The botanical treasures of Middle Pakiri Beach Farm, Pakiri

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Introduction

Middle Pakiri Beach Farm (MPBF) (c.148 ha) is located 6km north-west of Pakiri township on Auckland's NE coast, and adjacent to a large area of dunes designated as a Stewardship Area (c.47 ha), which is administered by the Department of Conservation (DoC) (Fig. 1). The farm is part of a continuous strip of low-lying alluvial land that would have once formed part of an extensive dune-wetland sequence. The property is unusual in that it still retains relatively large and intact areas of wetlands, including bogs in dune hollows, raupo swamp, swamp forest and manuka-sedgeland associations. Wetlands and terrestrial indigenous vegetation are largely absent from other properties in the area, with most land being grazed by dairy cattle. Hills to the west of Pakiri Block Road support substantial areas of mixed broadleaved-podocarp forest, much of which forms a contiguous remnant that extends across several property boundaries.

Pakiri Scenic Reserve is situated 3.1 km to the north-west of this remnant, while 3 km to the south lies Pakiri Hill Forest, the largest block of indigenous forest remaining in Pakiri. Pakiri Scenic Reserve and Pakiri Hill Forest are listed as Significant Natural Areas (SNA) as described by Mitchell et al. (1992). Together these remnants form a highly significant local habitat network and provide stepping stones for birds moving to and from outer Gulf islands such as Hauturu/Little Barrier and the Mokohinau Islands. MPBF is near two major local watercourses: Poutawa Stream and Pakiri River. The Poutawa Stream empties into the sea 1.2 km north of the site. A tributary to the Pakiri River flows through the property, but it has been significantly degraded by the loss of riparian buffering, trampling by stock, and farm run-off.

The underlying geology of Pakiri comprises mobile sand, which is influenced by wind-blown processes; stabilised marine sands of Holocene age; and consolidated marine sands of Pleistocene age (Mitchell et al. 1992). Further inland, the steep hills most likely comprise rocks of the Northland Allochthon (often called 'Onerahi Chaos'). These rocks are typically a mix of highly sheared and fractured mudstones, siltstones and limestones. They are characteristically extremely weak and are notorious for their instability, even at the most gentle of slopes.

An ecological survey of MPBF was undertaken by Wildland Consultants Ltd on 5-8 December 2011 in order to inform the management of its natural areas (Wildland Consultants 2012). The property owners

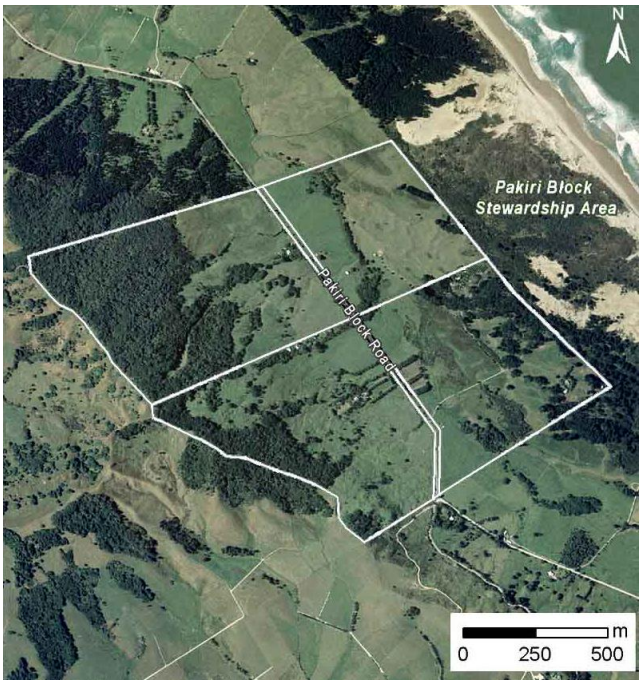

Fig. 1. Location of Middle Pakiri Beach Farm, Pakiri. Map: Wildland Consultants Ltd. Aerial photography sourced from Auckland Council GIS Viewer.

obtained funding from the DoC-administered Biodiversity Advice Fund to pay for the survey and ecological management report. A separate report on the management of the adjacent dunelands was compiled by ecologist Geoff Walls. The property has previously been visited by Auckland Council ecologists Cameron Kilgour, Abigail Forbes, Craig Pratt, Craig Bishop and Rue Statham. Cameron Kilgour, in particular, has botanised much of the wetlands and dunelands at MPBF, and has contributed significantly to the plant species list.

One hundred and forty-five species of indigenous plants and 144 species of naturalised plants were recorded from the property and dunelands. One plant was recorded that is classified as 'At Risk' (de Lange et al. in press) and four plants were recorded that are 'Regionally Threatened' as per Stanley et al. 2005. Species are listed in the order of their respective threat rankings:

<u>At Risk</u>
Kunzea ericoides var. *linearis* (Declining)

<u>Regionally Threatened</u>
Sparganium subglobosum (Regionally Critical)
Coprosma propinqua (Regionally Vulnerable)
Coprosma tenuicaulis (swamp coprosma) (Data Deficient)
Hydrocotyle pterocarpa (Data Deficient)

Fig. 2. Puriri, kahikatea, taraire, totara, kauri and nikau occur on the edge of a large forest remnant on hillslope. All photos by N. Goldwater, 5-7 Dec 2011.

Fig. 3. *Oplismenus hirtellus*, meadow rice grass and *Carex dissita* are common on the forest floor under a canopy of puriri, matai, kahikatea and kohekohe.

Vegetation

Coastal hill forest

A small remnant of cut-over forest is located in the south-west of the property, and is contiguous with regenerating shrubland and gorse (*Ulex europeaus*) to the south. The canopy is characterised by mature puriri (*Vitex lucens*) and locally common kahikatea (*Dacrycarpus dacrydioides*) with frequent taraire (*Beilschmiedia tarairi*) and totara (*Podocarpus totara*), and occasional emergent kauri (*Agathis australis*) and rewarewa (*Knightia excelsa*). The sub-canopy is dominated by nikau (*Rhopalostylis sapida*) with occasional rewarewa and cabbage tree (*Cordyline australis*). Nikau and wild ginger (*Hedychium gardnerianum*) are abundant in the ground tier, occurring with occasional *Coprosma rhamnoides*, *Carex lambertiana* and ponga (*Cyathea dealbata*).

To the north, a relatively large and floristically diverse remnant spans much of the western property boundary. It forms part of a larger area of indigenous forest that extends to the west and north. Much of the canopy comprises co-dominant taraire, puriri and kohekohe (*Dysoxylum spectabile*), while kahikatea, rewarewa and cabbage tree are occasional emergent species (Fig. 2). Cabbage tree is also locally common on the forest margins. The sub-canopy includes commonly occurring nikau, frequent kohekohe and occasional kaikomako (*Pennantia corymbosa*) and karaka (*Corynocaprus laevigatus*). Lacebark (*Hoheria populnea*) is locally common in the sub-canopy. Epiphytes such as kahakaha (*Collospermum hastatum*) are frequent in the canopy, favouring the large puriri. With the exception of nikau, little regeneration of canopy species was observed on the forest floor. Both areas of forest can be accessed by cattle.

Alluvial forest

To the east of Pakiri Block Road, near the northern boundary of the property, lies a small fragment of alluvial podocarp-broadleaved species forest that is contiguous with grazed indigenous treeland on the adjacent farm to the north. The canopy contains co-dominant totara and puriri with occasional matai (*Prumnopitys taxifolia*) and emergent kahikatea. Kohekohe occurs frequently with occasional nikau in the subcanopy. A history of grazing has prevented the establishment of understory vegetation, although there is an abundance of seedlings on the forest floor, including karaka, nikau, kohekohe and kowhai (*Sophora microphylla*). The ground tier is largely dominated by *Oplismenus hirtellus*, meadow rice grass (*Microlaena stipoides)* and *Carex dissita* (Fig. 3) Wild ginger and arum lily (*Zantedeschia aethiopica*) are locally common.

Fig. 4. Swamp forest in the foreground. In the distance, pine forest on the backdunes. Manuka bog visible between pine forest and swamp forest.

Fig. 5. Large pool in swamp forest with cabbage tree, nikau and *Carex virgata*.

Fig. 6. Pools under a manuka canopy with kiokio, swamp millet and harakeke.

Fig. 7. Small, grazed dune bogs dominated by Mercer grass, willow weed, soft rush, *Juncus articulatus*, *J. acuminatus* and spearwort.

Swamp forest

Situated near the south-east property boundary is small area of swamp forest dominated by kahikatea, totara and pukatea (*Laurelia novae-zelandiae*), with occasional cabbage tree and puriri (Fig. 4 and 5). Totara is more common on the drier, raised parts of the site; kowhai, kohekohe and nikau are frequent in the understorey. The northern half of the site is grazed and heavily pugged by stock. Large pools are present throughout the forest, some of which support species such as willow weed (*Persicaria maculosa*), purei (*Carex virgata*), giant umbrella sedge (*Cyperus ustulatus*), spearwort (*Ranunculus flammula*), water forget-me-not (*Myosotis laxa*), water purslane (*Ludwigia palustris*) and duckweed (*Lemna minor*). Browsing by stock has largely resulted in a depleted forest understorey and ground tier, although kahikatea and nikau seedlings are present in good numbers. Meadow rice grass is dominant in shaded areas, occurring with sedges such as purei, *Carex dissita* and *C. lambertiana*, *O. hirtellus* and unpalatable shrubs species such as *Coprosma rhamnoides* and *C. areolata*. Swamp mahoe (*Melicytus micranthus*) and swamp coprosma (*Coprosma tenuicaulis*) are present in less disturbed areas. A single, healthy specimen of *Peperomia urvilleana* was seen clinging to a large pukatea, well out of reach of hungry cattle.

Manuka bog

An area of manuka (*Leptospermum scoparium*) bog is located adjacent to the swamp forest (on the eastern side). The fragmented canopy of manuka occurs over a mosaic of commonly occurring swamp millet (*Isachne globosa*), *Eleocharis gracilis* and spearwort, frequent *Isolepis sepulcralis* and occasional kiokio (*Blechnum novae-zelandiae*), harakeke (*Phormium tenax*), cabbage tree, swamp coprosma and *Nertera dichondrifolia*. Shallow pools are common throughout this part of the site (Fig. 6). Further east, where the ground is more elevated, manuka is still the dominant canopy species with occasional emergent mamaku (*Cyathea medullaris*), although the understorey becomes dense with kiokio and *Machaerina rubiginosa*, and locally common *Eleocharis gracilis* and water fern (*Histiopteris incisa*). Hangehange (*Geniostoma ligustrifolium*), ponga, *Coprosma propinqua* and mingimingi (*Leucopogon fasiculatus*) are scattered throughtout. Two orchid species are also present in this part of the site: onion orchid (*Microtis unifolia*) and *Simpliglottis cornuta*, the latter of which was not in flower.

Dune bogs

Several small, ephemeral dune bogs are present at MPBF, most of which are degraded to varying degrees by cattle. In general, the vegetation is characterised by species such as Mercer grass (*Paspalum distichum*), willow weed and soft rush (*Juncus effusus*), occurring with frequent *Juncus sarophorus*, *J. articulatus*, *J. acuminatus*, spearwort and *Eleocharis acuta* (Fig. 7). Gorse is often a feature on the dry margins of these systems. Where stock have no access, indigenous sedges such as *Machaerina rubiginosa* and *M. teretifolia* are able to flourish. *Carex maorica* was recorded in low amounts from one dune bog.

Raupo reedland

The largest wetland present at MPBF is a fenced swamp dominated by raupo (*Typha orientalis*) with locally common jointed twig rush (*Machaerina articulata*). Swamp millet is frequent throughout the site, while small patches of *M. rubiginosa* and occasional manuka, cabbage tree and *Coprosma propinqua* occur on the eastern margins.

Grazed sedgeland

To the east of the raupo reedland is a relatively large and floristically diverse area of sedgeland within a gentle depression (Fig. 8). The substrate is very peaty, which is indicative of the infertile nature of bogs. *Machaerina rubiginosa* and spearwort cover much of the site, while water purslane and sparganium (*Sparganium subglobosum*) (Fig. 9) occur frequently with occasional *Juncus sarophorus* and

Fig. 8. Sedgeland dominated by *Machaerina rubiginosa* with locally common manuka in the background.

Fig. 9. *Sparganium subglobosum* in flower growing amongst *Machaerina rubiginosa.*

soft rush. In the northern part of the site, a discrete patch of spike sedge (*Eleocharis sphacelata*) occurs with *M. rubiginosa* and swamp millet, and frequent spearwort, sparganium, water milfoil (*Myriophyllum propinquum*) and occasional emergent manuka. The exotic rushes *Juncus acuminatus* and *J. articulatus* occur frequently throughout the sedgeland. Manuka has invaded the more elevated areas, while shallow pools are present in the more low-lying parts of the site. In areas where the wetland is more disturbed by cattle (and thus more eutrophic), Mercer grass is the dominant species, occurring with frequent spearwort and occasional soft rush. It is interesting to note the apparent browse-tolerance of sparganium.

Fern-sedge wetland complex

Located adjacent to one of the farm driveways is a wonderfully diverse mosaic dominated by ferns and sedges, with occasional shrub species and small trees. The southern part of this site comprises a narrow strip of tangle fern (*Gleichenia dicarpa*), matata (*Paesia scaberula*) and kiokio with frequent sedges *Machaerina juncea* and *Tetraria capillaris*. Present on the drier margins is occasional totara, kanuka, karamu, cabbage tree, wheki (*Dicksonia squarrosa*) and ponga. Exotic grasses such as cocksfoot (*Dactylus glomerata*), sweet vernal (*Anthoxanthum odorata*) and tall fescue crowd the verge along the driveway. A series of small, peaty pools are present in natural depressions, mainly within *M. rubiginosa* sedgeland. To the north the vegetation spreads out into an expanse of *M. rubiginosa*-manuka sedgeland with locally common spike sedge and swamp millet, and occasional harakeke, *M. teretifolia*, swamp willowherb (*Epilobium pallidiflorum*), *Coprosma propinqua*, *Coprosma propinqua × C. robusta* and *Sparganium subglobosum*. Larger, deeper pools are present in this part of the site; duckweed and water-meal (*Wolffia australiana*) are common on the surface of the pools. A small, alluvial terrace in the north-east of the site is dominated by matata and blackberry (*Rubus fruticosus* agg.).

Dunes

The Pakiri Stewardship Area is a DoC administered coastal block covering part of the foredune and dune complex of Pakiri Beach. Approximately half of its western boundary abuts Middle Pakiri Beach Farm. Around 70% of the dunes are covered in a diverse assemblage of indigenous and exotic plant species, while the remaining area comprises bare sand dunes, clay pans and coastal sand flats. Much of the mid- to foredune areas are characterised by a floristically diverse mosaic of toetoe (*Austroderia splendens*), pohuehue (*Muehlenbeckia complexa),* wiwi (*Ficinia nodosa*), shore bindweed (*Calystegia soldanella*), bracken (*Pteridium esculentum*), *Carex testacea* and harestail (*Lagurus ovatus*) (Fig. 10). Lupin (*Lupinus arboreus*), Mexican devil (*Ageratina adenophora*), hawkbit (*Crepis capillaris*) and broomrape (*Orobanche minor*) also occur, with occasional gorse, New Zealand spinach (*Tetragonia implexicoma*) and fleabane (*Conyza sumatrensis*), and locally common marram grass (*Ammophila arenaria*). Spinifex (*Spinifex sericeus*) and pingao (*Ficinia spiralis*) become more common closer to the shore, occurring with frequent evening primrose (*Oenothera glazioviana*) and locally common tauhinu (*Ozothamnus leptophyllus*).

The central part of the stewardship area is dominated by exotic shrubland comprising brush wattle (*Paraserianthes lophantha*), gorse and *Kunzea ericoides* var. *linearis*. In some areas, brush wattle has formed an extensive canopy reaching c. 4 m in

height. Pohuehue is locally common and Mexican devil is frequent together with grasses such as harestail, sand wind grass (*Lachnagrostis billardierei*) and silvery hair grass (*Aira caryophyllea*). Pohutukawa (*Metrosideros excelsa*) is scattered throughout the site and is represented both by large trees and small shrubs.

Most of the backdunes are characterised by *K. ericoides* var. *linearis* shrubland with occasional emergent totara, eucalyptus (*Eucalyptus* sp.) and radiata pine (*Pinus radiata*). Mapou (*Myrsine australis*), hangehange and mingimingi occur frequently in the subcanopy with occasional karo (*Pittosporum crassifolium*), mahoe (*Melicytus ramiflorus*), cabbage tree and houpara (*Pseudopanax lessonii*). The understorey comprises mapou, hangehange, mingimingi, *Coprosma rhamnoides*, sword sedge (*Lepidosperma laterale*), wiwi, bracken, turutu (*Dianella nigra*) and kowharawhara (*Astelia banksii*). Damp areas in dune hollows include locally common*Machaerina juncea* and *M. teretifolia*, and frequent swamp dianella (*Dianella haematica*). Wild ginger, smilax (*Asparagus asparagoides*), brush wattle, gorse and pampas (*Cortaderia selloana*) occur occasionally in the understorey. Located south of the *K. ericoides* var. *linearis* shrubland is an area of radiata pine forest, which is contiguous with a large area of open pine forest on the farm property. Pampas is locally common in parts and indigenous shrubland species are frequent throughout the understorey.

Fig. 10. Pakiri Block Stewardship Area. *Austroderia splendens*, bracken and wiwi occur in the foreground; low-stature brush wattle shrubland is visible in the centre of the photo; while open sand is covered by spinifex and pingao. In the background (left side of photo), pohutukawa occurs amongst dense pohuehue vineland.

Fauna

Birds

Twenty-four indigenous bird species were recorded from the property and adjacent dunelands. Kereru (*Hemiphaga novaeseelandiae*), shining cuckoo (*Chrysococcyx lucidus*), silvereye (*Zosterops lateralis*), fantail (*Rhipidura fuliginosa*), grey warbler (*Gerygone igata*), tui (*Prosthemadera novaeseelandiae*), morepork (*Ninox novaeseelandiae*) and kingfisher (*Todiramphus sanctus vagans*), were seen or heard within forest and shrubland habitats, while pukeko (*Porphyrio melanotus*), paradise shelduck (*Tadorna variegata*), white-faced heron (*Egretta novaehollandiae*), welcome swallow (*Hirundo tahitica neoxena*), Australasian bittern (*Botaurus poiciloptilus*) and spotless crake (*Porzana tabuensis*) were recorded from wetland habitat. Landowners have reported hearing fernbird (*Bowdleria punctata vealeae*) and it is likely that this species is still present at the site. Kahu (*Circus approximans*) were regularly observed patrolling overhead and North Island kaka (*Nestor meridionalis septentrionalis*) calls were heard on at least one occasion. Six indigenous bird species were recorded in the adjacent DoC-administered dunelands: northern New Zealand dotterel (*Charadrius obscurus aquilonius*), spur-winged plover (*Vanellus miles*), white-fronted tern (*Sterna striata*), red-billed gull (*Larus novaehollandiae*), black-backed gull (*L. dominicanus*), variable oyster catcher (*Haematopus unicolor*) and gannet (*Morus serrator*). Several dead fairy prions (*Pachyptila turtur*) were discovered on the beach. Eight indigenous bird species recorded from the property and dunelands are classified as 'Threatened' or 'At Risk' as per Miskelly et al. (2008).

Fourteen exotic bird species were recorded during the survey: eastern rosella (*Platycercus eximius*), blackbird (*Turdus merula*), songthrush (*T. philomelos*), house sparrow (*Passer domesticus*), mynah (*Acridotheres tristis*), goldfinch (*Carduelis carduelis*), greenfinch (*C. chloris*), chaffinch (*Fringilla coelebs*), yellowhammer (*Emberiza citronella*), skylark (*Alauda arvensis*), Australian brown quail (*Synoicus ypsilophorus australis*), Australian magpie (*Gymnorhina tibicen tibicen*), California quail (*Callipepla californica*) and, interestingly, kookaburra (*Dacelo novaeguineae*).

Fish

One inanga (*Galaxias maculatus*) was observed in shallow, shaded pools within *M. rubiginosa*-manuka sedgeland, and several small shortfin eels (*Anguilla australis*) were observed in a man-made pond. The pest species mosquitofish (*Gambusia affinis*) was frequently observed in pools near a culvert that runs under the main driveway.

Invertebrates

A targeted search for invertebrates was not part of the overall survey, although a couple of notable species are worth a mention. Stick insects (*Clitarchus hookeri*) were abundant on *K. ericoides* var. *linearis* in the backdunes, and are possibly an indicator of low rodent and wasp numbers. Whilst surveying an ephemeral dune slack, Cameron Kilgour, Abigail Forbes and I had the pleasure of being introduced to

the native aquatic leech *Richardsonianus mauianus*. Despite wearing wetsuit trousers and gumboots, both Cam and I managed to get bitten by these voracious little annelids.

Discussion

Wetlands at Middle Pakiri Beach Farm support a disproportionate amount of nationally and regionally threatened biota, including Australasian bittern, North Island fernbird, spotless crake, sparganium and *Hydrocotyle pterocarpa*. Cattle currently present the biggest threat to wetland and swamp forest integrity, although the landowners are planning to remove or exclude stock from all sensitive areas in the near future. The site supports some good examples of coastal forests on hills, which, together with nearby remnants, form part of an important local habitat network. The forest canopy is floristically diverse and contains some old-growth puriri and taraire. The ecological values of these forested areas are currently threatened by stock, goats and pest plants such as wild ginger. Consequently, the regeneration of most canopy species is limited. Mammalian pest animals are likely to be widespread across the project area. Given that it is not currently practical to control pests to low levels across the entire site, key high value sites should be targeted.

With the exception of wild ginger in one small forest remnant, pest plants were not commonly observed in natural areas on the farm. Large infestations of pest plants occur on the dunes within the Pakiri Stewardship Area, although these are mainly restricted to the backdunes. Thirty-seven species of pest plants were identified during the survey, 25 of which are listed in the Auckland Regional Pest Management Strategy 2007-2012 (ARC 2007). Some gardens contain pest plants that could wreak havoc if they were to spread to natural habitats, particularly agapanthus, which can aggressively invade open shrubland and duneland.

The wetlands and adjacent dunelands are likely to be regional strongholds for *Sparganium subglobosum* and *K. ericoides* var. *linearis*. The diverse mosaic of ecosystems present at the site serves as a reminder of how the landscape may have looked before the arrival of humans. Due to the foresight of the owners, most of the sites at Middle Pakiri Beach Farm are relatively intact; however, their ecological values will almost certainly erode in the long-term without active management (particularly those areas accessed by cattle). Through a carefully planned programme of pest plant and animal control, fencing, and planting to create linkages, the landowners will be able to enhance and sustain a vital, inter-connected ecosystem that unites forest and dunes in a landscape where indigenous plants and animals can thrive in the absence of introduced pests.

Acknowledgements

Damon and Kirsty Clapshaw, Paul and Josephine Miller, and Richard Collins (property owners) provided liaison and incredible hospitality. In mid-2011, Cameron Kilgour, Craig Pratt, Craig Bishop and Rue Statham (all ecologists at Auckland Council) carried out targeted botanical surveys at Middle Pakiri Beach Farm, mainly in wetland and duneland habitats. Plant species recorded by Auckland Council ecologists have been included in the Appendix.

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Appendix: Vascular plant species recorded from Middle Pakiri Beach Farm

This list is based on records from a survey undertaken between 5-8 December 2011 by Wildland Consultants, as well as a previous survey by Auckland Council ecologists.

* = exotic species
§ = planted species that occur in private gardens
^ = planted exotic species that have spread beyond gardens

AC = Auckland Council ecologists (23 June 2011)
WCL = Wildland Consultants Ltd (5-8 December 2011)

	AC	WCL
Lycopods		
Selaginella kraussiana *		+
Ferns		
Adiantum aethiopicum	+	+
Adiantum cunninghamii		+
Adiantum hispidulum		+
Asplenium flaccidum	+	+
Asplenium oblongifolium		+
Asplenium polyodon	+	+
Azolla pinnata *	+	+
Blechnum filiforme		+
Blechnum novae-zelandiae	+	+
Cyathea dealbata	+	+
Cyathea medullaris	+	+
Deparia petersenii	+	+
Dicksonia squarrosa	+	+
Doodia australis	+	+
Gleichenia dicarpa		+
Histiopteris incisa		+
Hymenophyllum demissum		+
Hypolepis distans		+
Lastreopsis glabella		+
Microsorum pustulatum	+	+
Microsorum scandens	+	+
Nephrolepis cordifolia		+
Paesia scaberula		+
Pellaea rotundifolia		+
Pneumatopteris pennigera		+
Pteridium esculentum	+	+
Pteris tremula	+	+
Pyrrosia eleagnifolia	+	+
Gymnosperms		
Cupressus lusitanica *		+
Cupressus macrocarpa *		+
Dacrycarpus dacrydioides	+	+
Dacrydium cupressinum		+ §
Pinus radiata *	+	+
Podocarpus totara	+	+
Prumnopitys ferruginea		+ §
Prumnopitys taxifolia	+	+
Dicots		
Acacia melanoxylon *	+	+ §
Ageratina adenophora *	+	+
Alectryon excelsus	+	+
Allocasuarina littoralis *		+ §
Anagallis arvensis *		+
Beilschmiedia tarairi		+
Brachyglottis repanda		+
Brugmansia candida *		+ ^
Calystegia sepium subsp.*roseata*	+	+
Calystegia soldanella		+
Carduus sp.*		+
Carmichaelia australis		+
Carpodetus serratus	+	+
Centella uniflora	+	+
Cirsium vulgare *		+
Clematis paniculata		+
Conium maculatum *		+
Conyza sumatrensis	+	+
Coprosma arborea		+
Coprosma areolata	+	+
Coprosma lucida	+	
Coprosma macrocarpa	+	+
Coprosma propinqua × *C. robusta*	+	+
Coprosma propinqua	+	+
Coprosma rhamnoides		+
Coprosma robusta		+
Coprosma tenuicaulis	+	+
Corynocarpus laevigatus	+	+
Crepis capillaris *		+
Daucus carota *		+
Duchesnea indica *		+
Epilobium ciliatum	+	+
Epilobium pallidiflorum		+
Erica lusitanica *		+
Erythrina ×*sykesii* *		+ §
Eucalyptus cinerea *		+ §
Eucalyptus sp. *		+
Ficus carica *		+ §
Galium aparine *		+
Galium divaricatum *		+
Geniostoma ligustrifolium	+	+

Gonocarpus micranthus	+		*Parentucellia viscose* *		+
Gunnera tinctoria *		+ §	*Pelargonium* sp. *		+ §
Hakea sericea *	+	+	*Pennantia corymbosa*		+
Haloragis erecta		+	*Peperomia urvilleana*	+	+
Hebe stricta		+	*Persicaria decipiens* *	+	
Hedycarya arborea		+	*Persicaria hydropiper* *	+	
Helminthotheca echioides *		+	*Persicaria maculosa* *		+
Hoheria polpunea		+	*Persicaria punctata* *	+	
Hydrocotyle pterocarpa	+	+	*Physalis peruviana* *		+
Hypochaeris radicata *		+	*Phytolacca octandra* *		+
Impatiens sodenii *		+ §	*Piper excelsum*		+
Knightia excelsa		+	*Pittosporum crassifolium*		+
Kunzea ericoides var.*linearis*	+	+	*Pittosporum eugenioides*	+	+
Kunzea ericoides var.*ericoides*		+	*Plagianthus regius*		+ §
Lapsana communis *		+	*Plantago australis* *	+	
Laurelia novae-zelandiae		+	*Plantago lanceolata* *	+	+
Leontodon taraxacoides *	+		*Plantago major* *		+
Leptospermum scoparium agg.	+	+	*Polycarpon tetraphyllum* *	+	+
Leucopogon fasciculatus	+	+	*Pomaderris amoena*	+	+
Leucopogon fraseri	+	+	*Populus deltoides* *		+ §
Linum bienne *		+	*Populus nigra* 'Italica' *		+
Liquidambar styraciflua *		+ §	*Prunella vulgaris* *		+
Lobelia anceps		+	*Ranunculus flammula* *	+	+
Lonicera japonica *	+		*Ranunculus repens* *	+	+
Lotus pedunculatus *	+	+	*Ranunculus sardous* *		+
Lotus suaveolens *		+	*Ranunculus sceleratus* *	+	+
Ludwigia palustris *	+	+	*Rosa* sp. *		+
Lupinus arboreus *		+	*Rubus fruticosus* agg. *	+	+
Lythrum hyssopifolia *		+	*Rumex acetosella* *	+	+
Magnolia grandiflora *		+ §	*Rumex conglomerates* *	+	+
Melicytus micranthus	+	+	*Rumex crispus* *		+
Melicytus ramiflorus		+	*Salix cinerea* *	+	+
Mentha pulegium *		+	*Salix fragilis* *		+
Metrosideros carminea		+	*Salix matsudana* 'Tortuosa' *		+ §
Metrosideros excelsa		+	*Senecio bipinnatisectus* *		+
Metrosideros perforata	+	+	*Senecio diaschides* *	+	
Modiola caroliniana *		+	*Senecio elegans* *		+
Muehlenbeckia australis	+	+	*Senecio glomeratus*	+	
Muehlenbeckia complexa	+	+	*Senecio hispidulus* *	+	
Mycelis muralis *		+	*Silene gallica* *		+
Myosotis laxa subsp.*caespitose* *	+	+	*Solanum nigrum* *		+
Myriophyllum propinquum	+	+	*Sonchus asper* *		+
Myrsine australis	+	+	*Sonchus oleraceus* *		+
Nasturtium officinale *		+	*Sophora chathamica*	+	
Nertera dichondrifolia	+	+	*Sophora microphylla*		+ §
Oenothera glazioviana *	+	+	*Streblus heterophylla*		+
Olea europaea *		+ §	*Taraxacum officinale* *		+
Orobanche minor *		+	*Tetragonia implexicoma*		+
Oxalis rubens *		+	*Trifolium repens* *		+
Ozothamnus leptophyllus	+	+	*Tropaeolum majus* *		+
Paraserianthes lophantha *		+	*Ulex europaeus* *	+	+

Verbena bonariensis *	+	+
Veronica serpyllifolia *	+	
Vicia sativa *		+
Vitex lucens	+	+

Monocots

Agapanthus praecox *		+ ^
Agrostis capillaris *		+
Aira caryophyllea *	+	
Alocasia brisbanensis *		+ §
Ammophila arenaria *	+	+
Anthoxanthum odoratum *		+
Aristea ecklonii *		+
Asparagus asparagoides *		+
Asparagus scandens *	+	+
Astelia banksii		+
Austroderia splendens	+	+
Axonopus fissifolius *	+	
Bambusa oldhamii *		+ §
Briza minor *	+	+
Bromus diandrus *		+
Bromus willdenowii *		+
Canna indica *		+ ^
Carex dissita		+
Carex divulsa *		+
Carex lambertiana		+
Carex maorica		+
Carex secta		+
Carex testacea		+
Carex virgata	+	+
Cenchrus clandestinus *	+	+
Collospermum hastatum	+	+
Colocasia esculenta *		+ §
Cordyline australis	+	+
Cordyline ? rubra *		+ §
Cortaderia selloana *		+
Crinum sp. *		+ ^
Cynodon dactylon *		+
Cyperus brevifolius *	+	+
Cyperus eragrostis *	+	+
Cyperus sanguinolentus *	+	
Cyperus ustulatus	+	+
Dactylis glomerata *		+
Dianella haematica	+	+
Dianella nigra		+
Earina mucronata	+	+
Echinochloa crus-galli *		+
Ehrharta erecta *		+
Eleocharis acuta	+	+
Eleocharis gracilis	+	+
Eleocharis sphacelata	+	
Ficinia nodosa	+	+
Ficinia spiralis	+	+
Freycinetia banksii		+
Gahnia xanthocarpa	+	+
Hedychium flavescens *		+
Hedychium gardnerianum *		+
Holcus lanatus *	+	+
Isachne globosa	+	+
Isolepis prolifera	+	
Isolepis sepulcralis *	+	+
Juncus acuminatus *	+	+
Juncus articulatus *	+	+
Juncus bufonius *	+	
Juncus bulbosus *	+	
Juncus edgariae	+	+
Juncus effusus *	+	+
Juncus microcephalus *	+	
Juncus pallidus	+	+
Juncus planifolius	+	
Juncus sarophorus	+	+
Juncus tenuis *		+
Lachnagrostis billardierei	+	+
Lagurus ovatus *		+
Landoltia punctata *	+	
Lemna minor	+	+
Lepidosperma laterale	+	+
Lolium perenne *		+
Machaerina arthrophylla	+	
Machaerina articulata	+	+
Machaerina juncea	+	+
Machaerina rubiginosa	+	+
Machaerina tenax	+	+
Machaerina teretifolia	+	+
Microlaena stipoides	+	+
Microtis unifolia agg.		+
Monstera deliciosa *		+ §
Morelotia affinis	+	
Musa ×paradisiaca *		+ §
Oplismenus hirtellus	+	+
Paspalum dilatatum *	+	+
Paspalum distichum *	+	+
Paspalum urvillei *	+	
Phoenix canariensis *		+
Phormium tenax	+	+
Rhopalostylis sapida	+	+
Ripogonum scandens	+	+
Schedonorus arundinaceus	+	+
Schoenoplectus tabernaemontani		+
Schoenus brevifolius	+	
Schoenus maschalinus	+	
Schoenus tendo	+	

Simpliglottis cornuta		+	*Uncinia uncinata*		+
Sparganium subglobosum	+	+	*Vulpia bromoides* *	+	
Spinifex sericeus	+	+	*Watsonia* sp. *		+
Tetraria capillaris	+		*Wolffia australiana*	+	+
Typha orientalis	+	+	*Zantedeschia aethiopica* *	+	+

Vegetation of the Motukaraka coast (Green Bay to "Pinesong"), Manukau Harbour

Rhys Gardner

Introduction

The place described here is fairly typical of cliffed parts of the inner Manukau Harbour and does not have especially-natural botanical or geological boundaries (Figs. 1 & 2). But it does differ slightly from land to the east (Green Bay to Blockhouse Bay), where the cliff-tops have an abundance of old pine trees, and from that to the west, where the higher ground ("Pinesong") is similarly pine-dominated and where the gullies behind Oatoru Bay are filled with tall kanuka (*Kunzea ericoides*).

It is located near where I grew up and I thought it about time I had a look at it. Unfortunately, this phrase is more or less literally correct — nearly all the coastal bush here is privately owned except for an esplanade strip and a pair of narrow, unmarked reserves below each end of Cliff View Drive; the rest is apportioned to the properties along the rear of this street. However, a few tracks run up from the shore to the houses and along them a certain amount of peeking has been done.

This part of the coast, referred to here as Motukaraka, c. 1.5 km long. It faces south-eastwards across a deep tidal channel to the Motukaraka Bank (no "motu" here now) and then to Puketutu Island and the Ihumatao peninsula, with Clark's Beach some 20 km distant beyond. Being quite exposed to wave-action then, its 20-30 m high frontage is generally rather steep, but there are numerous places safe to move about on, especially where the surface has been terraced by old slumps.

Until recently the only man-made structure here was a large concrete chamber about halfway between Green Bay and the "Pinesong" headland. This, the New Lynn Outfall of the old sewage scheme, formerly discharged effluent into the tidal channel. At the time of writing (September 2012) Watercare Services have just finished demolishing it

Fig. 1. The study area (Green Bay to "Pinesong Retirement Village" headland). From Auckland Council GIS viewer.

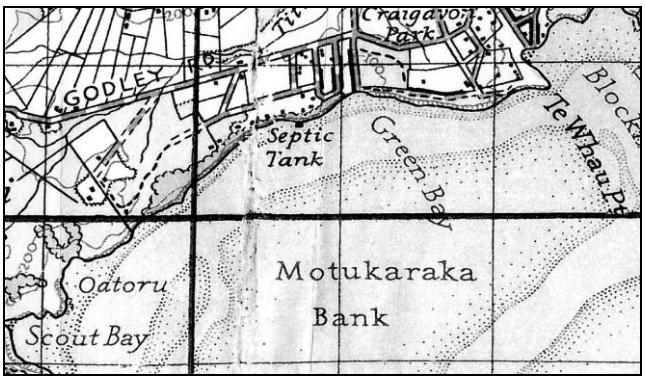

Fig. 2. Environs of the study area; from topographical sheet NZMS 1 N42 "Auckland", 1949. Grid lines are l km apart.

(Fig. 3). Fishermen and other persons fond of an evening drink will miss this homely amenity.

Green Bay itself I have always known simply by this name, but "Karaka Bay" appears on one official late 19th century map (Bonny 2011: 231). Two small but permanently-flowing streams (not shown on the