OF

DR VAUGHAN FRANCIS KEESING

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Introduction

Name, qualifications and experience

[1] My full name is Vaughan Francis Keesing.

[2] I am a Senior Ecologist and Partner with the consulting firm of Boffa Miskell Limited (BML).

[3] I have been a consulting ecologist for the last 23 years. My qualifications include a B.Sc. (Hons, 1st) in Zoology and a Ph.D. in Ecology, both from Massey University, as well as a Diploma in Research Statistics

[4] My skills lie in community ecology. I have specialist skills in the areas of entomology, zoology, and botany, and I have worked extensively in freshwater and terrestrial habitats throughout New Zealand.

[5] Prior to being an ecological consultant, I was an employed by Lincoln University as a research fellow where I taught entomology, applied ecology and restoration ecology. My research there was largely in invertebrate ecology.

[6] I have been practising as a consultant ecologist for the last 26 years, and have worked in a variety of locations including the Wellington region and elsewhere in the lower North Island, West Coast, Canterbury, central North Island, and the Far North, Auckland region, and the Bay of Plenty.

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

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

(a) determining significant wetlands (as part of exercises in the West Coast Region and Ashburton to identify Significant Natural Areas

(SNAs) and in Rangitikei as part of its Protected Natural Areas Programme);

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

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

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

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

(f) plan changes (e.g. Porters Ski field expansion); and

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

[9] Most relevant to this current application is the work I have undertaken to identify values and the effects of earthworks and vegetation clearance for:

(a) Omaha South (Darby Partners), A coastal Duneland system north of Auckland;

(b) Long Bay (Landco) development, A coastal Auckland site;

(c) Pegasus Bay (Infinity Co) development, a coastal Canterbury site;

(d) Ocean beach development (Lowe), a coastal dune system Hastings site;

(e) Te Arai Golf course, a dune golf course north of Auckland;

(f) Foxton wastewater expansion -Matakarapa Island;

(g) Levin wastewater expansion project; and

(h) Waitarere Surf club relocation.

[10] The most relevant work examples listed above are all assessments involving coastal sites with coastal dunes and dune vegetation, potential "natural wetlands", revegetation programmes, coastal fauna, and assessments requiring identification of values and significance in terms of section 6c of the RMA and predicting activity effects and outcomes.

Expert Code

[11] While this is not an Environment Court hearing, I have met the standards in that Court for giving expert evidence.

[12] I have read the Code of Conduct for expert witnesses issued as part of the Environment Court Practice Note 2014 (Part 7). I agree to comply with the Code of Conduct. I am satisfied that the matters addressed in this statement of evidence are within my expertise. I am not aware of any material facts that have either been omitted or might alter or detract from the opinions expressed in this statement of evidence.

Role in Project

My role in this project is the lead project ecologist, determining the studies and surveys to be carried out, the methodologies to be used and guidance in report writing as well as the review and overview of the conclusions of the resultant ecological assessments. I have also assisted my juniors on site with various aspects of data collection and interacted with the Regional Council ecological reviewer undertaken the section 92 response (including vegetation data collection, Katipo

survey and lizard ACOP set up) as well as assisting the projects revegetation / enhancement plans.

Purpose of Evidence

[13] My evidence relates the studies Boffa Miskell staff have undertaken to find and describe the ecological features and indigenous species using the site.

[14] It assesses what the ecological values present are, where they area and determines using the Regional planning instruments if they are significant in terms of the RMA section 6c or not. It then assesses what the impacts on those values and significance is likely to be because of the proposed activities for which the applicant seeks consents.

[15] Lastly, it describes the effects management methods available to the applicant to mitigate (avoid, minimise remedy) and (if required) offset adverse impact's which are more than minor as well as enhancement opportunities.

Executive Summary

[16] A number of studies by a number of experienced trained experts in their fields were conducted to survey the vegetation communities, determine the presence of fauna and demarcate schedule F areas as per the definitions in Schedule F of the One plan.

[17] The structure of the golf course was amended to miss the high value ecological features and minimise its impact on the schedule F areas. That effect is now less than 1 ha. To remedy the small range of adverse effects a dune restoration plan was established and revolved around removing the weeds and exotic trees present and revegetating the landscape with appropriate stable dune communities ultimately reducing fragmentation and edge effects and making the stable dune larger and more representative and resilient.

[18] From an ecological perspective there is no reason why Horizons should not grant consent, and there are ecological reasons why the proposal will be beneficial to this coastal environment.

Evidence

[19] Detailed ecological studies were commissioned of Boffa Miskell (BML) in March 2021 following, I understand, Regional Council further information requests after they had supplied a high-level ecological assessment of schedule F areas on the property (Horizons undated report by Lizzie Daily).

[20] My team commenced studies in April (2021) aiming to cover the delineation of the schedule F areas, the vegetation assemblages on site, find any threatened or at risk plants, identify the avian assemblages, identify any lizard assemblages in the habitats present, recognise any natural wetlands, recognise any threatened and at risk specific invertebrates, and characterise the potential receiving waterways (i.e. the Ohau River).

[21] After the process of surveys and identifying the assemblages and mapping the communities and values, I meet with some of the "wider team" and workshopped the golf layout design and influenced that shaping relative to the values I had identified. This did result in reducing the potential impacts at holes 4, 14, 16, 6 and 17, with reductions in the greens and fairways and Tee placements in relation to the better active fore dunes, and specifically the population of sand daphne found, as well as avoiding kanuka stands and the two wetland systems located. Many of the findings from the Boffa Miskell work confirm the prior work by Dr Frank Boffa (project landscape architect) and Mr Jim Dahm (project coastal scientist and geomorphologist).

[22] An AEE was developed and published. A section 92 from the Regional Council followed and involved further on-site studies to alleviate concerns regarding specific vegetation questions, the use of a particular lizard survey method, as well as a Katipo survey. The field work for these was undertaken in November-January 2021-2022 (the lizard survey requiring 6-8 weeks).

[23] The additional studies confirmed that our earlier mapping of the schedule F area was very conservative in the stable dune communities and I have amended those boundaries here. It also brought strong evidence of the absence of particular fauna (lizards and katipo spider).

Gathering the data

[24] The "site" is located directly north and adjacent to the Ohau River, on the coast and covers approximately 120 ha of low, rolling and flat land, which is or was historically sand dunes and inter sand dune flats (Figure 1).

Figure 1. The site as it sits on the coast west of Levin and north of the Ohau Stream.

[25] At the time of surveys, the majority of the site was an active farm, with areas of vegetation toward the coast partially fenced from stock. There had been exotic tree land felling (with slash piles left) and land recontouring historically and this shaped some of our understanding of the processes involved in why particular vegetation communities are what they are today.

[26] I will not repeat the various survey methodologies (they are in full in the ecological assessment (13 October 2021 lodged with the application as well as additional work undertaken to address section 92 matters) other than to say standard protocols were used for bird counts, lizard surveys (although my team did use a new protocol utilising fauna presence triggered camera technology), natural wetland (NPS-FM (2020 protocol), Katipo searches, vegetation descriptions and usual mapping conventions as well as normal species naming conventions.

[27] Most importantly I follow the EIANZ (2018) practioners guidance for impact assessment and the methods to value and assess impact therein.

Vegetation Communities

[28] The initial vegetation survey was undertaken by Melanie Brown of BML and a well-known expert botanist Mr Pat Enright, whom BML engages for his expertise. They traversed the entire dune and back dune areas recording the plant communities present and searching for rare and special plants and assemblages. They did not use vegetation plots as the systems they encountered were relatively simple and uniform and did not require plot information to differentiate the communities through ordination such that they could be accurately mapped. Walking transects recording plant species and relative abundances is the best method to use to describe large areas of low vegetation and map them.

[29] 12 district (and some with subsets) vegetation communities were recognised on site and their total areas as calculated by ArcGIS software as shown in the table below (Table 1). Figure 2 shows the vegetation community outlines.

Table 1. Vegetation communities identified on site and the total area they occupy.

Number	**Vegetation community**	**Total area** (ha)
1	Grazed grassland	59.57
2	Rank grassland	1.17
3a	Mixed wattle treeland	1.77
3b	Mixed pine treeland	14.17
4a	Poplar treeland	0.55
4b	Poplar treeland over exotic scrub	0.10
5	Macrocarpa	9.52
6a	Exotic scrub	10.45
6b	Exotic scrub under pine	2.12
7	Exotic native mix	0.34
8a	Kānuka treeland	0.70
8b	Thin kānuka treeland	0.24
9	Knobby clubrush stable duneland	7.31
10	Spinifex active duneland	6.53
11	Wetland	0.03
12	Saltmarsh	1.98

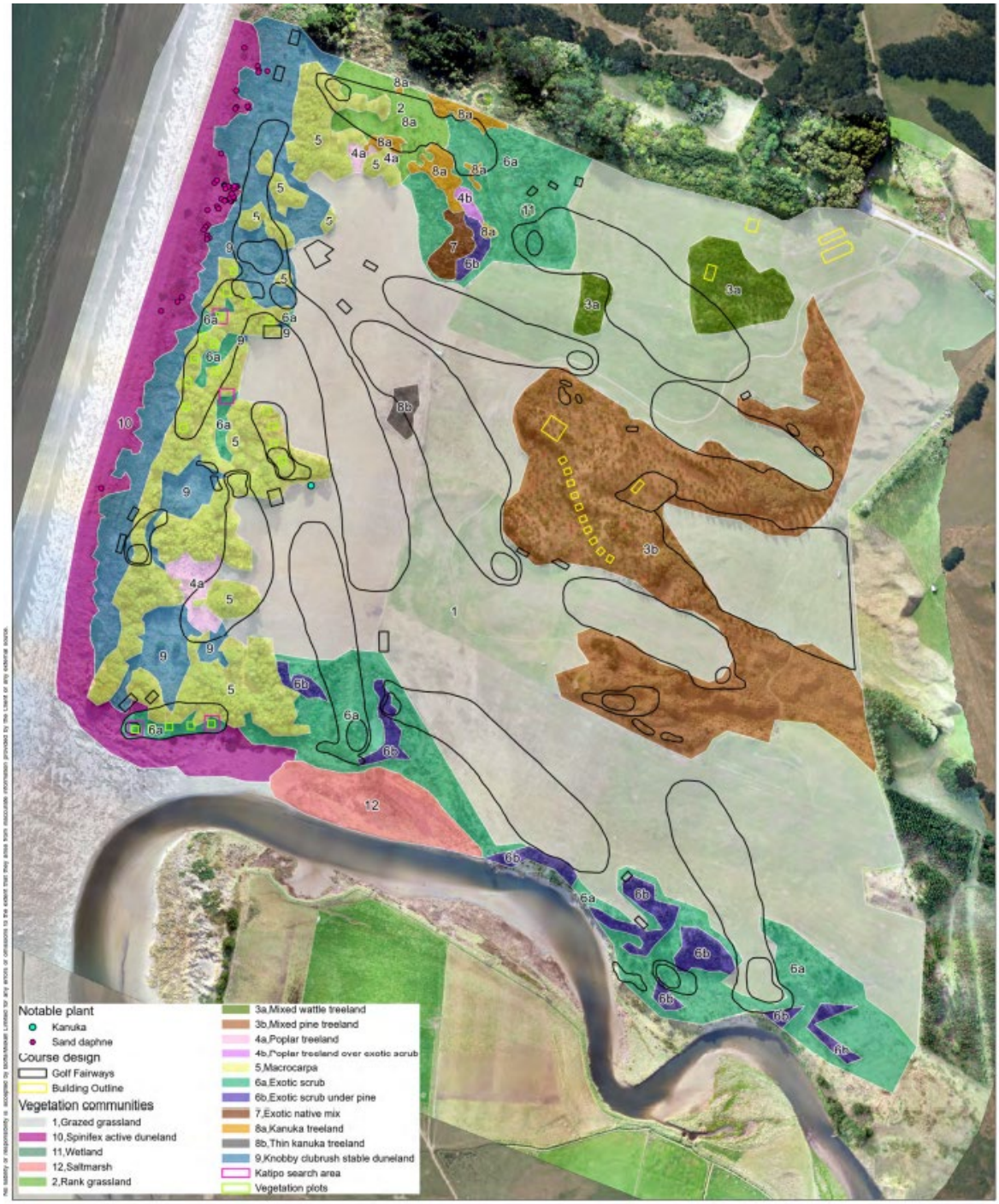

Figure 2. Surveyed vegetation map of the site. Colours indicate different plant communities and the proposed golf locations are shown as black lines.

[30] I will not describe the grazed grassland, rank grass, mixed tree wattle, mixed pine, exotic scrub, poplar treeland over exotic scrub, exotic scrub under pine, etc as these assemblages are all exotic, new, weeds and have little or no indigenous value or wider landscape ecological values. I shall describe the important schedule F and near schedule F vegetation communities. The following community labels are those of Table 1 and Map 2.

Community 7 - exotic native mix

[31] This small patch is in the area of the remnant kanuka patches in the northern central area of the site.

[32] This community contains an almost equal mix of native and indigenous species above the ground tier, with emergent silver poplar and totara *(Podocarpus totara*) forming the canopy. Silver poplar is spread commonly throughout the community, slightly more condensed at the northern end where it meets the poplar treeland. The totara is contained largely to the centre of the community, where a cluster of approximately seven very narrow-trunked trees have grown alongside each other and are in varying states of health.

[33] The groundcover contains pasture grasses (clover, cocksfoot, tall fescue), gorse, lupin, boxthorn, lucerne, wilding pine, and pampas, intertwined with blackberry encroaching from the neighbouring community at common densities. Among this are a mix of young native species at 1-2m in height. Mahoe (*Melicytus ramiflorus*), *Myrsine australis*, and knobby clubrush were common and less common, sapling totara, pōhuehue, hangehange (*Geniostomia ligustrifolium*), cabbage tree (*Cordyline australis*), five finger, and coprosma hybrid species.

Myrsine australis and knobby clubrush growing among pampas and pine

Community 8a and 8b - Kānuka treeland

[34] The kānuka (*Kunzea robusta)* treeland areas at the northern end of the site varied between 3 and 6 m in height, forming a dense canopy. The thin kānuka treeland has only "spindly" specimens without a closed canopy.

[35] The westernmost stand of the kanuka treeland contains mānuka (*Leptospermum scoparium*) and infrequent cabbage trees (*cordyline australis*) as part of the canopy. Subcanopy species were infrequent but included tree fern (*Dicksonia squarossa*) and C*oprosma propinqua* at edges, the interior of the kanuka fragments are largely devoid of groundcover or subcanopy. The groundcover at the edges of fragments included dense levels of fern species *Histiopteris incisa* and *Polystichum vestitum*, with encroaching veldt grass and cocksfoot among other grasses.

[36] The thin kānuka treeland is located in a grazing paddock with full stock access, and no regeneration of native species can be seen in the understorey. Groundcover is entirely pasture species, as well as creeping buttercup *(Ranunculus repens*), two *Juncus pallidus*, and occasional pasture weeds.

[37] Kanuka and manuka are currently recognised as "At Risk" taxa, not because they are rare or the populations in NZ are declining, but because there is a risk to the national and regional populations related to the disease Myrtle rust.

Kanuka treeland and thin kanuka treeland

Community 5 Macrocarpa

[38] There is substantial Macrocarpa (*Cypressus macrocarpa*) canopy cover (7- 10m in height) along the back-dune area with overlapping canopy of *Pinus radiata.* These exotic treelands grow most on the ridges and hill tops of the old back dune and form a large component of the Council viewed schedule F stable dunes edges and breaks. I do not consider them schedule F communities.

[39] Under the canopy of either pine there is very little vegetation, with no subcanopy species and varying degrees of cover of New Zealand spinach, more prominent toward the dunes, occasional clusters of *Asplenium* sp. (*A. appendiculatum, A. flabellifolium, A. flaccidum, A. oblongifolium*, and *A. polyodon*), low *Coprosma repens*, houndstongue (*Microsorum pustulatum*), *Paesia scaberula*, Glen Murray tussock (*Carex flagellifera*), and shaking brake (*Pteris tremula*).

[40] The groundcover is largely bare, open sands with dropped branches and leaf litter from the macrocarpas.

[41] Where macrocarpa met the margins of grassland, there are pockets of silver poplar over rank grass and gorse, with occasional kānuka seedlings, lucerne, tree lupin, and pampas grass. Where macrocarpa meets stable duneland communities, native spinach, knobby clubrush, lupin, and two exotic daisy's: white arctotis (*Arctosis stoechadifolia*) and *Gazania* sp. (exotic flowers) are present.

[42] The community is growing on duneland sands but is almost entirely exotic.

[43] The Regional Council's section 92 questioned the survey results and the delineation of schedule F communities and the plant species and cover under the macrocarpa/pine/sliver poplar canopies.

[44] I undertook to measure a number (17) of 20m by 20m vegetarian plots to quantify the vegetation cover in and around holes: 14, 15, 16 and 17.

[45] Four plots specifically in the macrocarpa canopy community illustrated that the great majority of macrocarpa and pine canopy areas are largely barren underneath with occasional ferns and very sparse beach spinach. The spinach is an "At risk" naturally uncommon (extreme fluctuations, secure overseas and sparse) species. Under the EIANZ (2018) protocol a species with an at risk status other

than declining has a "moderate value" and that was reflected in the values assessment. Of some note is that the only reason the beach spinach is present in the back dunes is because of the canopy of macrocarpa and pines (and silver poplar) because it cannot compete in the grass and scrub areas of the dune slacks and hollows.

[46] The data in the section 92 assessment strongly support not including this community type as a schedule F community.

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<tr><td>  </td><td>Examples of the canopies and ground tiers of the macrocarpa-pine dunes.</td></tr>
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Community 9 stable dune land

[47] This is the majority of the "back dune" community that makes up the fragmented edge of the schedule F proper habitats. It is most intact and best in the northern 1/3rd. However, none of the communities seen are of particular

indigenous character and integrity, all of the area has substantive exotic composition.

[48] This community is dominated by one indigenous rush and exotic grasses and scrub species and is a reflection of extensive historic modifications. It grows in the hollows and slopes between the canopies of macrocarpa and pine.

[49] It only arguably meets the Schedule F stable dune system definition because it is a mosaic of exotic and indigenous dune vegetation. Much of the area I mapped conservatively as schedule F stable dunes in the AEE is in fact often dominated by exotic species (not "scattered" in terms of schedule F definition).

[50] Knobby clubrush (*Ficinia nodosa*) is the characteristic native plant of this community. It grows densely only in a few patches at approximately 60 – 70 cm in height. Pohuehue (*Muehlenbeckia complexa*) makes up a small, rare component of the community. This landscape is commonly interspersed with oioi (*Apodasmia similis*), but it is tree lupin and cocksfoot which forms the noticeable vegetation cover. The lupin is particularly dominating toward the coast, where it forms a dense boundary between the active and stable duneland. Gorse is infrequent, though becomes common toward the active and stable duneland boundary in the same way as lupin. Gravel groundsel (Senecio skirrhodon), *Olearia solandri*, and tauhinu (*Ozothamnus leptophyllus*) are other natives present in low numbers as a gradient between the active and stable duneland, while pampas is occasional but throughout the community, sometimes forming competitive clusters. Rarely, coastal wattle (*Acacia sophorae*) and flax (*Phormium cookanium* subsp. hookerii, P. tenax) are present. One *Coprosma acerosa* individual was noted.

[51] Vegetation plots carried out for the section 92 response (data in addendum 1) in the vicinity of hole 17 to better quantify the levels of indigenous versus exotic plant cover show that much of the back dunes outside of the macrocarpa are in fact lupin and rank pasture grasses (cocksfoot) and only a few areas where Knobby club rush is prominent. These plots enable me to challenge the conservatism I had in the AEE and I can state that the mapped stable dunes included as Schedule F is a very conservative approach because much of the "stable dune" mapped as schedule F by me is actually largely exotic vegetation with scattered indigenous

clusters. I have modified those areas such that the schedule F map in this evidence is even more accurate than that in the initial AEE.

[52] Some areas were almost exclusively exotic grass and lupin. Using the 20/50 dominance protocol (Clarkson 2013) these communities are best described as exotic grasses and lupin.

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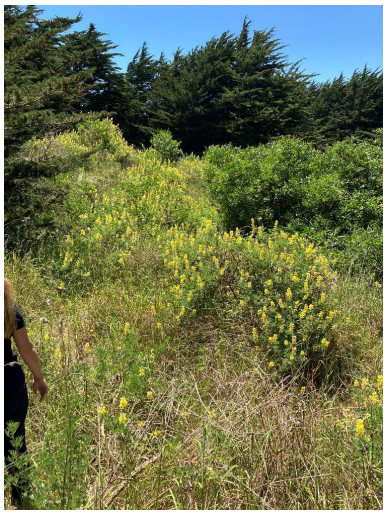
<td> 
Largely exotic grass dune hollow with gorse edge</td>
<td> 
Dune slipe in lupin and exotic grasses</td>
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<td> 
Mixed grass dune slope and hollow</td>
<td> 
Knobby club rush hollow</td>
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These photographs show heavy exotic communities around holes 16 to 17 to one of the better knobby club rush pockets at hole 4.

Community 10 - Spinifex active dune land

[53] This is the best, most intact, indigenous dominated, representative vegetation habitat ”on” the site.

[54] The foredune bounds the entire western side of the site and is dominated by duneland grasses adapted to the shifting sands, namely spinifex (*Spinifex sericeus*), commonly with areas of pingao (*Finicia spiralis*). Marram grass (*Ammophila arenaria*) however, is successfully competing with the native grasses in several areas along the dune.

[55] A range of dune natives dominant and set the natural character and cause a high representativeness of the vegetation assemblage. Sand daphne (*Pimelea villosa*) an At- Risk special dune species was infrequently present but towards the northern end of the site at the inland edge of the active sand dune there is a concentration of them. There are also exotics such as buck’s thorn plantain, common clover ,pampas yucca, evening primrose, and banksia.

[56] Wheel tracks from motor vehicles have caused erosion of the dunes but these are present only toward the southern end. Some large patches of gorse and tree lupin are establishing at the northern end, encroaching from the neighbouring stable dune.

Active fore dune in spinifex

Sand Daphne.

Community 11 wetland (natural wetland)

[57] There was one (natural) wetland located on site during the survey which is very circular (perhaps because it was once a stock pond). It is surrounded entirely by pampas grass, lucerne, gorse, and coastal wattle. The interior is raupō (*Typha orientalis*) dominated, approximately 6 m x 6 m, with Isolepis (*Isolepis prolifera*) surrounding the raupō in a ~2m wide radius. One 2 x 2 m area of deep mud, which appears to be open water during wet times, is entirely covered by duck weed (Lemna disperma).

[58] This wetland classifies by the rapid test (MfE 2020 delineation protocol and pNRP) as a natural wetland.

Community 12 - Salt marsh (a natural wetland)

[59] I and my team did not spend much time surveying this feature as little to no direct or indirect effects were indicated by the proposed activities.

[60] The saltmarsh follows a gradient from the eastern upper edge with exotic scrub and rank pasture with flax, lupin, pampas, and gorse, and occasional cabbage trees. This graduates into the majority of the feature which is an indigenous rushland containing large swathes of many appropriate indigenous rush and reed species (see AEE for a list).

[61] This then transitions into a smaller area of herbfield and mudflats, which at the transition zone contained more indigenous appropriate herbaceous species. The mudflat habitat had large bare areas, though a diverse array of typically small species were scattered over the fine mud and sands including a further list of indigenous representative appropriate species.

Salt marsh

Avian fauna (birds)

[62] A day was spent on site and on adjacent areas (12 April 2021) by an experienced and qualified ornithologist (Ms Sievwright).

[63] In total records for the area list 63 species that use, or potentially use the habitats at, or in close proximity, to the project site.

[64] This includes six Threatened species, 14 At- Risk species, 22 Not Threatened species, one non-resident native species and 20 introduced species

[65] During the site visit, 27 of these species were observed, including five At - Risk species (black shag, pied shag, royal spoonbill, variable oystercatcher and white-fronted tern), 11 Not Threatened species and 11 introduced species.

[66] The primary habitats for Threatened and At Risk species on site and in the immediate surrounds include freshwater/wetlands (the Ōhau River and potentially the saltmarsh wetland) and the coastal/estuarine areas (the Ōhau River mouth, beach and front dunelands).

[67] The kānuka treeland habitat provides habitat for common, Not Threatened native species and introduced species.

[68] The freshwater wetland is small (0.03 ha) and isolated and provides habitat for common, Not Threatened native species and introduced species.

[69] The grassland habitat on site, in addition to the coastal habitat, may provide foraging, roosting and possibly nesting habitat (areas of rank grassland) for New Zealand pipit.

[70] The macrocarpa trees along the dune edge may provide roosting and/or nesting habitat for shags.

[71] The remaining vegetation communities on site (exotic scrub, exotic scrub under pine, poplar treeland types, brush wattle treeland, mixed pine treeland exotic native mix provide habitat for native, Not Threatened species and introduced species.

Native bats

[72] No surveys for bats were undertaken in the initial surveys because records did not show a likelihood of their presence and the habitat did not suggest it likely.

[73] The Peka Peka to Otaki NZTA Opus report (2011) noted that the long-tailed bat *Chalinolobus tuberculatus* has been recorded on Kapiti Island and the Tararua Forest Park. Curiously no specimens have ever been collected on Kapiti Island. DoC has also translocated 20 short tail bat pups to Kapiti Island.

[74] No bat surveys have, to my knowledge, ever been undertaken along the coastal dunelands of the Kapiti and Horowhenua coasts. Duneland's were not historically part of the native (long or short tailed) bats home range (in the absence of forest). They may have flown the riparian vegetation of the Ohau seasonally with emergence of flighted larger insects – but this forest is no longer present. There has been no large forest ecosystems in the coastal lands of the area for over 200 years (only a few small remnants see Foxton PNAP (Ravine 19921)) and it is unlikely any remnant bat population remain in the highly modified and predated rural landscape or visit the various coastal macrocarpa trees that are, at most on site, 70 years old as night roosts form the forested hills of the Tararua Forest Park.

Herpetofauna (lizards)

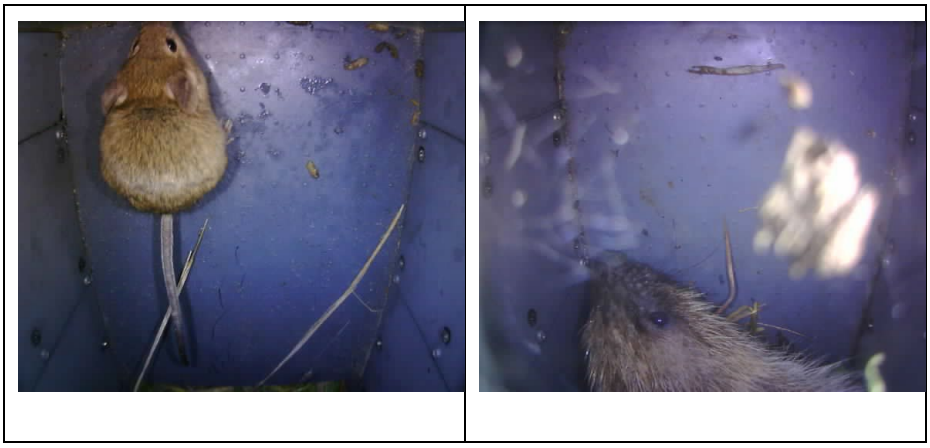
[75] Site visits Conducted by Ms Healy (a trained and experienced herpetologist) were carried out on the 15th and 23rd of April and again in November 2021 to set ACO's (following council 92 requests) and these were up lifted (surveyed) in February 2022.

[76] The initial surveys using CritterPic (deployed along the active foredune-stable hind dune ecto tone) and habitat searches resulted in no lizard species records. The CritterPic data actually indicated an extremely high level of mouse

[1] Ravine, D. A. (1992). Foxton Ecological District: Survey report for the Protected Natural Areas Programme (New Zealand Protected Natural Areas Programme No. 19). Wanganui: Department of Conservation.

occupation and a high mouse accusation normally correlates with a low lizard populations.

[77] The habitat most likely to contain lizard populations are the active and stable dunelands. Vegetated dunelands provide high quality habitat to a number of indigenous lizard species, including northern grass skink (which have been recorded in the wider area). However, there was evidence of high pest numbers across the site; considerable densities of pest tracks were observed in the dunes, and a feral cat was observed onsite. Mice were very evident in the Critapic data. High pest numbers considerably reduce the quality of lizard habitat, and the ability for populations to persist in an area.



A mouse and a hedge hog caught on camera in the Critapic box.

[78] Following the section 92 request, a further survey was undertaken searching potential habitat while also surveying for katipo and 40 artificial Cover objects were installed. These ACO's (using odoline corrugated squares roughly 40cm X 40cm) provide a low ground cover into which over time (weeks) lizards congregate. We left the ACO out for around 10 weeks (6 weeks is the usual) and then checked for lizard presence. No lizards were located at all.

[79] I am confident that if lizard species are present in the active dune or stable hind dune it is the common northern grass skink and it is in very, very low abundance.

[80] There are areas of kānuka treeland on the site. Kānuka is a preferred habitat type for a number of arboreal gecko species (barking gecko, ngahere gecko). However, these patches of kānuka are small, limited in under canopy and ground

cover and isolated from potential source populations of gecko, which makes it very unlikely that there are arboreal lizards present. The very high pest numbers present on the site further reduces the likelihood.

Schedule F – Ecological communities of Significance

[81] In the Horizons One Plan (Horizons Regional Council, 2014) the identification and protection of significant vegetation and habitats is covered by Policy 13-4. Under this policy, At- Risk, Threatened, or Rare habitat types are defined in Schedule F (Indigenous Biological Diversity). To be deemed significant, a community must meet at least one criterion in Table F.2a which identifies Rare, Threatened and At-Risk plant communities and habitats, and must not be excluded by Table F.2b which identifies a range of community types that are not considered to be Rare, Threatened, or At-Risk.

[82] Schedule F only considers those habitats which are indigenous, defined in the plan as 'vegetation comprised **predominantly** of indigenous species, but which may include **scattered** exotic species'.

[83] To further inform the use of this definition, the One Plan definition of 'scattered' is also required, and is: '*species that contribute less 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*'. This is a measure of the contribution to an area of interest (e.g., the same habitat type or forest tier) of a species in relation to other species in the same area, and is not simply a frequency count as both biomass and density of a given species are considered'.

[84] I make the observation that significance is I understand based purely on the habitat type and condition at the time of survey and does not consider the future health (e.g. predator impacts, regeneration outlook), or potential.

[85] Table 2 below summarises the significance outcomes of the vegetation community types identified on site when assessed against Schedule F of the One Plan. The significant vegetation communities are shown on Map 3.

Table 2 - Community types and their outcome compared to Schedule F of the Horizons One Plan.

Number	Vegetation community	Significance
1	Grazed grassland	These communities were not found significant under Schedule F as the vegetation does not meet the One Plan definition for being predominantly Indigenous. **Not Significant.**
2	Rank grassland	
3a	Mixed wattle treeland	
3b	Mixed pine treeland	
4a	Poplar treeland	
4b	Poplar treeland over exotic scrub	
5	Macrocarpa	
6a	Exotic scrub	
6b	Exotic scrub under pine	
7	Exotic native mix	
8a	Kānuka treeland	One out of seven areas of kānuka treeland is larger than 0.25ha and is considered Threatened and **Significant**. **The remainder are excluded** on the basis of size (<0.25ha) and/or canopy height (>4.5m)
8b	Thin kānuka treeland	This area is less than 0.25ha and is not well-developed kānuka. **Not significant**.
9	Knobby clubrush stable duneland	Classified as Stable Duneland – Rare. A mosaic of exotic and indigenous flora, much of it exotic dominated but areas can be found which are more indigenous and partially representative. **Significant.**
10	Spinifex active duneland	Classified as Active Duneland – relatively intact indigenous dominated dune vegetation, high representativeness and at least two at risk species. Rare habitat. **Significant**
11	Wetland	While a natural wetland it is excluded on the basis of size (less than 0.05ha). **Not significant.**
12	Saltmarsh	Classified as Saltmarsh wetland – Threatened. **Significant.**

[86] Those areas identified as Significant according to Schedule F fit the following definitions:

[87] Kānuka Treeland - Kānuka treeland is dominated by almost pure stands of well-developed kānuka. This habitat type is differentiated from kānuka scrub by size (greater than 4.5m tall or 20cm diameter measured at 1.4m above the ground). Seven areas of kānuka treeland on site were identified (community 8a), though only one of these fits the height and size specifications outlined in Table F.1 which

defines the required height (at least 4.5m) and size in Table F.2a, (must be at least 0.25ha). The one area of thin kānuka treeland is also excluded on the basis of size and is not considered well-developed as per the definition.

[88] Saltmarsh wetland – Threatened - The saltmarsh wetland support areas of low growing indigenous herbfield, rushland, sedgeland and scrub, form within areas of tidal intertidal zones, and is fed from groundwater (related to the Ohau River) and estuary waters. The vegetating cover is relatively intact and dominated by indigenous species. The saltmarsh wetlands show environmental gradient responses (sequences) and occur in association with tidal mudflats. The saltmarsh wetland is an estimated 1.98ha in size and fits the description of salt marsh wetland as according to Schedule F.

[89] Active duneland – Indigenous grassland or sedgeland occurring on active duneland formed on raw coastal sand. The active duneland on site (i.e. the fore dune with spinifex dominance) fits this description and is not excluded by any F2.b factors

[90] Stable duneland – Indigenous grassland, tussock land, herbfield (including *Pimela actea* and *P. arenaria*), or shrubland occurring on stable duneland formed on recent coastal sand. The vegetation cover does not really meet well this definition as the "stable dune area" while having the morphological characteristics of a hind dune, is largely vegetated in exotic species which are increasing in abundance. Nevertheless, and conservatively, I have mapped much of this type into the schedule F communities map and consider that parts of this community are sufficiently indigenous to be "stable dune" rare and so significant even if not overly representative (and is not excluded by any F.2b factors).

[91] The freshwater wetland on site is 0.03ha and so is excluded in the factors listed in Schedule F.2a, which states threatened wetland habitat must be at least 0.05ha in size to be considered significant. However, I also note that under the new NPS-FM the wetland will classify as a natural wetland, but again there is no clear direction as to a minimum size that should be considered. It is noted that the NPS-FM directs Councils to consider 0.05 ha wetlands, or smaller if appropriate. I do not consider a raupō-isolepis wetland as a typically small wetland type (less than 0.05ha) and consider a wetland of this type should be at least 0.05 ha to be

functional and representative. It is possible that this area is not a schedule F listing but to avoid the argument I have left it in. The negligible effects created by the proposal means nothing from an ecological perspective turns on its inclusion.

[92] All other areas of vegetation not listed above do not meet the One Plan definition of 'indigenous' due to level of exotic species present (more than 'scattered) and so are not considered against Schedule F for Indigenous Biological Diversity.

[93] It is worth noting that habitat type qualifying in table F.1 must meet at least one of the criteria in table F.2(a). Even if this were the case for this site next to the river, we have assessed the activities as having a negligible effect on any ecologically significant resource.

Figure 3. New Schedule F zone once the fragments initially mapped are corrected for by vegetation plot data. The area of Schedule F on the site is Ca. 14.8 ha.

Ecological values

[94] Sites which are not considered significant under Schedule F of the Horizons One Plan may still have potential for ecological values, in the same way that sites determined to be significant may have low ecological value. For this reason, an assessment of ecological value was carried out to further inform ecological considerations for the project.

[95] An assessment of ecological value guides consideration of site sensitivity to change, the magnitude and importance of ecological effects, and the need for, and quantum, of required mitigation.

[96] I consider the four criteria outlined in the EIANZ Guidelines (2018): Representativeness, Rarity/distinctiveness, Diversity/pattern, and Context. Each of these criteria are rated between Low and Very High for each vegetation community assessed. Continuing the process outlined in the EIANZ, when these four ratings are combined, they aid in determining the ecological value of the vegetation community: Very high, High, Moderate, Low, or Negligible.

[97] In some circumstances I look at individual species where they are present and relevant to the effects. This is not the case here and I do not therefore step through all the threatened and at-risk taxa individually – their value is however, recognised in the habitat evaluation below.

[98] The table below outlines the ecological value of each habitat type identified as part of the schedule F communities.

Table 3 Values assessment

	Represent-ative	Rarity	Diversity	Context	Conclusion
Exotic dominated communities					
Grazed grassland	Very low	Moderate	Very low	Very low	Low
Rank grassland	Very low	Moderate	Very low	Very low	Low
Mixed wattle treeland	Very low	Very low	Very low	Low	Negligible
Mixed pine treeland	Very low	Very low	Very low	Low	Negligible
Poplar treeland	Very low	Very low	Very low	Low	Negligible

Poplar treeland over exotic scrub	Very low	Very low	Very low	Low	Negligible
Macrocarpa	Very low	Very low	Very low	Moderate	Low
Exotic scrub	Very low	Very low	Very low	Very low	Negligible
Exotic scrub under pine	Very low	Very low	Very low	Very low	Negligible
Exotic native mix	Very low	Very low	Low	Low	Low
Kānuka treeland	Moderate*	Moderate	Moderate	Moderate	Moderate*
Thin kānuka treeland	Low	Low	Very low	Very low	Negligible
Stable duneland	Low*	High (where daphne) else moderate	Low*	Moderate*	High (where daphne) else Moderate
Active duneland	High	Moderate	High	Moderate	High
Wetland	Moderate	Moderate	Low	Low	Moderate
Saltmarsh	High	Moderate	High	Moderate	High

*These represent changes from the initial AEE assessment brought about by the additional Section 92 vegetation plot data.

[99] In terms of the faunal values the absence of recorded katipo or lizards means the value of those faunal components are low or negligible. In terms of the avian fauna the values on site are low, common natives and introduced species even while the values on the Ohau River mouth, estuary and beach are high to very high. I note in conjunction with those birds using the Ohau River and lagoon the macrocarpa canopy trees do have some value as roosting sites hence their moderate contextual value.

Ecological effects & their management

[100] The method I use to undertake the assessment is consistent with the EIANZ guidelines for undertaking ecological impact assessments (Roper-Lindsay et al., 2018), whereby ecological values are assigned (as above) and the magnitude of effects identified (as below) in order to determine the overall level of effect of the proposal (Table 4) prior to any consideration to mitigate the effect.

[101] According to Roper-Lindsay et al. (2018), the overall level of effect can then be used to guide the extent and nature of the ecological management response required (including the need for biodiversity offsetting):

- Very High adverse effects require a net biodiversity gain.
- High and Moderate adverse effects require no net loss of biodiversity values.
- Low and Very Low effects should not normally be a concern.

[102] Furthermore in terms of identifying the extent of loss of area or population I consider a 1% loss to be Negligible, 1-15% loss to be low, 15%-40% moderate, 40%-70% high and over 70% loss to be a very high magnitude (at the correct scale). This errs on the side of retaining value rather than a linear progression.

Table 4 criteria for describing the level of effect based on value and magnitude of the effect

Ecological Value ▸ Magnitude ▾	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Ecological Effects analysis

[103] I understand the following to be the main construction activities for each stage of the development:

- Site establishment and construction of erosion and sediment controls;
- Isolation of sensitive areas (including existing vegetation to be retained and any existing on-site utilities);
- Clearance of vegetation from works area;
- Stripping and storage of topsoil from the areas to be disturbed;
- Cut to fill earthworks to achieve desired landform;
- Removal of any unsuitable material;

- Re-spreading of topsoil and/or stabilisation of the completed areas through grassing/tarmacking/etc. to facilitate erosion and sediment control;

- Removal of all controls and reinstatement of site.

[104] The potential direct and indirect adverse ecological effects associated with the above that have been considered in my assessment are the following:

- Clearance or disturbance of indigenous vegetation;
- Clearance or disturbance of schedule F communities not predominantly indigenous (stable dunes)
- Loss of Threatened or At-Risk species;
- Increases in edge effects on indigenous habitats;
- Habitat fragmentation;
- Disturbance to wildlife;
- Construction phase earthworks and sedimentation of waterways;
- Golf course management – mowing, fertiliser, watering, weed sprays, in respect to wetland hydrology and nutrient status.

[105] In considering these effects I only examined the ecological change within the Schedule F (significant) areas, I have not considered for example the effects on grasslands and pasture or exotic treelands.

Clearance or disturbance of indigenous vegetation

Active Dune

[106] In terms of specific areas of foredune effect, I note that the area of effect (hole 14) may fall into the category of active foredune, however, as discussed it is not schedule F indigenous dominated active or stable dune, but predominantly exotic vegetation cover (lupin, hairs tail and dandelion).

[107] For the reason that the habitat is not predominantly indigenous not representative and with no katipo I also do not consider that this effect triggers Policy 11 of the NZ Coastal Policy Statement as it is not a loss of predominantly indigenous biodiversity in the coastal environment.

The area of proposed hole 14 and the active dune beyond in the fore ground

To our knowledge there is no clearance of any active dune or dune vegetation or habitat.

Stable Dune

[108] There is around 22 ha of stable (hind) dune between the Ohau Stream and the Waiwiri stream north (Figure 4). This is the local area of dune habitat into which the site sits, although really the dune habitat that is interactive and as a unit is from the Otaki River to at least the Manawatu River. I could also consider the stable dune habitat in the Foxton Ecological District or in the Region which are larger spaces again and would be appropriate given that the scale at which values are made are regional and ED and even national. Of this 22 ha of local stable duneland, 0.9 ha on the property is proposed to be converted to fairways (or Tees and Greens) permanently (mostly associated with hole 4). I have identified and are assured that the sand daphne area (the active sand dune) is not part of the stable dune system that is affected.

Figure 4. Local context of active and stable hind dune Ohau to Waiwiri Streams (red box), the site (orange box) and the area of most substantive clearance (yellow box).

[109] The effect equates to a 4% loss at the relevant local context (Ohau to Waiwiri) and a less than 1% loss at a wider Otaki-Manawatu scale and a << 1% at the ED scale. Thus, on area affected, as per the rules I use (stated above) and irrespective of the poor quality of the lost area, I must assess the level of change (the magnitude of effect) as being **low**.

[110] A moderate value habitat suffering a low magnitude of adverse effect results in (pre-effects management) a **low level of effect** (when Table 4 is applied).

[111] The change on site will not threaten or otherwise diminish the stable dune habitat such that it is not self-sustaining or reduced in its functions or as habitat for its supported fauna. In terms of the level of effect, as per the EIA NZ guidance, low and very low levels of effect are not normally of concern and can be considered synonymous with "less than minor" adverse effect in the planning sense.

Salt Marsh and freshwater wetlands

[112] Neither the salt marsh (1.98 ha, a threatened and significant habitat and natural wetland) nor the small freshwater wetland will be impacted by the golf course at all.

[113] Indirect effects were raised in the Councils Section 92 related to potential hydrological change and nutrient discharges. I did not give these potential effects much weight in the AEE as they seem highly unlikely given that links golf course turf management is typically less demanding than farming practices in regard to nutrient and water use. Where irrigation is used it is usually very controlled (greens and tees once established) and has very little to no run off or leachate potential.

[114] In response to the section 92, I examined the freshwater wetland. It is a raupo wetland pocket that is best described as a swamp (Johnson and Gerbeaux 2004) and the vegetation components (mostly raupo) are very able to manage high nutrient loading (e.g. Pegman & Ogden 2005 , Vymazal 2011) Raupo has high decomposition rates (3kg/m^2/year) and high biomass production rates enabling it to utilise any nutrient loading. It will not be adversely affected.

[115] I note also that current farm practices in relation to nutrient addition will cease and the inputs will be far more managed in terms of the amounts, types and application. I also understand Mr Allan on behalf of Grenadier assessed this potential issue in the further information response. According to Mr Allan these effects will not occur.

[116] Concerning the salt marsh wetland, this feature is some distance (20-30m) from any fairway or green and therefore there will be a substantive non-fertilised area (an area proposed to be revegetated in native communities) between it and those activities; and in a predominantly sand soil, leachate of that distance is highly unlikely. No adverse effect is likely and there may rather be beneficial effects.

[117] There was some residual concern from the Horizons officials about the effects of the course as a result of changes in sub and surface water flows. The concern was said to be about potential changes in hydrology for the salt marsh. As a result the Applicant's experts meet to collaboratively assess the residual concerns. Alexandra Johansen (hydrogeologist), Jim Dahm (coastal scientist), and I

(ecologist) met along with Mr Allan (lead for course construction). We jointly produced a paper that was sent to BECA (for the Council) to address any residual concern and crossed over all disciplines. That information has not been countered and I am confident these effects will not be realised for the Salt Marsh.

Kanuka Treeland

[118] The Schedule F area of kanuka (0.29 ha) will be avoided as has been agreed by the design team. No direct effect.

Construction phase earthworks and sedimentation of waterways

[119] My understanding of the earthworks required on site is (after vegetation clearance) of a subtle reshaping of the existing sand forms because a links course aims to retain the coastal sand dune morphology. I have seen this done successfully at the Te Arai and Omaha north courses at North Auckland.

[120] There is a draft erosion and sediment control plan, but I am more confident at this site than many sites I work on that there will be no issues of discharge effects to surface water systems because much of the area to be worked nearer the Ohau River and wetlands is sand country and it is relatively flat coastal plains and still some distance from these water systems. Sand if discharged in stormwater is of far less an issue to water than fine alluvial sediments but especially so where the work is some distance from the receiving water body and without any direct conduits to those surface water bodies.

That said the construction management plan draft (section 8.5) lays out the proposed management of sediments and erosion. This is a reasonable array of precautions and processes which I consider likely to succeed.

Lizards

[121] There is little to no potential for direct or indirect effects on any skink inhabiting the coastal active dunes as this area is avoided. Survey so far has not identified any skink or gecko in the stable dunelands. Likewise any gecko in the kanuka treeland will not be affected, although their presence is also highly unlikely. While there may be the "common" northern grass skink, its numbers are so low that even though it is protected under the wildlife act, there is no recordable

population to protect. The potential effects appear non-existent. If during vegetation clearance lizards are seen a simple discovery and management protocol can be instigated and follows the common response to lizard presence on work sites.

Avifauna

[122] The vegetation or habitat to be removed is predominantly exotic with large old pine and macrocarpa (in the main) and grasslands and some weed fields and small areas of hind dune.

[123] The primary habitat for the observed Threatened and At Risk species on or near site are freshwater/wetlands (the Ōhau River and potentially the saltmarsh wetland) as well as coastal/estuarine areas (the Ōhau River mouth, beach and dunelands), not the farmlands. The macrocarpa trees along the dune edge may provide roosting and/or nesting habitat for shags.

[124] The remaining vegetation communities on site (exotic scrub, exotic scrub under pine, poplar treeland types, brush wattle treeland, mixed pine treeland exotic native mix) provide habitat for common native, Not Threatened species and introduced species.

[125] The habitats of greatest value and which would have the greatest negative impact for birds are avoided. The magnitude of the predominantly exotic vegetation change for avian habitat resource use is considered negligible and temporary as either most habitat use is coastal, Ohau River or salt marsh and beach directed, or the areas of native habitat which will be retained and will be still available as habitat. Thus a negligible magnitude on a low value results in a very low level of effect.

Disturbance to wildlife

[126] Another potential adverse effect is that of disturbance to wildlife through construction and to a lesser extent operation by way of both direct impacts (e.g., death or loss of feeding, flocking, roosting and nesting sites) or indirect impacts (e.g., reduced breeding or feeding because of noise).

[127] The magnitude of the adverse effects associated with disturbance activities can is typically proportional to the extent of habitat or population affected compared to that which remains unaffected. I estimate the effect of construction in terms of the more valued habitat (schedule F) to be less than 5% and in pockets, not large scale. The effect of golf may be viewed as no different from stock and dogs and farming equipment disturbance, something all species habituate to or do not exist there. Currently the species present are common and largely exotic, and they are there because they are able to co-exist with farming practices. I consider golf management and play to be more "sedate" and no more intense than farming. There is a management approach I recommended to ensure roosting birds of importance are not affected directly by the felling of the macrocarpa trees in the Ohau River proximity.

[128] The magnitude of disturbance will be low (at most) and to generally low value systems (as the high value systems are being avoided). This results in a very low level of potential effect.

Loss of Threatened or At-Risk species

[129] Through design I am confident that there will not be any loss of recorded or even suspected threatened and at-risk taxa. Currently this means katipo spider, sand daphne, kanuka and any at risk of threatened shore bird- (black shag, pied shag, royal spoonbill, variable oystercatcher and white-fronted tern).

Increases in edge effects on indigenous habitats

[130] The current level of edge effects through farming has been significant in the past and resulted in extensive weed invasion and stock and pest animals (rabbits, hedgehogs, mice etc). The change in land use will actually reduce these threats as the golf course itself (but also the management required) will reduce animal and weed threats and the revegetation proposed will help secure areas and heal some edges including the landward side of the salt marsh (I refer you to the revegetation management plan). The magnitude of change is considered positive and the current "value" of the edges is considered low. The resultant impact is considered beneficial.

Habitat fragmentation

[131] Given the current level of fragmentation inland of the Active dune and accepting that the salt marsh and Ohau River are in no way adversely affected the only habitats that could potentially suffer further fragmentation are the active and stable dune system. The foredune is (aside from hole 14 which is not actually active dune) avoided and so there is no potential to fragment the foredune community between the Ohau and Waiwiri streams.

[132] In regard to the stable hind dune, the fairways of one hole in the main (hole 4) remove some of this vegetation (Ca. 1 ha) but the effect area is in an already fragmented and irregular boarder. Only at hole 4 is there an island separated from the main band of stable dune, initially but it is reconnected following action of the proposed revegetation plan. The removal of the pine and poplar and macrocarpa will have the most dramatic temporary effect, but these exotic trees are currently restricting any form of indigenous stable dune community establishing and so removing them allows progress and with the revegetation plan a longer-term benefit.

[133] Examination of the conservative schedule F boundary as mapped by my team and I and the prosed golf holes (Figure 5) shows that now or after the development (before the revegetation) the level of fragmentation is not meaningfully different and the largest area of impact is at hole 4. The kanuka treelands remain isolated in the absence of restorative planting and its position in the landscape in terms of connectivity does not change. However, as with the edge effect, the proposed revegetation in the locations as suggested (by me and others) will actually reduce the current level of fragmentation does not exacerbate it, as well as help secure edges. A positive outcome is envisaged.

Figure 5. Schedule F areas and the interaction with the proposed gold holes

Cumulative Effects

[134] In some landscapes and circumstances there can be a range of developments and projects affecting a wider similar ecological resource. It is therefore appropriate to consider the proposal in the wider landscape and if it adds significantly to an effect of a particular ecological resource.

[135] As far as I am aware there are no other nearby land use changes or consents for development that would impact on the coastal margin, foredune, hind dune, river or salt marsh.

[136] The Councils "pot" (wastewater treatment) changes, a little north, may affect a small area of stable hind dune but more likely in a restorative effect.

[137] Further land subdivision is unlikely to be in the stable hind dunes where any form of indigenous community persists which does not involve more substantive replacement of indigenous systems than their loss.

[138] The waste water disposal areas for the course facilities are located inland and east of any areas identified as being ecologically significant.

[139] I know of and see nothing to indicate that these effects, minimal though I consider them, add to other local effects on similar values.

Pre-Effects Management Conclusion

[140] Through the design responses, ecological effects have been restricted to areas of negligible or low value. Primarily the responses have been to minimise the reductions to stable hind dune and a small area of exotic dominant foredune, as well as avoidance of the kanuka treeland, freshwater wetland and salt marsh. The remaining ecological effects are considered equivalent to "less than minor". From an ecological perspective the values affected, and the level of effects is low to very low and not of any particular concern, being largely exotic in nature and of limited faunal resource. The removal of the coastal pine and macrocarpa and the proposed restorative revegetation of appropriate stable dune communities was the only way this area was going to be enhanced and levels of existing fragmentation resolved.

[141] Nevertheless, adverse effects should be managed through the mitigation hierarchy (avoidance, remedy, offset or compensation). The following considers these aspects.

Effects management

Avoidance and minimisation and remedy

[142] Through design responses the project has now avoided direct adverse effects to the freshwater wetland, it always avoided the salt marsh, it has redesigned to avoid the kanuka treeland, in always avoided the active foredune, but it did alter hole 4 to avoid the population of sand daphne and it substantially reduced Hole 14 to keep out of the indigenous active dune area. These are the most sensitive and valuable habitats and species on site and they are avoided.

[143] The proposal also avoids effects such as sediment discharge to the Oahu River through management as well as operation effects such as wastewater discharge to wetlands or the river.

[144] In terms of the kanuka on the property, aside from the more intact area recognised, there are numerous other thin bands and single trees and small thin clusters. The value of these (although not schedule F) are also recognised by the project course designer, and although they are not of any particular ecological value, the designer has sort to minimise their loss, and has considered their value in future restoration and habitat creation.

Remedy

The applicant has proposed (and I have been part of a collaborative team in designing) a revegetation programme which is designed to not only augment the golf course but have specific specialist indigenous areas to cause a betterment of the schedule F remains, putting a better representative assemblage back in the gaps created by the removal of the pine and macrocarpa and silver poplar such that fragmentation and edge effects will be reduced and buffering will occur of the wetlands. The quantum proposed that will be ecologically focused is Ca. 9 ha (5 ha

stable dune, 2.5 ha kanuka support, 1.5 ha dune slack wetland) and this more than remedies the Ca. 1 ha of stable dune lost to greens, fairways and tees.

[145] A plan and management draft has been completed and is attached to the applicant's evidence. The plan is produced below.

Draft revegetation proposed, including the ecologically focused stable dunes etc.

Biodiversity Offset

[146] The Regional Council section 92 asked for a peer reviewed methodology to offset (or compensate) for the permeant loss of rare and threatened ecosystems. As described above those areas (active dune, salt marsh, freshwater wetland, sand Daphne, kanuka treeland) have all been avoided. The Stable dune does not meet for the most part the definition in Schedule F but I have been conservative with the mapping and so Ca. 1 ha is removed. That effect is however, remedied.

[147] An offset is actually an action to amend any residual effect to ecology after mitigation – i.e. avoidance and remediation. It is focused on returning a no net loss or a net gain. It is not a response to significant adverse effects or only applied to affects that are greater than minor. It is a normal response to a no net loss policy common in today's plans. However, the EIANZ (2018), many plans, and the RMA all accept a low level of loss of species and areas of indigenous vegetation and not all ecological effects are required to be brought to a net zero.

[148] In this application the very important things (those rare and threatened) are not adversely affected and the adverse effects to things of some ecological importance have been considered and minimised as much as is possible. In return (and as a remedy/benefit) the revegetation management proffered will result in much more and much better than the current land use practices (include weed and pest management) and the revegetation offered as part of the golf course, with extensive indigenous revegetation, will replace spatially the affected "schedule F" area, greatly enhance the representative nature of the assemblage, the viability and quality of the remaining habitats. If anything, this application through remediation will reduce current fragmentation, edge effects and weed and pest presence and better secure the stable dune system. That said the "restoration plan" should not be viewed as a biodiversity offset, but as a positive contribution to the environmental values of the site.

Section 42A offers report – Ecology

[149] In most areas the reporting ecologist eventually agrees with my assessment, the existing values, and the beneficial outcome with the restoration programme proposed.

[150] However, there are a number of inaccuracies and points of disagreement that I consider important to canvas.

[151] At paragraph 6 of his evidence Mr Whiteley makes reference to a letter he produced for Horizons entitled "Ecological Effect Review" dated 20 December 2021. He includes this review in his evidence appendix, but this is the first opportunity I have had to see this review and his responses to the section 92 material I supplied and to the discussions we had on site.

[152] In essence, it is a discussion about our disagreement on what forms schedule F and what does not on site. He stated he preferred my first mapped Schedule F extent, not my revised one when more vegetation data had been collected (the data requested in the section 92 request). I surmise he didn't like what that better data did in defining the communities from that of my initial conservative schedule F extent.

[153] He makes a point of directing attention to the physical substrate part of the definition stating that consideration is not limited to vegetation cover alone. And while that is the case for a number of habitat types e.g. Karst systems or screes of calcareous rock or boulder fields of volcanic rock where that focus on substrate is reflected in the definition in the main table of schedule F; e.g. -"Boulder fields of volcanic rock" defined as: "*Bare substrate*…etc." In Schedule F under active dunes the definition is "*Indigenous* grassland* or sedgeland* occurring on active duneland* formed on raw coastal sand*". There is no direction to consider bare sand and the definition is entirely about the vegetation cover on raw coastal sand, while stable dune systems are defined as "*Indigenous* grassland*, tussockland*, herbfield* (including Pimelea actea and P. arenaria), or shrubland* occurring on stable duneland* formed on recent coastal sand.* Again, measured by the plant communities on the substrate, not the substrate. Hence my assessments have considered the vegetation communities, their intactness and composition on the sand substrate.

[154] Mr Whitely then goes on to question in bullet points the RECCE plot data interpretation, seemingly miss understanding where the plots were, how they were used, and where schedule F changes were made because of the results. This perhaps is not unexpected as Mr Whitely is not a plant ecologist and does not have vegetation ecology training.

[155] Firstly, the northern holes' type 9 schedule F community areas have not been altered and hence there were no RECCE plots under taken in them.

[156] Secondly the small islands of Type 9 in and between Holes 17, 15 and 16 were the focus of the RECCE plots to better ascertain what the walk through transects did not, which is an accurate proportion of indigenous dune species relative to the exotic weeds. The plots were not exactly as planned by aerial as they had to reflect the actual conditions on the ground, but they were moved to enable

answering the question at hand, which was: were those areas of community 9 properly schedule F. The plot data gathered showed that those areas I have removed from Schedule F now labelling them 6a (exotic scrub) was the correct approach, as they are not indigenous dominated sand communities and they have considerably more exotic coverage than "scattered" as per the definitions for Schedule F (even acknowledging stable dunes noting "Exotic invasive species are also a feature of stable duneland").

[157] Then, Mr Whitely discusses hole 14 stating in his opinion because of aerial photographs he viewed he considers it active dune and because he noted sand carex and sand convolvulus on his site visit. First, I do not know what species he refers to by "sand carex", but the active sand species community (see description in my main evidence) are not present in the hole 14 area, only outside it in the active dune system, this is proven, and was proven at the time he wrote this review, by the RECCE plot data requested. Secondly, the extensive lupin and marram and hairs tail etc have stabilised the area which was never a hummocked dune system but a relatively stable sand flat area.

[158] On the matter of the RECCE plots and the section 92 Mr Whitely at paragraph 17-19 seems to imply that the purpose of the RECCE plots was to facilitate the restoration plan (overlaying the plan on the RECCE plots), and that I took advantage of the plots to then redefine schedule. That is not accurate in my opinion. I understood the purpose of the RECCE plots was to better determine the effect of those holes proposed to be in or near initially mapped schedule F areas and to quantify the areas of stable dune that might receive restorative works. Whatever the purpose, the facts of the plots are the facts, and through analysis those plots show the small type 9 communities initially mapped (from aerial) are not stable dune indigenous schedule F communities and I could not ignore those results.

[159] Mr Whitely in paragraph 22, despite the evidence supplied, states that he disagrees with the revised schedule F area stating evidence (from aerial photographs) of instability of sand - I do not see the relevance of this; and that in his opinion the dominance of weed species is not a factor to remove those areas form consideration because the definition has a note that says exotic invasive species may be a feature of stable dunes. The definition of "indigenous" at the start

of schedule F clearly addresses this mater and carefully defines indigenous and the level of acceptable exotic presence – being "scattered".

[160] Concerning values Mr Whitely agrees with my assessments. But at paragraph 30 he appears to suggest that the active and stable dune communities should not be evaluated separately but as one. They are two distinctive communities recognised as two communities in Schedule F. While they have an ecotone and share some species as do most adjoining habitats including the pasture, there is a clear distinction in species, texture, processes, environmental influences etc and should be separated. It is a common mistake, to amalgamate, and can result in either a vaulted value of the poorer system, or a depressed value of the better system, usually the former.

[161] The only difference between us in terms of the level of effects is around the magnitude of the effect of clearance of the schedule F vegetation and so the resultant level of effect. I note that there are new and more accurate area estimates for the clearance of schedule F on the property and for the extent of stable dunes in the local environment since the section 92 material.

[162] Mr Whiteley expresses his opinion after his preamble on how to assess the magnitude, at paragraph 36 that "*broadening the scale of comparison overly dilutes the effective loss of these regionally rare priorities*". And there he has hit a nail on the head by accident. The value, the rarity, the special nature of these features is measured at a regional scale. The effect of change therefore must also be measured at a regional scale to be relevant and be reflective of the scale at which the value is made. It is now common practice to consider the scale at which the values assessed are made or at least the relevant landscape scale such as a catchment. My scale is just such a scale.

[163] I am more conservative than taking a regional scale, I took a local, logical, area of connected stable duneland "separated" from further adjacent stable dunes by two river out washes. This gave me the base of 22 ha as the comparison of local available habitat from which to judge the loss.

[164] Mr Whiteley then falls to Table 8 of the EIANZ, rather than expressing the level of change as an ecological resource change, or habitat effect – he thinks that

the change will be "detectable", "notable to the point where post development character, composition or attributes will be partially changed".

[165] The EIANZ (2018) actually says : "Magnitude of effect is a **measure of the extent or scale of the impact and the degree of change** that it will cause". And "Generally, it is recommended that an assessment at the scale of the feature (e.g. contiguous dunes…". This is what I have always done. In this case I have set the parameter of comparison (22ha of local continuous stable dune) and then have considered the extent of the change (1 ha). I also considered how the loss is arranged in the landscape, and if it is then a change that would alter the availability and quantity and quality of the habitat, or change the underlying character, composition and attributes of the system.

[166] Mr Whitley reports on a range of matters refereeing Table 8 of the EIANZ to come to a moderate magnitude of effect - but Table 8 says: for a moderate magnitude consider: "*Loss or alteration to one or more* ***key*** *elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature*".

[167] The losses related in the main to hole 4 do not involve loss of key elements of the existing (or remaining) area. A key element in the stable dune is the Knobby club rush and the dune hollows, that will persist throughout the site and wider stable dunes post effect. Mr It is hard to decipher what Mr Whiteley means as does not say what he understands are the key elements of the community being affected. The composition of the area remains the same, the attributes the same and there is no moderate proportion of known populations or range of any elements that is lost.

[168] The change simply does not meet the moderate scale of magnitude on either the numerical extent, or descriptive changes of Table of the EIANZ.

[169] It best meets the low magnitude. I.e. 1 ha of 22ha, and a "*Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be*

similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature".

[170] Regardless of the various areas of disagreement, he agrees that the restoration proposed will result in a gain / improvement post effect. We also disagree on the semantics of what that restoration is to be called, remedy, mitigation, offset or compensation. It really does not matter, where the consent granted references the draft restoration plan as provided in this hearing the out come for the site will be an ecological enhancement.

[171] Mr Whiteley talks about offset (paragraph 59-61) and talks about the restoration plan as an offset. I wish to make it very clear; I have assessed the impacts and the levels of effects and discussed the avoidance and mitigation of those effects. The re8maining effects are low or less and the mitigation proposed is akin to remedy which is replacement (of better) vegetation communities adjacent to the effects and were they are not currently present. There is a surplus of mitigation prosed to the point where ethe result is a considerable benefit . There is no residual effect that requires an offset.

[172] Guided, I assume, by Mr Whiteley' s review the consent conditions suggest a number of management plans. A number of these I address in the table below as not being required.

Table 5. Reasons why some of the proposed ecological consent conditions are not required.

Proposed conditions 17-22 Sand Daphne survey and translocation plan	All the sand Daphne have been GPS located and mapped and the activity is designed to ensure the area they occupy is avoided. There is no risk of new daphne plants germinating within the already fully vegetated stable hind dune of the proposed activity. The fruit of sand daphne are dispersed by lizards or else roll down the parent dune, this is the spread mechanism. No lizards have been found on site and the area of activity is not within rollable distance of the area of sand

	daphne. Furthermore, while it grows amongst Knobby club rush, tauhinu and sand coprosma, the exotic grass cover and lupin will restrict its entrance. Further marram grass is no site and spreading and is a major issue for the continuance of this species. No additional pre works surveys should be required.
Proposed condition 16 Katipo management plan	A trained and experienced entomologist has searched for katipo in the stable hind dunes and did not find suitable habitat or any katipo. A management plan is simply not required for the areas and habitats to be changed.
Proposed condition 6 Lizard management plan	After the application of three survey technics by a specialist trained and experienced herpetologist over 6 months, no lizards have been found in the various dune habitats. A lizard translocation plan and DoC permit is not required.
Proposed condition 13 Wetland and lagoon monitoring plan	No adverse effects are assessed to occur, the risk of unforeseen nutrient or chemical or sediment discharge is negligible, and the risk of a hydrological change related to the golf course is also near zero. The saltmarsh community is highly dynamic related to river flow, tidal ingress, climate change, and weather and yearly seasonal change. There is nothing that could be measured in the salt marsh that would reflect a golf course activity effect. The proposed consent asks for measures of ecological function (and its decline) and an increase in nutrient. The condition does not

	indicate thresholds for nutrient change or what "ecological functions" might be, but I strongly suggest, having undertaken numerous such monitoring programmes in the past, that neither is measurable and then relatable to golf course activity because of the spatial context, the likely diffuse nature of any inputs, the already dynamic nature of the saltmarsh as well as an inability to gather and understand the natural variation in those factors that occurs now.

Recommendations:

[173] I have made the following recommendations in relation to the construction of the course, I add several more in relation to the operation. If consent is to be granted than the following should apply.

- Avoid those areas outside the golf course (holes, tees and greens) recognised to be schedule F and or of moderate or high ecological value– i.e. the active foredune, the freshwater wetland, the salt marsh, the kānuka treeland.

- Identify by accurate GPS and flag tape the habitats requiring avoidance, i.e., set a physical buffer to this exclusion (including the sand daphne area).

- Set a similar buffer demarcation in the stable dune to ensure works are limited to the extent current proposed in relation to holes 14, 15, 17 and 4.

- Ensure specifically that the sand daphne population and kanuka treeland area is not adversely affected.

- Carry out the indigenous revegetation as indicated by the restoration plan. Begin this programme with areas that have a buffer function first or early in the programme.

- When felling the large coastal trees, do so from late morning (10 am) onwards and not after dusk to avoid affecting roosting native species.

- Ensure well set up and maintained earthworks sediment management occurs along the border with the Ohau River and the salt marsh and freshwater wetland.

- During operation and specifically for tees and greens (holes 4, 10, 14, 15, 17) i.e. those near stable or active dunes or saltmarsh, ensure there are rules that a ball hit out of bounds are not recovered by the players so as to remove the potential for trampling and tracking.

- Have a management regime that ensures weed and pest management occurs in at least the stable hind dune and new revegetation areas, but also the active dune and salt marsh boundary. This activity should be carried out by persons trained to recognise the ecological values as well as correct management methods for the various weeds and pest on site.

- Utilise the pest and weed management staff to recover as they undertake weed and pest management those balls as and were they come upon them.

- Human access to the beach or through the foredunes can create tracks and cause sand blow outs and both open the vegetation to greater weed invasion and greater bared sands. The property is developed as a golf course and not a beach picnic site and we have recommended that no access be made available to golfers through any foredune.

Conclusion

[174] In my opinion the proposed activities will result in an overall benefit to the ecology of the site and the schedule F areas, both improving quality, area (expansion) resilience and security long term. The ecologically important components of the landscape have been avoided.

[175] The small scale schedule F area vegetation losses are technically a low – "less than minor adverse" adverse effect. . The removal of the current land use / management is pivotal in removing the continued expansion of weed species through the dune lands which is and has caused fragmentation and dilution of the remaining ecological values of the coastal margin of the site.

[176] The proposed restoration plan, although not a requirement related to the level of adverse effect, will lead to considerable positive ecological outcomes and expand the area and the security of the future schedule F.

[177] From an ecological perspective there is no reason why Horizons should not grant consent, and there are ecological reasons why the proposal will be beneficial to this coastal environment.

Dated 12th April 2022

Dr Vaughan Francis Keesing

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Addendum 1. Vegetation plot data additional to the AEE and produced after the section 92 (see after table for maps).

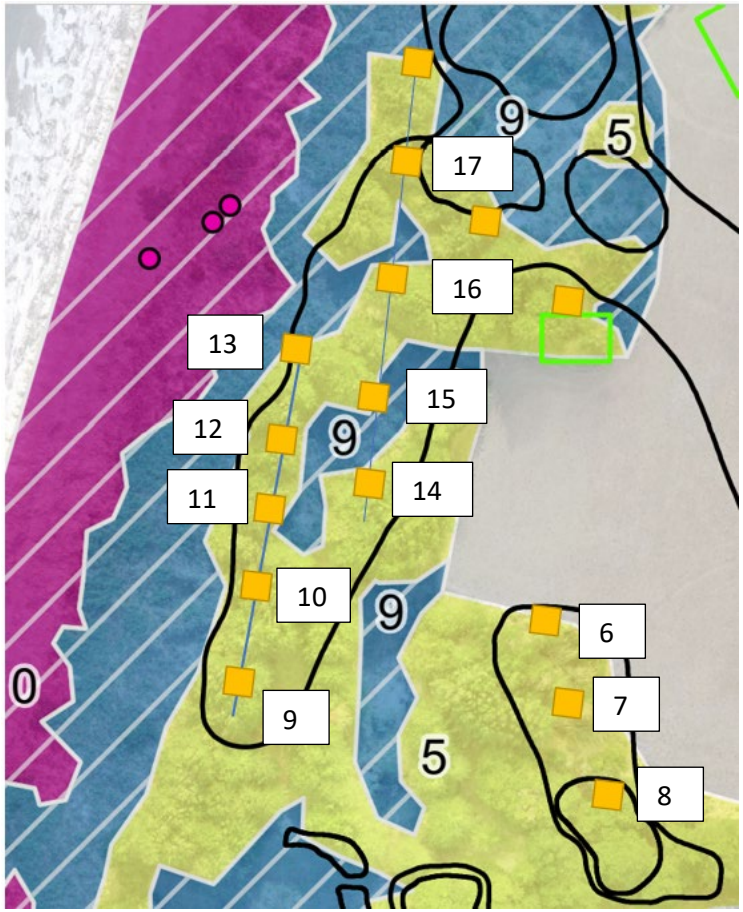
		Hole 14 -active dune area					Hole 15				Hole 17							
Plant taxa in plots	exotic/ native	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
beach spinach	N							3			1		5					
blackwood	E											2		5				
cocksfoot	E											40		10		5		10
Cleavers	E													1				
crested dogs tail	E											20				1		
dandelion	E	10	5	10	5	2		2				2		5		3		1
fleabane	E	2	1	1	1	1		1										
hairs tail	E	20	40	20	30	20		1						5				
hanging spleenwort	N						1	2								2		
hawkebit	E	1	1	1	1	1												
hounds tongue fern	N						3	10				1				60		80
Knobby club rush	N	0	1	5	2	1		1						30		5		
lotus	E	1	0	0	0	0				70								
lupin	E	40	60	70	70	70				1		30		20				10
macrocarpa	E						90	95	95	0	100		100					
marram grass	E	5	0	1	1	1												
moss	N											10						
night shade	E	0	1	0	0	0		1										
pampas	E	0	1	0	0	0												
pine	E				10													
pohuehue	N											1						
purple groundsel	E	3	0	1	1	1		1										
radiata pine	E																	

ragwort	E							2										
Rautahi	N									1								
sand bindweed	N	1																
Glen Murray tussock	N																	
shining spleenwort	N						2					1				10		
silver poplar	E						1											
boarder panic grass	E							10								5		
tall fecue	E	0	0	0	5	0				5				15				
tall oat grass	E	0	0	0	0	1						2						
taupata	N																	
vetch	E															1		
Yorkshire fog	E									40								
bare unvegetated surface		17				2	94	66	100		99		95	10	100	10	100	
	Sum	100	110	109	126	100	101	100	100	117	100	109	100	101	100	102	100	101
	native (%)	1	1	5	1.6	1.0		47		1	1	12	5	33		75		79
	exotic (%)	99	99	95	98.4	99		53		99	99	88		67		25		30
	cover canopy	0	0	0	0	0	90	95	95	0	100	0	100	0	100	55	100	0

Dominant vegetation cover descriptions

Plot numbers	1-5	6-8	9	10	11	12	13	14	15	16	17
20/50 plot dominance	lupin/hairs tail	bare ground	Lotus/Yorkshire fog	bare ground	cocksfoot/lupin/crested dogs tail	bare ground	Knobby club rush/lupin	bare ground	hounds tongue fern	bare ground	Knobby club rush

Hole 14 vegetation plots (1-5) and katipo search grids (yellow)



Vegetation plots in relation to holes 15-16 and 17.

Addendum 2. Draft Restoration plan

Douglas Links

Restoration Management Plan
Prepared for Grenadier Limited

20 March 2022

Document Quality Assurance

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Prepared by:	Dr Vaughan Keesing Senior Ecologist/ Partner Boffa Miskell Limited	
Status: DRAFT	Revision / version: F	Issue date: 20 March 2022

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File ref: A03236B_301_PC166_Vegetation_Mgmt_Plan_RevF_VK_review_201703309.docx

Cover photograph: Degraded 13th green site

CONTENTS

Appendices

1.0 Introduction

The Douglas Links property is a 107.2 ha parcel of coastal land, to the north of, and adjacent to, the Ohau River. The property contains a mix of farmland, commercial pine forest and scrubland. Four differing land uses border the site; to the east is farmland, to the west is Ohau beach, to the south is the Ohau River and to the immediate north is the Ohau Sands subdivision.

The property is held in two titles. xxxxxx……..

The site is located within the Ohau Water Management Zone in the Horizons Regional Council One Plan.

The project provides for environmental enhancement through the enhancement of the dunelands, the protection and enhancement of endangered native flora, and the removal of any longer-term impacts caused by the current farming and forestry operations continuing in perpetuity.

This current document, the Vegetation Management Plan (VMP) outlines the methods that will be used to protect and enhance both the landscape and ecological values on the site while allowing for the overall site concept of a high quality sustainable golf and hospitality operation . The works associated with this VMP are required to be completed within five years of site works commencing.

2.0 Douglas Links Vegetation & Habitats

2.1 Background

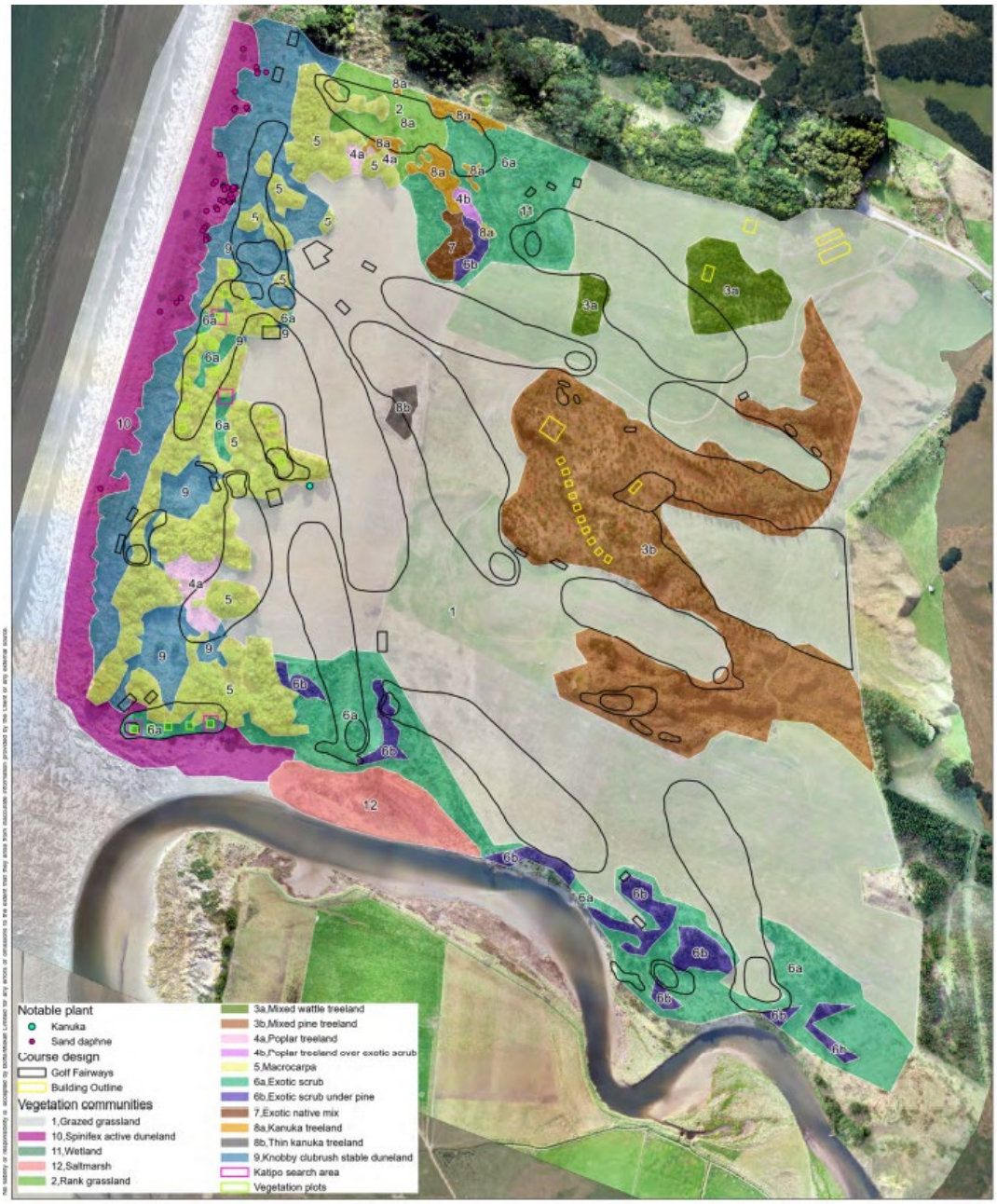
The areas on site identified as Significant according to Schedule F (see map below) fit the following definitions:

- Kānuka Forest or Treeland - Kānuka forest or treeland is dominated by almost pure stands of well-developed kānuka. This habitat type is differentiated from kānuka scrub by size (greater than 4.5m tall or 20cm diameter measured at 1.4m above the ground. Seven areas of kānuka treeland on site were identified (community 8a), though only one of these fits the height and size specifications outlined in Table F.1 which defines the required height (at least 4.5m) and size in Table F.2a, (must be at least 0.25ha). The one area of thin kānuka treeland is also excluded on the basis of size and is not considered well-developed as per the definition.
- Saltmarsh wetland – Saltmarsh wetlands support low growing indigenous herbfield, rushland, and scrub, form within areas of tidal intertidal zones, and are fed from groundwater and estuary waters. Saltmarsh wetlands occur in association with mudflats. The saltmarsh wetland is an estimated 1.98ha in size and fits the description of salt marsh wetland as according to Schedule F.
- Active duneland – Indigenous grassland or sedgeland occurring on active duneland formed on raw coastal sand. The active duneland on site fits this description and is not excluded by any F2.b factors

- Stable duneland – Indigenous grassland, tussock land, herbfield (including Pimela actea and P arenaria), or shrubland occurring on stable duneland formed on recent coastal sand. The stable duneland in a number of areas on site loosely fits this description and is not excluded by any F.2b factors

All other areas of vegetation not listed above do not meet the One Plan definition of 'indigenous' due to level of exotic species present (more than 'scattered) and so are not considered against Schedule F for Indigenous Biological Diversity.

The map below shows the various vegetation types and the golf hole layout. The magenta, blue and orange coloured vegetation types represent the areas of Schedule F vegetation / habitat. This plan focuses on improving those areas after the golf infra structure has been installed.



The Ōhau River, Ōhau River mouth/estuary, the beach and dunelands provide foraging and roosting habitat for waders, gulls, terns and shorebirds. The Ōhau estuary is recognised as an 'important area for birds' (B. M. Robertson & Stevens, 2016). The macrocarpa trees along the dune edge may provide roosting and/or nesting habitat for shags.

The saltmarsh wetland is relatively small (Ca. 2 ha) but is in reasonably good condition, with a dense swathes of native saltmarsh vegetation (refer to Section 3.2.17 for a vegetation description). It is part of a network of wetlands in the wider area in which one to two bittern and banded rail have occasionally been recorded (e.g. Te Hakari dune wetland, Lake Horowhenua)4. Given the small size of the wetland, it is unlikely to provide permanent habitat for these species, however it may on occasion provide temporary foraging habitat for these mobile species, together with the Ōhau estuary.

The kānuka treeland habitat provides habitat for common, Not Threatened native species and introduced species.

The freshwater wetland is small (0.03 ha) and isolated and provides habitat for common, Not Threatened native species and introduced species.

The grassland habitat on site, in addition to the coastal habitat, may provide foraging, roosting and possibly nesting habitat (areas of rank grassland) for New Zealand pipit.

The remaining vegetation communities on site (exotic scrub, exotic scrub under pine, poplar treeland types, brush wattle treeland, mixed pine treeland exotic native mix; refer to Section 3.2.1 for vegetation community descriptions) provide habitat for native, Not Threatened species and introduced species.

3.0 Retaining Existing Vegetation

Existing vegetation in areas outside of the golf corridor will be maintained where it fits within the wider revegetation plan. Examples of this are the solo and small stands of Kanuka in the southeastern corner of the property, and the muehlenbeckia clumps in the valley between the 7th and 8th tees. Within the golf corridor there are rare examples of established native trees, such as the Kanuka adjacent to the 13th tees, which will also be retained. Much of the existing grassland vegetation will not be removed but will be supplemented with natives as per the plan.

4.0 Revegetation and Restoration

The Schedule F areas on site total approximately 14 ha. Of these areas, 0.9 ha is proposed to be converted to fairways permanently. Two Schedule F habitat types are encompassed by the current design, with 7 ha stable duneland and 6.5ha active duneland (both rare habitat types). The salt marsh (2 ha, threatened) is not proposed to be impacted by the course, however, management through enrichment planting is proposed here and will assist in securing is landward edges. The Schedule F area of kanuka (0.29 ha, Map 1) will be avoided but will also be enhanced.

It is proposed that alongside the permanent conversion of Schedule F habitat to fairways, the surrounding habitat – including that which does not meet Schedule F – such as the areas of macrocarpa and pine that are to be removed, would be enhanced ecologically through actions such as pest (predator and weed) control, exotic species clearance, and vegetation rehabilitation/planting. Adding to this, the surrounding grassland, and exotic habitats, where not converted to fairways or course related areas, would be revegetated and some would become representative, diverse, indigenous stable duneland, dune slack or coastal dune shrubland. These actions would enhance the current ecological values of the site, even when permanent clearance of some Schedule F habitat (through golf course creation) occurs, as community types will be enhanced and restored as a result of the project and in a greater proportion than that lost.

The active dune on site (Ca. 6.5 ha) does not require revegetation but it does require management and that will be of the form of weed and predator control as well as specific protection/enhancement of the sand daphne population. Although there will be no direct effects on the active duneland habitat, and therefore no mitigation required under 13-4 (b), the proposed management actions in the surrounding habitat will enhance the ecological value of the active dunes and result in a net gain ecologically.

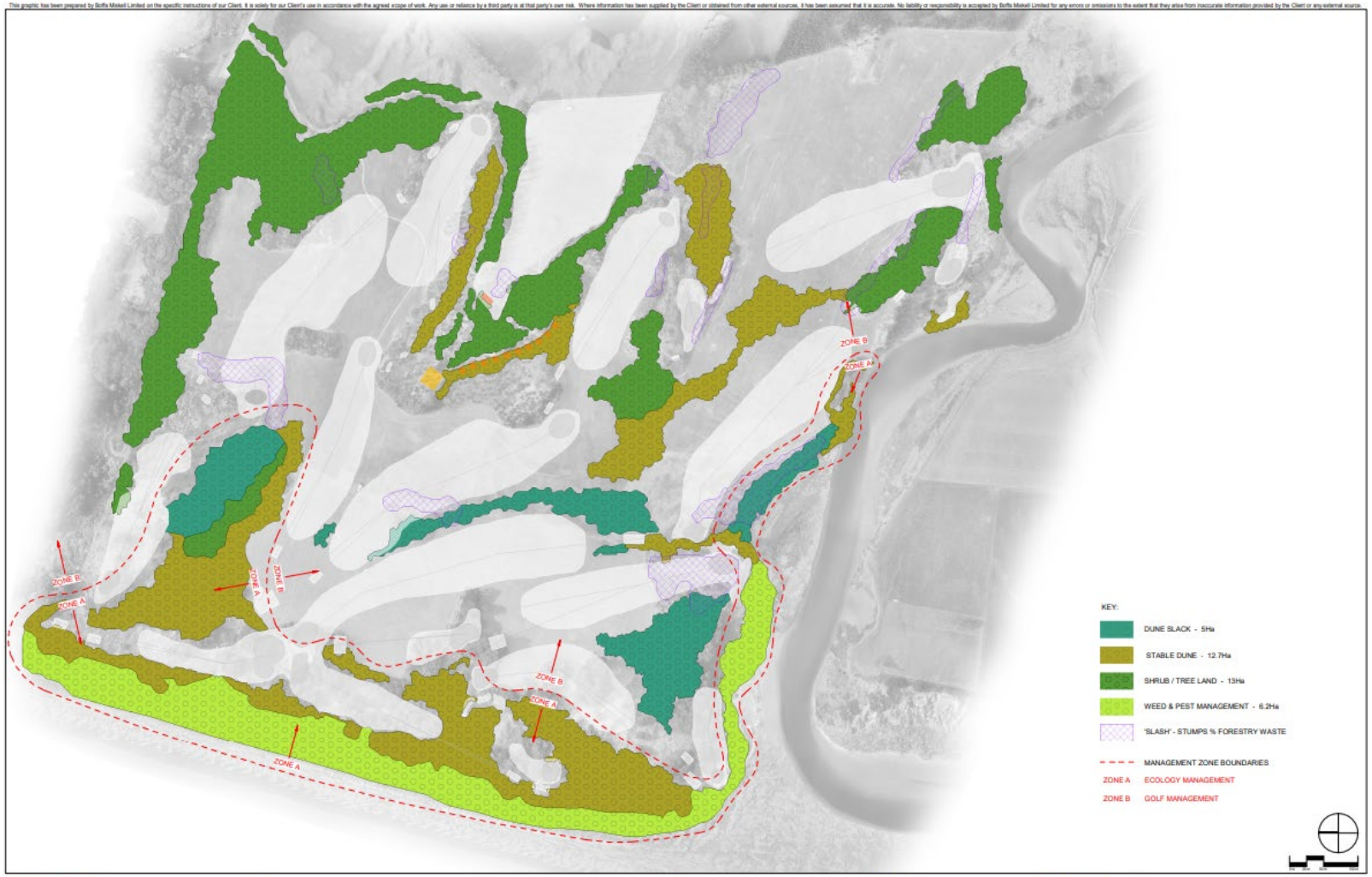
Many small areas of kanuka treeland are present on site which do not qualify as Schedule F areas due a combination of size, height, and fullness requirements. While these do not qualify as Schedule F habitats, they may be a valuable addition to any areas converted to coastal scrubland and retaining these areas to enhance future restoration would be beneficial to the project. This is also recognised by the project course designer, and as such they are areas targeted for support/restoration and habitat creation. The 0.29 ha area of Schedule F kanuka (rare-significant) will be enhanced through revegetation connections and general weed and pest management.

The small raupō wetland discovered, is a microcosmos unto itself and needs only edge native buffer plantings..

A draft restoration plan has been developed by a project landscape architect and Dr Boffa. We assume and expect that the existing natives such as the titoki and totara will form part of that restoration effort. An indication of the species to be used and the areas to be revegetated and provided is shown in the plans Appendix 2. While additional native plant species could be added, the backbone of the assemblages in the plan are ecologically appropriate, and the areas and sizes will result in a net indigenous biodiversity and functional gain.

We indicate on this figure by way of the yellow circles the areas for ecological offset focus, either to enhance the existing (stable hind dunes) or recreate new native assemblages. It is noted that the revegetation is aimed specifically at replacing greater than lost stable hind dune systems, reducing fragmentation, increasing community size and resilience increasing buffering and creating a better than current more connected indigenous dominant stable dune community. The communities outlined by the yellow circles include: active duneland (and sand daphne), stable duneland knobby clubrush, kanuka treeland, exotic native mix, saltwater marsh and freshwater wetland.

The species chosen are those representative of what was there, these may also reflect cultural considerations such as mahinga kai. These have been included in the restoration planting list to build on the vision for the course to share cultural value in the area. It is recommended that the final restoration plan submitted for approval should include an opportunity for Tangata Whenua to add species and cultural practices to the plan. The Applicant would need to resource that process accordingly as part of the final conditions of consent.



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NOTES

CONTRACTORS TO VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING WORK.

CONTRACTORS ARE RESPONSIBLE FOR CONFIRMING THE LOCATION OF ALL UNDERGROUND SERVICES ON SITE PRIOR TO COMMENCING WORK.

FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.

REV	DATE	DESCRIPTION	APP

CLIENT: Muhunoa Golf Links

CONSULTANTS

DRAFT

Muhunoa Golf Links
Ohau

Restoration Planting Areas

Design	VKa	Scale	Date
Drawn	OBa	1:2500 @ A1	13.04.2022
Check	TSt	1:5000 @ A3	

DRAWING NO.: BM210081_211

REVISION:

4.1 Plan basics

The restoration plan of the indigenous systems (stable dune, salt marsh buffer, kanuka enhancement) has the following overarching requirements:

- Contract local nurseries / suppliers for species and abundances to be used -there will be lead in times;
- Remove existing exotic canopy species, keeping only some of the larger trunks o site to be laid down as wood debris;
- Remove all grass and shrub cover in the areas of the Tees, greens and fairways and any other areas to be revegetated;
- Recontoured as required the tees, greens and fairways;
- Sow unstable, "stable" hind dunes exposed by removal of vegetation in a light fescue as a binder until revegetation prepared;
- When areas are ready for revegetation spray off 2 weeks in advance the fescue;
- Plant out indigenous species in patterns and abundances as described and required by micro-site conditions;
- Maintain the plantings ensuring minimal weed completion, irrigation as required and animal pest management;
- Monitor and maintain until establishment and plants growth indicates appropriate coverage of the site.

The clearance and revegetation is to happen in stages across the golf course and the pattern of development is not linear and achieved in one time period, but spread depending on when clearance and management can occur and when plant materials come available.

4.2 Staged Pine, Scrub, and Macrocarpa Removal

Removal of pines, scrub, and macrocarpa in the areas to be re-vegetated will be undertaken in a staged manner. All pine, scrub, and macrocarpa removal and revegetation will be carried out over a period of five years. As per recommendation sin the ecological report clearance of trees could affect roosting native birds and so clearance is advised to be after 10 am in the mornings and not after "dusk" such that any roosting birds are unlikely to be present.

Native planting into the cleared areas will be undertaken as quickly as possible after pine, scrub, and macrocarpa removal, but within the appropriate planting season (refer to Section 4.4). The rapid stabilisation of exposed areas using Fescue grasses will be used to help ensure a more successful transition to native plant cover, but also the retention of the sand dunes beneath the current cover. In many zones existing vegetation will remain largely untouched with natives progressively introduced.

4.3 Revegetation Species

An appropriate arrangement of species is to be achieved to ensure species compatibility with habitat and landform (refer to Appendix 2). That is representative communities are formed. Thus, the species selection for the re-vegetation is based on:

1) Suitable native species that are likely to have grown naturally in the locality. All plants to be planted within the vested reserve area are to be sourced from within the Horowhenua Ecological District. That is Eco-sourcing will be the primary sourcing method and plant selection shall take into account the suitability of local threatened plant species for planting;

2) Their appropriateness to the site and the surrounding coastal character and their contribution to enhancing the existing ecosystems on site; and

3) Their likelihood of survival in the prevailing environmental conditions; for coastal species this will include tolerance to periods of drought, high winds and potential coastal inundation.

A revegetation planting plan (xxxxx) has been produced which takes into consideration species vulnerability and sensitivity, while producing a palette that aims to follow and mimic natural landscape patterns and micro topographical changes . The coded types (dune slack, stable dune etc) have a palate of species allocated to them but that palate covers micro-site conditions such as: dry, damp, sandy, richer, slopes windy etc hence a range of plants appear on more than one list. This approach will ensure that the re-vegetation generates naturalistic species associations based on ecological niches. This will provide the plants the greatest chance for survival when initially planted into the open ground.

In order to achieve the ultimate species diversity targeted in the initial approach, the simplified list shown in Appendix 2 will later be amended on site with a palette of enrichment species. Initially the hardier and more adaptable species in the lists will be planted out and encouraged to establish naturally within the deforested area. Once satisfactory establishment has been achieved to provide cover and stabilisation, it is then proposed that the more vulnerable species will be planted in small numbers and encouraged to establish as part of the mix.

4.4 Revegetation Methodology

All planting and maintenance operations shall be carried out by persons suitably qualified and experienced in native revegetation planting programmes and familiar with the site constraints and requirements for establishing dune vegetation.

Planting shall be undertaken in favourable conditions, at the earliest opportunity during the planting season, preferably over the autumn months. Work shall only be undertaken when the weather is suitable. All planting operations shall be suspended during periods of severe storms, drought or persistent drying winds.

Plants shall be set out and appropriately spaced in an informal manner avoiding straight lines and regular geometric patterns, whilst ensuring an even cover across planting. Species will be distributed according to each species niche preferences, microclimate and ground conditions.

A selection of plant sizes will be used depending on the species, species availability and location of planting. All plants will be encouraged to grow to maturity as naturally as possible to achieve their desired character and form, through sound management practices including weeding, and other accepted horticultural practices.

Slow release fertiliser shall be used within the proposed planting operation; this has been shown to enhance the survival rates of planted dune plants.

4.5 Weed Control

Outlined below is the weed control which will be undertaken as part of the maintenance operation for revegetation programme. Possible control programmes for each of the target weed species are outlined following. However, the final methodology will be determined on a site-by-site basis, and be dependent on plant size and habitat context. Control operations should be undertaken during the main growing season of weeds (i.e. between October to May).

4.5.1 Planning of Control Operations

Prior to the commencement of a weed control programme it is important to consider the following:

1. Establish and map the environmental weed[1] species present and their relative abundances and priorities to manage.
2. Establish a monitoring / action and reporting system, along with a calendar of management actions.
3. Work in stages, controlling outlying weed patches first to slow the rate of weed spread before starting on the worst areas. Replace weeds with natives or non-weedy plants as work progresses.
4. Timing of control operations to occur before weeds fruit or seed.
5. Prevent the spread of seeds or fragments that could resprout. Decide on the best disposal method before commencement of work.

In instances where chemical control is used, there will be a minimum period of time (recommended by the herbicide manufacturer) between herbicide application and enhancement planting. When cleared patches cannot be planted promptly, mulching the cleared ground will reduce weed invasion and conserve soil moisture.

4.5.2 Control Methods

All plantings will be spray released (using herbicide at low pressures to avoid spray drift) or hand released, subject to the situation and vulnerability of certain species to spray operations, as well as the proximity of the planting to the existing dune vegetation and waterways.

The following are general principles for control methods for the different growth forms:

- **Herbaceous groundcover weeds –** Apply herbicide sprays in accordance with manufacturers' recommendations on herbaceous and groundcover weeds. Spot spraying or hand removal techniques in instances of close proximity to protected vegetation, and areas

[1] Environmental weeds are invasive plants which Cronk & Fuller (1995) define as "an alien plant spreading naturally (without the direct assistance of people) in natural or semi-natural habitats, to produce a significant change in terms of composition, structure or ecosystem processes".

of native or non-invasive groundcover in order to eradicate environmental weeds and accommodate new plantings.

- **Shrub weeds –** Remove the top part of shrub weeds for access. Cut the base of the plant close to ground with a straight flat cut, and apply herbicide immediately as the sap ceases to flow using a paintbrush. Coppice or mulch the plants that will not grow vegetatively. Remove any branches that have seed heads attached or that may sprout.
- **Mature weed trees –** Ring-barking of wilding pine and wilding Tasmanian blackwood is the recommended method of culling these tree species, especially within wetland areas where direct felling would cause significant damage to the existing wetland habitats. Where trees are likely to resprout, make deep cuts and drill holes into sapwood at regular intervals around the base of trees. Immediately apply herbicide, using a paint brush or squeeze bottle. Remove any material that may sprout. Where trees are not likely to resprout and can be removed safely, fell the tree, making the lowest cut below the lowest branch.

If herbicides are to be used, it is important to use chemicals that are species-specific. Furthermore, given the coastal nature of the property spray drift could potentially be an issue and as such direct application methods (e.g., cut and stump painting, spot spraying, drill and inject) should be employed in order to minimise non-target effects and the volume of herbicide used.

Works are to comply with all relevant legislation and regulations. All materials shall be of a high standard, and workmanship shall be that of appropriately qualified persons performing all labours in the best practice to the specified level of effectiveness.

Likely target weed species known to occur on the site are listed in the application (especially ecology) reports.

4.5.3 Surveillance & Monitoring

Surveillance is an important component of weed control. This allows new invasions to be caught and controlled early, and for the success of projects to be tracked. As such, following the initial round of weed control, six-monthly monitoring should be conducted over the establishment period of the revegetation planting, with a triggered level of response related to the monitoring measures.

Monitoring should measure the change in weed abundance following weed control, whereby the long-term objectives are to:

- Control woody weeds and pampas to 0% of total vegetation cover; and
- To control all other weed species to a level of less than 5% of total vegetation cover.

4.6 Animal Pest Control

The site suffers from a variety and abundance of pest animals, not least of which are feral cats, stoats, hedgehogs, hares, rabbits and mice. Given the absence of indigenous important invertebrates, lizards and ground nesting birds control of predatory animals is a secondary and beneficial activity.

The principal concern must be the herbivorous pests that could adversely affect the revegetation. This principally means rabbits, hares and any possum, goats, pigs, deer and even pukeko.

Given that these pests are abundant in the wider landscape the site can not be kept clear of all these species all the time, but there are key periods, not least of which is when blocks of vegetation are planted.

Therefore prior to any planting activity for indigenous species areas a property wide control should be undertaken 1 week in advance of planting, through planting, and for at least 1 month after planting and there on as required by monitoring of damage levels.

There are numerous methods to manage the range of pests but the most common are poisons (e.g. pindone for rabbits, brodifacoum for possums and rats,) either using bait stations or hand casting. The other option is shooting. A combination of both is usually most effective. Certainly, if there are deer, pigs or goats a professional control operation to shoot out the these larger pests is recommended. However, a pre poison shoot of hares and rabbits and possum can reduce the areas and amounts of poison to be used and provide good early protection for planted vegetation.

We recommend that a specific plan be developed by an expert in the field of pest animal control targeting the protection of the revegetation areas.

4.7 Revegetation Monitoring & Maintenance

A five year revegetation maintenance programme shall be implemented in accordance with Appendix 4. Maintenance will include replacement of plant failures, fertilising, replacement of mulch (if any), animal pest and weed control operations.

On-site care and maintenance will influence survival, particularly in the first year following planting. As such, the following monitoring will be undertaken (in line with the ERMP):

- Site inspections shall be undertaken monthly over the growing seasons for the first two seasons and less frequently over the winter months. These inspections shall identify any management issues as they arise (e.g. weed/pest problems, releasing requirements, replacement planting requirements). Any such issues will be addressed accordingly.
- 90% plant survival is to be achieved at all times. Replacement plantings shall be of a grade commensurate with planting requirements identified in the appropriate upcoming planting season.

5.0 Programme & Timing

The works associated with this VMP are required to be completed within five years of the site works commencing. Table 1 tabulates the activities by zone, where the zones are shown on figure xx

6.0 Activity Zones

Table 1 and Drawing (Clearance pathway plan) outline the proposed zones of clearance and revegetation.

Table 1: Clearance and Revegetation Zones

Zone	LOCATION
1	Entrance off Muhunoa West Road and driveway sides
2	Clubhouse, Accommodation and Practice Golf Area
3	Sparse scubland between Driving Range and Maintenance Facility
4	Owner's Residence and surrounds
5	Northern boundary and 3rd hole
6	2nd Fairway knob
7	13th Approach and Green
8	10th Approach, Green and Saltmarsh adjacent zone
9	8 Green, 9th, and 10th Tee area
10	South eastern corner
11	North western corner macrocarpa dominant
12	Western dune edge and Southern macrocarpa dominant

NEED zone / staging map

While there is a preferred staging sequence, outside influences, such as contractor availability and the ability to provide safe and separated work zones, may dictate that some of the zones are cleared outside of the original plan. In the event that the order is revised, the associated pine, scrub, and macrocarpa removal and re-vegetation staging will be revised as appropriate.

6.1 Schedule

Table 2: Vegetation Management Stages. Management to include pine removal (P), scrub removal (S), macrocarpa removal (C), revegetation (R), monitoring (M) and enrichment planting (E).

ACTIVITY	ZONE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
PINE, SCRUB, AND MACROCARPA REMOVAL	1	P,S				
	2	P,S				
	3	P,S				
	4	P,S				
	5	P,S	P,S			
	6	P,S				
	7	P,S	P,S			
	8	P,S	P,S			
	9	P,S				
	10	P,S				
	11	C	C			
	12	C	C			
REVEGETATION & MONITORING	1	R	R	M,E		
	2	R	R	M	E	
	3		R	R,M	E	
	4	R	M	E		
	5			R	M	E
	6		R	R,M	E	
	7		R	R,M	E	
	8		R	R,M	E	
	9		R	R,M	E	
	10			R	M	E
	11			R	R,M	M + E
	12			R	R,M	M + E

7.0 Management of the Foredune

The active foredune is not in any way being affected by the project but as part of the sites maintenance of the look and the feel and the retention of the indigenous communities which make the look and feel, the golf course managers have proposed to manage the weeds and pests in the fore dune.

7.1 Golf activities

Human access to the beach or through the foredunes can create tracks and cause sand blow outs and both open the vegetation to greater weed invasion and greater bared sands. We have recommended that no access be made available to golfers through any foredune.

There will be a need to manage lost golf balls from especially holes 4, 14, 16 and 17 such that while golfers will not be allowed to enter the fore dune and stable dune to retrieve balls hit into these zones the maintenance staff will be, and do so as part of weed and pest monitoring and control. Nevertheless, great care will be required by the staff not to also incur tracking and indigenous plant damage resulting in opening of the vegetation and sand erosion.

7.2 Plant weeds

The current level of weeds is low but there are a range of threatening species present such as the marram grass and lupin which could if unchecked slowly replace the indigenous species. There will also always be new threats such as the non native ice plant, coastal wattle, purple groundsel, etc.

A focus must be therefore on marram and lupin. Where areas of marram are controlled either by repeated use of targeted Glyphosate or physical removal by hand consideration of replacement planting in spinifex is suggested and will depend on the area exposed. If the area exposed by the death of a marram patch is greater than 4m2 then we recommend including planting of 4 spinifex plants.

In respect to lupin we recommend hand removal in all cases and again if the area removed leaves a space of bared sand over 4m2 then this be replanted from stocks in either spinifex or pigeon or whichever other local indigenous grass or sedge is dominant.

In undertaking the monitoring and control s care in required not to cause tracking and the opening up of the existing spinifex etc cover. This only leads to further weed invasion and dune blow outs.

7.3 Predators

The golf course would also like to foster a better fauna in the active and stable dunes. To do this means reducing the current levels of feral cats, stoats, hedge hogs and mice. Again, where these are controlled that reduction simply opens up space for new colonists from the surrounding landscape, but for a period it offers relief. Therefore, control prior to spring is the best approach to relieve some pressure through the breeding season of birds. Lizards and invertebrates. It is noted that control of these predators requires an broad approach as there are can be unforeseen consequences of top down only control or bottom up only control. Examples of this include removal of stoats and cats can result in very abundant rabbit and mice. Or control of rabbits and mice can lead to prey switching in the remaining stoats and cats such that greater pressure occurs to nesting birds etc. Given the values that might potentially be regained are invertebrates and lizards and birds nesting at the river mouth we suggest a program of hedge hog and mice reduction. We suggest the hedgehogs be by active night time collection and appropriate euthanasia, while mice be through a poison drop (hand spreading) regularly in August-September.

Appendix 1: Douglas Links Photos

Photo 1: Typical ungrazed shrubland/treeland

Photo 2: Typical reserve esplanade vegetation

Photos 3 & 4: Typical pine coverage and preferred Kanuka goal

Photo 5: High gorse and boxthorn at 10th tee

Photo 6: Blackberry and Muehlenbeckia with adjacent pine slash

Photo 7 Common mix of shrubland gorse, inkweed and lupin

Photo 8 Pingao near 14th hole

Photo 9 Rare Kanuka in shrubland southeast of property

Photo 10 Sand daphne in reserve esplanade near 4th

Photo 11: 13th green site from near saltmarsh

Photo 12: Muehlenbeckia in valley between 7 and 8

Photos 13 &14: Macrocarpa edges 14th hole and reserve esplanade

Photo 15: Rabbit damage near 14th green

Photo 16: Large lone Kanuka near 13 tee

Photo 17: Treeland 3 months after pine and scrub removal with forestry mulcher

Photo 18: Back side of Kanuka left of 3rd hole

Appendix 2: Revegetation Species Palates

Dune Slack		Species Mix		68,300	Centres	Density	Number
Ficinia nodosa	Knobby clubrush	8	*0.08*	5464	1	1	5464
Cyperus ustulatus	Umbrella sedge	1	*0.01*	683	1	1	683
Austroderia splendens	Toetoe	2	*0.02*	1366	0.5	2	683
Apodasmia similis	Oioi	6.25	*0.0625*	4268.75	1	1	4269
Muehlenbeckia complexa	Pohuehue	2.25	*0.0225*	1536.75	1	1	1537
Machaerina juncea	Twig rush	3	*0.03*	2049	1	1	2049
Phormium tenax	Flax/harakeke	3	*0.03*	2049	1	1	2049
Typha orientalis	Raupo	5	*0.05*	3415	1	1	3415
Cordolyine australis	Cabbage tree	5	*0.05*	3415	1.5	0.44	7761
Carex secta	Carex	2.75	*0.0275*	1878.25	0.5	2	939
Carex geminata	Carex	2.75	*0.0275*	1878.25	0.5	2	939
Schoenus nitens	Shiny bog rush	1	*0.01*	683	1	1	683
Bolboschoenus caldwell	Caldwells clubrush	1	*0.01*	683	1	1	683
Schoenoplectus pungens	Sharp clubrush	1	*0.01*	683	1	1	683
Plagianthus divaricatus	Saltmarsh ribbonwood	1	*0.01*	683	1	1	683
Kunzea ericoides var. linearis	Kanuka	*10*	*0.1*	6830	1.5	0.44	15523
Open Ground		45	*0.45*	30735	NA	NA	NA
		100	1	68300			32520

Fordune/Stabledune		Species Mix		106,000	Centres	Density	Number
Spinifex sericeus	Spinifex	*12*	*0.12*	12720	0.3	2	25440
Ficinia spiralis	Pingao	*7*	*0.07*	7420	0.3	2	14840
Pimelea villosa	Sand daphne	*3*	*0.03*	3180	1	1	3180
Ficinia nodosa	Knobby clubrush	15	0.15	15900	0.5	2	31800
Austroderia splendens	Toetoe	*1*	*0.01*	1060	1.5	0.44	466
Apodasmia similis	Oioi	*1*	*0.01*	1060	0.5	2	2120
Machaerina juncea	Twig rush	*1*	*0.01*	1060	1.5	0.44	466
Muehlenbeckia complexa	Pohuehue	*5*	*0.05*	5300	0.5	2	10600

Dodonaea viscosa	Akeake	*0.25*	*0.0025*	265	1.5	0.44	117
Cordyline australis	Cabbage tree	*0.25*	*0.0025*	265	1.5	0.44	117
Kunzea ericoides var. linearis	Kanuka	*0.25*	*0.0025*	265	1.5	0.44	117
Carex secta	Carex			0			0
Bolboschoenus caldwell	Caldwells clubrush	1	*0.01*	1060	0.5	2	2120
Schoenoplectus pungens	Sharp clubrush	1	*0.01*	1060	0.5	2	2120
Olearia solandri	Coastal daisy bush	*2*	*0.02*	2120	0.5	2	4240
Coprosma acerosa	Sand coprosma	*5*	*0.05*	5300	0.5	2	10600
Coprosma rhamnoides.	Twiggy coprosma	*1*	*0.01*	1060	0.5	2	2120
Open ground		44.25	0.4425	46905	NA	NA	NA
		100	1	106000			110463

Shrubland/Treeland		Species Mix		162,900	Centres	Density	Number	
Ficinia nodosa	Knobby clubrush	*5*	*0.05*	8145	1	1	8145	
Coprosma robusta	Karamu	*2*	*0.02*	3258	1.5	0.44	1434	
Dodonaea viscosa	Akeake	1	*0.01*	1629	1.5	0.44	717	
Coprosma propinqua	Mingimingi	*1*	*0.01*	1629	1.5	0.44	717	
Cordyline australis	Cabbage tree	*3*	*0.03*	4887	1.5	0.44	2150	
Phormium tenax	Flax/harakeke	*3*	*0.03*	4887	1.5	0.44	2150	
Carex secta	Carex	2	0.02	938.1	0.5	2	1876	
Bolboschoenus caldwell	Caldwells clubrush	1	0.01	53	1	1	53	
Schoenoplectus pungens	Sharp clubrush	1	0.01	53	1	1	53	
Austroderia splendens	Toetoe	*1*	*0.01*	48.87	1.5	0.44	22	
Apodasmia similis	Oioi	*1*	*0.01*	48.87	0.5	2	98	
Pseudopanax lessonii	Houpara	*1*	*0.01*	1629	1.5	0.44	717	
Kunzea ericoides var. linearis	Kanuka	*25*	*0.25*	40725	1.5	0.44	17919	
Leptospermum scoparium	Manuka	5	*0.05*	8145	1.5	0.44	3584	
Muehlenbeckia complexa	Pohuehue	*2.5*	*0.025*	4072.5	1.5	0.44	1792	
Open Ground		*45.5*	*0.455*	74119.5	NA	NA	NA	
		100	1	154267.84			41426	
						Total		**184408**

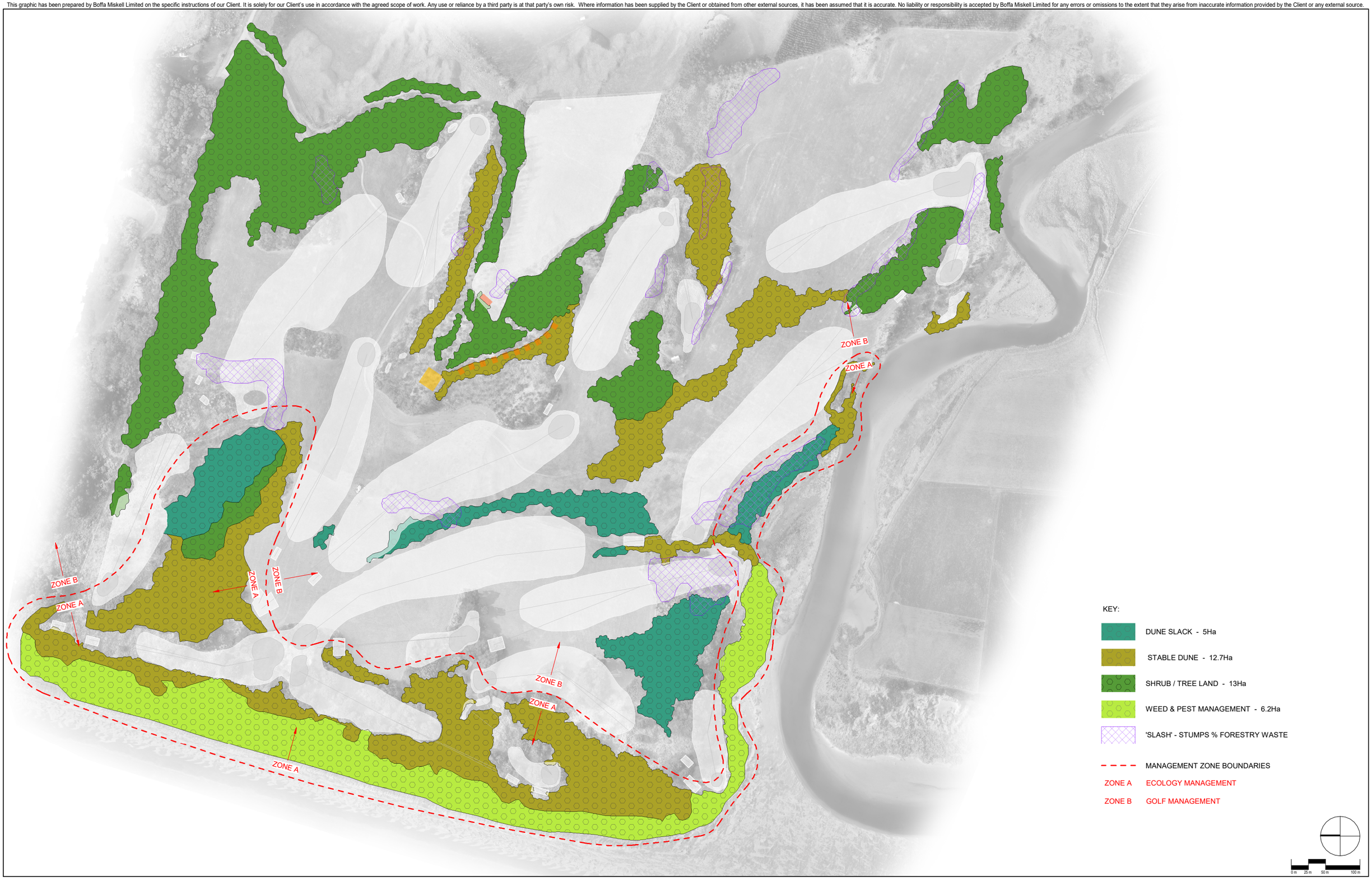
Appendix 3: Potential Weed Control Methods

Weed Species	Possible Control Methods[2]	Site Management
Acacia sp. Wattle	• Hand-pull or dig seedlings (all year round). Ensure minimum soil disturbance. • Cut and squirt (all year round): Make 1 cut every 100 mm around the trunk, apply triclopyr 600 EC (5ml) per cut. • Bore and fill (all year round): Make 1 hole every 200 mm around the trunk, apply metsulferon-methyl 600g/kg (3mg) or triclopyr 600 EC (10ml) per hole. • Cut down and paint stump (all year round): triclopyr 600 EC (100ml/L) or Yates Hydrocotyle Killer (500ml/L) or metsulferon-methyl 600g/kg (5g/10L) or Vigilant gel.	• Maintain native groundcover at all times in the treatment area.
Cortaderia selloana Pampas	• Dig or grub out seedlings or small plants. Chainsaw small plants. Compost or leave on site to rot down. Burn or bury any flower heads. • Spray (summer and autumn): Gallant (150ml/10l + crop oil) for most sites (i.e. if overspray of native species is likely).	• Seed banks re-infest bare, burnt and sprayed sites, and grazed plants resprout. • Pampas recedes as shade increases, so encourage weed replacement (planting, regeneration) as control is carried out.
Lupinus arboreus Lupin	• Slash tall plants close to ground (all year round). Mulch. • Hand pull or dig small plants (all year round). Mulch. • Stump swab (all year round): glyphosate 20%, or Grazon 10%, or Escort 1 g /L. • Weed wiper (all year round): Escort 1 g /L; or glyphosate33%; or Grazon 20%. Add penetrant in all cases. • Spray: Versatill or Grazon at label rates (during active growing period).	• Cut stumps occasionally resprout. • Persistent seedbank. • Sites with strong tall regeneration can usually be left for falling light levels to eliminate. This process can be assisted by slashing and/or interplanting. • Control probably only necessary in low-growing plant communities (eg coastal dunes).
Phytolacca octandra Inkweed	• Pull out small plants: Leave on site to rot down, minimise disturbance. • Slash stems close to ground. Leave on site to rot down. • Cut down and paint stump (all year round): metsulferon-methyl 600g/kg (1g/L).	• Control this weed only where it is rare, habitat is vulnerable, or where disturbance has caused dense sites. Regenerating shady sites (or where groundcover is becoming dense) can normally be left as the weed will be crowded out.

[2] Best method will depend on plant size and site context.

Weed Species	Possible Control Methods[2]	Site Management
Solanum mauritianum Woolly nightshade	• Pull up all small plants (easiest in winter). Leave on site to rot down. • Cut and squirt (all year round): make cuts at regular intervals around the trunk, apply undiluted Tordon Brushkiller (1.5ml per cut). • Cut and paint stumps (all year round): Tordon Brushkiller or triclopyr 600 EC (100ml/L) or Vigilant gel. • Frilling (all year round): Tordon Brushkiller (100ml /L) or triclopyr 600 g/L (100ml/L) or Yates Woody Weedkiller (200ml/L). • Injection method: use either 10 mm wide holes drilled at 45 degree angle down into trunk 50 mm deep spaced at 50 mm around trunk, or a series of 80 mm wide blazes cut to a depth of 15-20 mm, spaced at 20-40 mm. Fill each with Vigilant gel. • Spray: Tordon Brushkiller (25ml/10L) or triclopyr 600 EC (60ml/10L) or triclopyr 300 EC (12ml/L).	• Reseeds profusely in bare sites within 1-2 years. • Rarely invades intact habitats. • Maintain shade by planting dense cover. • Usually short-lived seed, follow-up three years.
Ulex europaeus Gorse	• Stump swab: glyphosate (250ml/L) or metsulfuron-methyl 600g/kg (2g/L) or triclopyr 600 EC (250ml/L) or Tordon Brushkiller (100ml/L) or Vigilant gel. • Spray (spring-summer): triclopyr 600 EC (20ml/10L) or triclopyr 300 EC (40ml/10L). • Spray (autumn-winter): metsulfuron-methyl 600g/kg (5g/10L+ penetrant (knapsack) or 20g/100L + penetrant (spraygun) or Tordon Brushkiller (250ml/100L (spraygun). • Frilling: With a sharp chisel or axe, make a deep cut into the sapwood at regular intervals around the base of the tree, taking care not to ring-bark the plant. Immediately saturate each cut with undiluted Tordon Brushkiller. • Injection method: As each hole is drilled saturate it with undiluted Tordon Brushkiller using a sheep drench pack with a spraygun.	• Stumps resprout quickly. • Only use glyphosate spray when all vegetation on site is to be bared for replanting (generally not recommended). • Maintain humus layer. • Sites with appropriate tall forest species present can usually be left to be overtopped; can speed by selective slashing, stump swabbing or planting. • Maintain roadsides, cuttings and other vectors, check road gravel and fill.
Ammophila arenaria Marram grass	• Dig out small patches and dispose of (all year round). • Spray: Gallant (150ml/10l) + crop oil) (all year round).	• Use Gallant where pingao or sedges are present (note that Gallant will kill spinifex but only stunt pingao). • Follow up required annually. • Begin control at windward end of infestation, or where native vegetation is best represented. • Prevent physical damage of marram at existing sites to prevent rhizome migration.

Appendix 4: Five Year Maintenance Schedule



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NOTES

CONTRACTORS TO VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING WORK;

CONTRACTORS ARE RESPONSIBLE FOR CONFIRMING THE LOCATION OF ALL UNDERGROUND SERVICES ON SITE PRIOR TO COMMENCING WORK;

FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.

REV	DATE	DESCRIPTION	APr

CLIENT
Muhunoa Golf Links

CONSULTANTS
-

DRAFT

Muhunoa Golf Links
Ohau

Restoration Planting Areas

Design	VKe	Scale	Date
Drawn	DBa	1:2500 @ A1	13.04.2022
Check	TSt	1:5000 @ A3	

DRAWING NO.
BM210081_211

REVISION

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