

ECOLOGICAL ASPECTS OF
A 'WHOLE OF ISLAND PLAN'
FOR MATAKANA ISLAND

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Prepared for:
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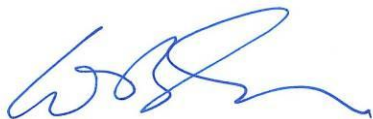
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1. INTRODUCTION

Matakana Island is located within the Western Bay of Plenty District and is a long reasonably flat island with a total area of 6,076 ha. Matakana extends approximately 24 km from the Mount Maunganui entrance of Tauranga Harbour, in the southeast, to the Bowentown entrance in the northwest. The island is 5 km across at its widest point and has two distinct parts: a barrier island which is exposed to the Pacific Ocean and connected by narrow isthmus to a peninsula on the harbour side of the island where most of the human population lives.

Despite the amount of exotic plantation forest and pastoral land use on Matakana Island, there is also a diverse range of indigenous habitats, resulting in a rich and varied array of indigenous biodiversity. It is a nesting site for a large number of sea birds, including the endangered New Zealand dotterel (*Charadrius obscurus*), and has an extensive system of wetlands and sand dune vegetation. Some ecological restoration has been carried out by private landowners and local groups.

There has not yet been a full, comprehensive set of studies carried out for Matakana Island as a whole, to form a basis for a planning framework. Parties associated with Matakana Island have been working on a process to prepare a Plan for the island. Before such a plan is prepared information is required on constraints and opportunities for the island. The information is part of method 17A.4(iv) in the Regional Policy Statement, which states that the Councils will:

Investigate a future land use and subdivision pattern for Matakana Island, including papakainga development, through a comprehensive whole of Island study which addresses amongst other matters cultural values, land which should be protected from development because of natural or cultural values and constraints, and areas which may be suitable for small scale rural settlement, lifestyle purposes or limited Urban Activities

This report describes and maps the vegetation and habitats on Matakana Island, and provides an assessment of ecological values. This information has been used to identify ecological constraints to development on the island. There are also opportunities for enhanced protection of ecological values, and relevant guidance is provided in the last part of this report. Lists of vascular plants (Appendix 1) and selected site photographs (Appendix 2) are also provided.

2. PROJECT OBJECTIVES

The objectives of this project were to:

- Collate and review existing ecological information about the study site;
- Develop base map(s) showing landcover/vegetation/habitats, and the locations of streams, rivers, wetlands, and any other waterways;
- Map and describe significant natural resources, including sites already identified in statutory planning documents; and

- Identify ecological constraints to future development and potential opportunities that might arise.

3. METHODS

Relevant digital data and hard copy information was compiled, including recent digital colour aerial photographs, information held in databases, published and unpublished reports, and statutory planning documents. This information is summarised in Section 4 below.

Earlier this year the study area was surveyed on foot and from a vehicle, from public roads and Council reserves, and vegetation and habitat descriptions were compiled for areas not already identified as natural areas or from other work that Wildland Consultants Ltd has been involved in previously. Findings from the field survey were used to assess and map the ecological values of vegetation and habitat classes not already identified in previous studies.

A constraints ranking system that has been applied previously to other parts of the Western Bay of Plenty District (e.g. at Minden, Wildland Consultants 2009a) was then used to identify and map ecological constraints on Matakana Island.

4. EXISTING INFORMATION

4.1 Topography and geology

Matakana Island is approximately 24 km long and acts as a natural barrier protecting most of Tauranga Harbour from the Pacific Ocean. The island comprises two distinct parts that are connected by a narrow isthmus: the barrier island (c.4,300 ha) forms the eastern coastline and is an aeolian dune series; and the western peninsula (c.1,500 ha) which extends into Tauranga Harbour and comprises low rolling hills derived from siltstones, sandstones, and conglomerates (Burns and Whaley 1996). Matakana Island is classified as a nationally significant geological site, primarily for the c.70 parallel beach ridges that are about 10 m high and 40-80 m apart (Rijkse and Cotching 1993). The outer coastline changes constantly through accretion and erosion of coastal sand, although the overall effect has been a prograding (seaward expansion) of the seaward shoreline (Munro 1994).

4.2 Ecological context

Matakana Island is within the Tauranga Ecological District, which encompasses Tauranga Harbour and its margins and islands, Maketu Estuary, Waihi Estuary, coastal dunes between Waihi and Otamarakau, coastal plains, and the low, rounded hills of the Western Bay of Plenty lowlands. This Ecological District has been highly modified by human activities associated with agriculture, horticulture, and urbanisation. Forests have been felled or burned, and most freshwater wetlands have been drained. Relatively little indigenous vegetation remains away from the sand dunes and margins of the harbour and estuaries, and even saline wetlands have been

reduced in extent by drainage and conversion to agricultural or horticultural land uses. There are very few protected natural areas, and most are small. However, many of these protected and unprotected natural areas are significant, in part because so few remain in the Ecological District.

Nearly the entire island is within an 'Acutely Threatened' (<10% indigenous cover remaining) land environment (Landcare Research and MfE 2003), with only the northern-most part of the coastal sand dune system classified as 'Critically Underprotected' (>30% indigenous cover remaining; <10% legally protected). Examples of indigenous vegetation and habitats that lie within 'Acutely Threatened' and 'Chronically Threatened' (<20% indigenous cover remaining) land environments are high priorities for the protection of biodiversity on private land (MfE and DOC 2007a, 2007b).

4.3 Vegetation history

Prior to human arrival, the island would have been covered predominantly in coastal forest dominated by pohutukawa (*Metrosideos excelsa*), puriri (*Vitex lucens*), kauri (*Agathis australis*), tanekaha (*Phyllocladus trichomanoides*), kahikatea (*Dacrycarpus dacrydioides*), rimu (*Dacrydium cupressinum*), totara (*Podocarpus totara*), northern rata (*Metrosideros robusta*), kamahi (*Weinmannia racemosa*), and perhaps hard beech (*Nothofagus truncata*). The main period of deforestation probably coincided with human occupation around 800 years ago, although some forest cover may have survived until as recently as 150 years ago. A low cover of indigenous scrub, shrubland, fernland, and grassland would have developed following deforestation, and would have been subject to occasional burning. A sheep and cattle station was established on the barrier island by the late 19th Century. Establishment of exotic forest plantations started in the late 1920s and these now cover most of the dunes, with the exception of the seaward margin and freshwater wetlands at the northern end of the island (Burns and Whaley 1996; Wildland Consultants 2005).

4.4 Current vegetation and habitats

The western side of Matakana Island comprises approximately 1,725 ha of predominantly grazed agricultural land. A narrow isthmus connects it to a further 4,351 ha of land which is exposed to the Pacific Ocean and is largely covered in exotic, plantation forests. However, the coastal margins of the island and its northern tip include examples of indigenous dune communities, dune lakes, estuarine wetlands, freshwater wetlands, and small areas of pohutukawa forest. Areas of ecologically significant indigenous vegetation have been mapped and described by Wildland Consultants (2010) (refer to Section 5 below).

The relative diversity of indigenous species and vegetation assemblages reflects the range of habitats present, including freshwater wetlands, freshwater-estuarine wetland complexes, open sand dunes, sand dune plant communities, harbour margins with associated sand spits and high tide roosts, intertidal flats, and managed and unmanaged pine forests on dunes.

Threats to indigenous biodiversity include pest animals, pest plants, human activities, off-road vehicles, trampling and disturbance, management of adjacent pine plantations (mainly during harvest and replanting), rubbish dumping, fire, domestic pets, grazing, and drainage.

4.5 Flora

Over 200 indigenous vascular plant species are known from the island (Beadel 2009; Appendix 1). Eight of these species are included in the New Zealand threat classification lists (de Lange *et al.* 2009):

- At Risk-Declining
Cyclosorus interruptus
Dianella haemata
Pimelea villosa
Thelypteris confluens
- At Risk-Relict
Ficinia spiralis (pingao)
- At Risk-Naturally Uncommon
Coprosma acerosa (sand coprosma)
Tetragonia tetragonioides
- Data Deficient
Ranunculus macropus

A further nineteen regionally uncommon vascular plant species (as per Wildland Consultants 2009c) have also been recorded on the island: *Rorippa palustris*, *Senecio glomeratus*, *Schoenus nitens*, *Senecio quadridentatus*, *Sparganium subglobosum*, *Juncus caespiticus*, *Schoenus apogon*, *Tetragonia capillaris*, *Empodisma minus*, *Hypolepis distans*, *Austrostipa stipoides*, *Zoysia pauciflora*, *Limosella lineata*, *Oxalis rubens*, *Senecio biserratus*, coastal mahoe (*Melicactus novae-zelandiae*), *Asplenium appendiculatum* subsp. *maritimum*, *Olearia solandri*, and *Poa pusilla*.

4.6 Fauna

Avifauna

The dunes and beach are breeding and nesting grounds for a range of 'Threatened' and 'At Risk' shorebirds (as per Miskelly *et al.* 2008), including Northern New Zealand dotterel (*Charadrius obscurus aquilonius*; Threatened-Nationally Vulnerable), banded dotterel (*Charadrius bicinctus*; Threatened-Nationally Vulnerable), variable oystercatcher (*Haematopus unicolor*; At Risk-Recovering) and pied stilt (*Himantopus himantopus leucocephalus*; At Risk-Declining) (Wildland Consultants 2010). Matakana Island is a key breeding site for northern New Zealand dotterel (Dowding and Davis 2007) and the population on Matakana Island has been actively managed since 1992.

The wetlands also provide habitat for birds, including grey duck (*Anas superciliosa cuperciliosa*, Threatened-Nationally Critical), Australasian bittern (*Botaurus poiciloptilus*; Threatened-Nationally Endangered), banded rail (*Gallirallus philippensis assimilis*; At Risk-Naturally Uncommon), spotless crane (*Porzana tabuensis plumbea*; At Risk-Relict) and North Island fernbird (*Bowdleria punctata vealeae*; At Risk-Declining). Australasian bittern is likely to be the most threatened fauna species present on the island. The species is primarily threatened by loss and degradation of wetland habitat through reclamation and drainage, reduced water quality, agricultural chemical seepage, and grazing. Additionally, predation is likely to occur of eggs and chicks by stoats, cats and dogs probably occurs.

Lizards

Copper skink (*Oligosoma aeneum*) and shore skink (*Oligosoma smithi*) are the only lizard species known from Matakana Island. Copper skink is one of the more common and widespread lizard species in New Zealand (Towns 1999), and shore skink is the most commonly-occurring *Oligosoma* species in the North Island (Towns *et al.* 2002). Both species are classified as 'Not Threatened' (Hitchmough *et al.* 2010).

Fish

Recent fish surveys undertaken by Murden and Reynolds (2009) in some drains at the northern end of the barrier part of Matakana Island recorded three indigenous species: shortfin eel (*Anguilla australis*), inanga (*Galaxias maculatus*), and giant bully (*Gobiomorphus gobioides*). These species are 'Not Threatened' (Allibone *et al.* 2009). One exotic pest species, mosquito fish (*Gambusia affinis*), was also recorded. Other indigenous species are likely to be present in any streams, drains or wetlands that have unimpeded access to the harbour.

Invertebrates

The most extensive population of katipo spider (Chronically Threatened-Serious Decline) in the Bay of Plenty is present along the dunes and beaches of Matakana Island (Patrick 2002).

5. PREVIOUSLY IDENTIFIED NATURAL AREAS

Twenty-one (21) natural areas have been described in earlier reports (most recently in Wildland Consultants 2010) and most have been identified as significant ecological features in the operative Western Bay of Plenty District Plan (WBOPDP) (<http://www.westernbay.govt.nz/Publications/District-PlanA/Operative-PlanA/>) and/or the Regional Coastal Environment Plan (RCEP; amended 2011) (www.boprc.govt.nz). Refer to Figure 1. These sites are described below, based on site evaluation and mapping undertaken by Wildland Consultants (2008a & b, and 2010).

‘Matakana Island 1’ is identified in the WBOPDP (2002) as Site U13/3 and in the RCEP (2011) as Site SSL-8. It comprises high quality, nationally significant sand dune communities and wetland communities. The indigenous sand-binders, spinifex (*Spinifex sericeus*) and pingao (*Ficinia spiralis*) dominate the majority of the foredune with the introduced grass marram (*Ammophila arenaria*) (Plate 1, Appendix 2). *Pimelea villosa* (sand daphne, ‘At Risk-Declining’, Plate 2 in Appendix 2) and coastal mahoe (regionally uncommon) are also present on the dunes. Weeds that are present on the dunes include marram, coastal tea tree (*Leptospermum laevigatum*), gorse (*Ulex europaeus*), boxthorn (*Lycium ferocissimum*), and pines. The wetlands (Plate 3, Appendix 2) include one of the best populations of *Thelypteris confluens* and *Cyclosorus interruptus* (Plate 4, Appendix 1) in New Zealand. Both species are classified ‘At Risk-Declining’. *Ranunculus macropus*, a ‘data deficient’ species, also occurs in the wetlands. Over parts of the site exotic pines are emergent above a much lower canopy that is generally dominated by indigenous species including: sedges such as *Baumea juncea*, *Ficinia nodosa*, oioi (*Apodasmia similis*), *Zoysia pauciflora* (a ‘regionally uncommon’ grass species), shore lobelia (*Lobelia anceps*), and orchids such as *Earina mucronata*, *Winika cunninghamii*, and *Thelymitra longifolia* (Plate 5, Appendix 2). The beach and dunes provide habitat for katipo spider (Chronically Threatened-Serious Decline) and a suite of shorebirds.

‘Matakana Wetlands A’ is identified in the WBOPDP (2002) as part of site U13/2 and in the RCEP (2011) as site part of Site SSL-108. It comprises several areas dominated by grey willow (*Salix cinerea*), ti kouka (cabbage tree, *Cordyline australis*) and manuka (*Leptospermum scoparium*) above a groundcover layer of indigenous sedges and rushes (Plate 6, Appendix 1). *Cyclosorus interruptus* (At Risk-Declining) and *Zoysia pauciflora* (regionally uncommon) are present. This site is regionally significant.

‘Matakana Wetlands B’ is a nationally significant site that is identified in the WBOPDP (2002) as part of Site U13/3 and in the RCEP (2011) as site part of Site SSL-8. The centre of the wetland comprises one of the largest areas of raupo (*Typha orientalis*) reedland in the Bay of Plenty Region, and the margins are dominated by grey willow and ti kouka. There are large populations of *Thelypteris confluens* and *Cyclosorus interruptus* (both species are classified ‘At Risk-Declining’) and *Ranunculus macropus* (Data Deficient).

‘Matakana Wetlands C’ and **‘Matakana Wetlands D’** are regionally significant sites identified in the WBOPDP (2002) as parts of Site U13/2 and in the RCEP (2011) as parts of Site SSL-108. Matakana Wetlands C comprises the largest freshwater wetland on Matakana Island, but it has been extensively drained and most of the site is dominated by a canopy of grey willow. However, the groundcover is dominated by indigenous species of sedges, rushes, and shrubs. *Cyclosorus interruptus* (At Risk - Declining) and *Hypolepis distans* (‘regionally uncommon’) are present. The wetland provides habitat for a suite of ‘Threatened’ and ‘At Risk’ species of wetland birds. Matakana Wetlands D is dominated by a canopy of grey willow and ti kouka above pampas (*Cortaderia selloana*), harakeke (*Phormium tenax*), karamu (*Coprosma robusta*), mingimingi (*Leucopogon fasciculatus*), and koromiko (*Hebe stricta*). There is a small area of raupo reedland. *Cyclosorus interruptus* (At Risk-Declining) is present in both wetlands. *Thelypteris confluens* (At Risk-Declining) is present at

Matakana Wetlands D and *Hypolepis distans* ('regionally uncommon') is present in Matakana Wetlands C.

'**Matakana Island 3**' is a locally significant site that is not included in the WBOPDP (2002) or the RCEP (2011). It is part of a highly modified tidal inlet that has been partially drained and planted with pines. It includes a remnant of indigenous freshwater wetland (e.g. manuka scrub and harakeke flaxland) but pampas is the dominant species within the site.

Parts of '**Central Matakana Wetlands**' are identified as Site U13/24 in the WBOPDP (2002) and part is included in Site SSL-109 in the RCEP (2011). It is a mosaic of wetlands dominated by indigenous species and mixed indigenous-exotic shrublands. Wetlands along the coastal fringe are dominated by harakeke or *Baumea juncea* and the shrublands include indigenous sedges, pampas, pines (*Pinus* spp.) and eucalypts (*Eucalyptus* spp.). This site is 'locally significant'.

'**Matakana Island 2**' is identified as Site U13/7 in the WBOPDP (2002) and CHPZ-4 in the RCEP (2011). It is a 'regionally significant' site that includes estuarine, mangrove (manawe, *Avicennia marina* subsp. *australasica*)-dominated wetlands, freshwater wetlands dominated by indigenous sedges and harakeke, a sandspit, and radiata pine (*Pinus radiata*) forest over *Austrostipa stipoides* (a regionally uncommon species). Banded rail and fernbird, which are both 'At Risk', have been recorded at this site.

'**Matakana Island 4**' is also a regionally significant site that includes estuarine and freshwater wetlands. It is identified as Site U13/21 in the WBOPDP (2002) and CHPZ-5 in the RCEP (2011). *Hypolepis distans*, a regionally uncommon species, is present, and two 'At Risk' bird species,

'**Duck Bay**' is not identified as a significant ecological feature in the WBOPDP or RCEP. It is a locally significant area of estuarine wetlands that includes mangroves, searush (*Juncus kraussii* var. *australiensis*), oioi, and *Austrostipa stipoides*, a 'regionally uncommon' species.

'**Southeastern Matakana Wetlands**' is dominated by a canopy of grey willow and ti kouka above pampas, *Baumea juncea*, harakeke, karamu, kohuhu, mingimingi, and koromiko. In the centre of the site there is an area of raupo reedland. Other species include *Baumea articulata*, *Carex virgata*, and *Carex secta*. No rare or uncommon plant or fauna species have been recorded at this site and it is regarded as 'locally significant'.

'**Blue Gum Bay 1**' is a 'nationally significant' area of estuarine and freshwater wetlands that is identified as Site U14/116 in the WBOPDP (2002) and CHPZ-6 and SSL-10 in the RCEP (2011). The estuarine wetlands include mangrove shrubland and indigenous sedgeland, while the freshwater wetlands include large areas dominated by grey willow. *Olearia solandri*, a regionally uncommon plant species, is present, and banded rail, fernbird (both "At Risk" species), and Australasian bittern ('Threatened') have been recorded at the site.

‘Blue Gum Bay 2’ includes locally significant estuarine and freshwater wetlands in Blue Gum Bay and in the gullies which drain into the bay. The site has been modified by drainage, weeds, planting of exotic species, grazing, and effluent runoff. Parts of the site are identified in the WBOPDP as Sites U14/117, U14/126, and U14/127. In the RCEP it is identified as SSCMA-60, SSL-10, and SSL-11.

‘Tirohanga Point Beach’ and **‘Tirohanga Point Pohutukawa’** are locally significant sites which are not identified in planning documents. The beach is regularly used as a nesting site by a pair of New Zealand dotterel, a ‘Threatened’ species. The point includes a small example of pohutukawa forest, a vegetation type which would once have been common on Matakana Island and elsewhere in Tauranga Ecological District. ‘Matakana Point’ also includes a small example of pohutukawa forest.

‘Tahunamanu Island’ is regionally significant because it is a very important roosting area for shorebirds, including two ‘Threatened’ species and four ‘At Risk’ species. It includes one of the larger, better-quality examples of glasswort (*Sarcocornia quinqueflora*) herbfields in Tauranga Harbour. It is identified as Sites U14/105 and U14/114 in the WBOPDP and SSCMA-18 in the RCEP.

‘Opureora Spit’ (including Motungaio Island and Opureora Islet) is identified as Sites U14/112, U14/113 and U14/104 in the WBOPDP (2002) and SSCMA-17, CHPZ-19, and CHPZ-20 in the RCEP (2011). It is an important breeding site for three ‘Threatened’ bird species and is used by five ‘At Risk’ bird species. It includes a distinctive vegetation type, *Austrostipa stipoides*-oioi-*Baumea juncea*-searush tussockland, which has not been found elsewhere in Tauranga Harbour. *Austrostipa stipoides* is a ‘regionally uncommon’ flora species.

‘Opureora Inlet’ is a locally significant example of estuarine and palustrine wetland that is habitat for fernbird, an ‘At Risk’ species. It comprises searush tussockland, oioi-makaka (*Plagianthus divaricatus*) shrubland and rushland, and ti kouka above upokotangata (umbrella sedge, *Cyperus ustulatus*) sedgeland. It is identified as Site U14/113 in the WBOPDP and CHPZ-19 in the RCEP.

‘Waihirere Road Wetland’ is a ‘locally significant’ site that is dominated by grey willow and is identified in the WBOPDP as Site U14/114.

‘Otapu Bay’ is identified as Site U14/109 in the WBOPDP and CHPZ-18 in the RCEP. It comprises estuarine and freshwater wetlands. The freshwater wetlands include species such as manuka, *Baumea* spp., tanglefern (*Gleichenia dicarpa*), and grey willow. The estuarine wetlands include oioi, searush, makaka, and *Baumea juncea*. *Austrostipa stipoides*, a regionally uncommon species, is present. Banded rail, fernbird, and Australasian bittern have been reported at the site.

Proposed covenant areas were identified within the Blakely Pacific Ltd (Wildland Consultants 2008?). Proposed covenant areas that lie outside previously identified natural areas are mapped in Figure 1 and have been assessed in Sections 10 and 11 below.

6. OTHER VEGETATION AND HABITATS

Outside of previously identified natural areas, twelve broad vegetation and habitat classes were mapped (refer to Figure 1):

1. Exotic plantation forest
2. Pasture
3. Horticulture
 - 3a. Maize crops
 - 3b. Orchards
4. Buildings
5. Exotic scrub and treeland
 - 5a: Woolly nightshade-gorse scrub
 - 5b: Brush wattle-dominated scrub
 - 5c: Woolly nightshade treeland
 - 5d: Gorse scrub
 - 5e: Barberry-woolly nightshade scrub
- 6: Pohutukawa forest
7. Indigenous treeland
8. Willow forest
 - 8a. Grey willow forest
 - 8b. Grey willow-woolly nightshade forest
9. Restoration plantings.
10. Searush-oioi-*Baumea articulata* wetland
11. Manuka scrub

These vegetation and habitat classes are described below.

1. Exotic plantation forest

Exotic plantation forest dominates the barrier island that forms the eastern part of Matakana Island (Plate 7, Appendix 1). Radiata pine is the most widespread plantation species, but there are also eucalypts (*Eucalyptus* spp.) and maritime pines (*Pinus pinaster*). This vegetation class comprises plantations at various stages in the growing-harvesting cycle, including some recently harvested areas that are relatively open or are dominated by pampas (*Cortaderia selloana*). Beneath the forest canopy, pampas is common in the understorey and other exotic species include gorse (*Ulex europaeus*), woolly nightshade (*Solanum mauritianum*), Chinese privet (*Ligustrum sinense*), brush wattle (*Paraserianthes lophantha*), and blackberry (*Rubus fruticosus* agg.). Indigenous species that are present in the understorey include *Baumea juncea*, pohuehue (*Muehlenbeckia australis*), wiwi (*Ficinia nodosa*), mapou (*Myrsine australis*), ti kouka, mamaku (*Cyathea medullaris*), mingimingi, oioi, *Carex testacea*, manuka, *Coprosma lucida*, and *Asplenium lucidum*.

2. Pasture

Pasture grazed by domestic stock is the predominant cover on the western lobe of Matakana Island that extends into Tauranga Harbour (Plate 8, Appendix 1). It includes barberry (*Berberis glaucocarpa*) hedges and specimen trees of poplar (*Populus* spp.), radiata pine, eucalyptus, and macrocarpa (*Cupressus macrocarpa*). There are also patches of gorse and woolly nightshade. From observation of aerial photographs it appears that the extent of pasture has increased in recent years as a consequence of some areas woolly nightshade-gorse scrub and gorse scrub being cleared and grassed. Road margins within pastoral areas are dominated by woolly nightshade, pampas, gorse, and rank pasture grasses.

3. Horticulture

3a. Maize crops

Maize (*Zea mays*) is being cultivated on flat and rolling country on the western lobe of Matakana Island (Plate 9, Appendix 1). These areas are a virtual monoculture of maize. It is likely that land which is currently cultivated for maize may be grazed as pasture in other years.

3b. Orchards

Orchards of kiwifruit (*Actinidia* spp.) and avocados (*Persea americana*) are surrounded by shelterbelts of species such as Japanese cedar (*Cryptomeria japonica*), she-oak (*Allocasuarina littoralis*), and lawsoniana (*Chamaecyparis lawsoniana*) (Plate 8, Appendix 1). On the west coast of the island, north of Tahunamanu Island, an area of trees has been identified as comprising this vegetation type based on aerial photographs. However, it may comprise some other tree crop or plantation forest.

4. Buildings and curtilages

Buildings (and associated curtilages) are scattered across the western lobe of the island, and this type also includes one or more Urupa. The main residential area is located at Opureora. A complex of buildings is also present on the barrier island in association with plantation forestry operations. The roadsides within Opureora include species such as canna lily (*Canna indica*), wild ginger (*Hedychium gardnerianum.*), red cestrum (*Cestrum elegans*), castor oil plant (*Ricinus communis*), loquat (*Eriobotrya japonica*), Cape honeysuckle (*Tecomaria capensis*), and montbretia (*Crocasmia ×crocsmiiflora*).

5. Exotic scrub and treeland

5a. Woolly nightshade-gorse scrub

This vegetation class is dominated by woolly nightshade and gorse with barberry, blackberry, treeferns (mainly mamaku, *Cyathea medullaris*) and

occasional wilding pines, eucalypts, and poplars (Plates 9 and 10, Appendix 1). It tends to occur on steep faces and on the harbour margins of the 'lobe' that extends into Tauranga Harbour. It appears that some areas of this type have been cleared and converted to pasture since the date of the aerial photograph (2007).

5b. Brush wattle-dominated scrub

There are limited areas of scrub dominated by brush wattle. Other species present include woolly nightshade, kawakawa (*Macropiper excelsum*), kanuka (*Kunzea ericoides*), karamu (*Coprosma robusta*), and mamaku.

5c. Woolly nightshade treeland

On a hillslope above a wetland restoration site there is an area of woolly nightshade treeland above blackberry vineland. Other species present include poplars, barberry, and kanuka.

5d. Gorse scrub

Gorse scrub is present on the margins of woolly nightshade-gorse scrub and at sites where conversion to pasture is underway. Other species present include occasional woolly nightshade and barberry.

5e. Barberry-woolly nightshade scrub

This vegetation type is dominated by barberry with woolly nightshade, gorse, blackberry, and brush wattle.

6. Pohutukawa forest

Small areas of pohutukawa forest occur on the west coast of the island. The small example of this type located between 'Tirohanga Point' and 'Matakana Point' was identified from aerial photographs. Pohutukawa forest south of 'Tirohanga Point' occurs on coastal cliffs with species such as kanuka, kawakawa, kanuka, mamaku, ti kouka, pampas and occasional rengarenaga (*Arthropodium cirratum*). Much of the coastline of the 'western lobe' of Matakana Island comprises eroding coastal cliffs with species such as wilding pines, pampas, brush wattle, and tutu (*Coriaria arborea*). Occasional pohutukawa probably occur along these cliffs as scattered individuals.

7. Indigenous treeland

7a. Karaka treeland

There is a small area of karaka (*Corynocarpus laevigatus*) treeland on Matakana Point. It is not fenced and appears to be grazed by domestic stock. The understorey comprises pasture species.

7b. Kanuka treeland

Treeland dominated by kanuka is present on the shore between Tirohanga Point and Matakana Point. This vegetation type may be grazed by domestic stock.

8. Willow forest

8a. Grey willow forest

Grey willow forest occurs in gullies within pasture and land that is cropped for maize (Plate 11, Appendix 1). Much of it appears to be grazed and the ground cover is dominated by pasture grasses. Species in the canopy include ti kouka and mamaku. Woolly nightshade and gorse are also present.

8b. Grey willow-woolly nightshade forest

This vegetation class is differentiated from Type 8a, above, by the greater abundance of woolly nightshade.

9. Restoration plantings

On the north side of Waihirere Road a wetland restoration project is being undertaken. It bounds part of 'Blue Gum Bay 2' (refer to Section 5.1 above). Willows have been controlled, fences have been built to exclude domestic stock, and indigenous species such as ti kouka, manuka, karamu, and harakeke have been planted (Plate 12, Appendix 2). It was not possible to accurately map the extent of this restoration site from the roadside vantage points and it may be larger than shown in Figure 1.

Near the intersection of Matakana Road and Matakana Point Road, a restoration project is underway in gullies that drain westwards and flow into part of 'Blue Gum Bay 2' (Plate 13, Appendix 2). In addition to the species planted at Waihirere, pohutukawa, whau (*Entelea arborescens*), and taupata (*Coprosma robusta*) are also present.

On the coast south of Matakana Point an estuarine wetland and a freshwater wetland in the adjacent gully are being restored (Plate 14, Appendix 2). Species that have been planted in the gully include harakeke and ti kouka, while manuka has been planted on the steep slopes above the gully.

At a wetland in Opureora, an area of wet pasture is being restored to a wetland of *Baumea articulata* and sedges (*Carex* spp.) surrounded by plantings of ti kouka, manuka, harakeke, akeake (*Dodonea viscosa*), and upokotangata (Plate 15, Appendix 2).

10. Searush-oioi-*Baumea articulata* wetland

An estuarine wetland dominated by searush and oioi with patches of *Baumea articulata* is part of a restoration project that is focussed in a gully south of

Matakana Point (Plate 14, Appendix 1). Harakeke have been planted into this vegetation type.

11. Manuka scrub

There is a strip of manuka scrub on the foreshore adjacent to the mouth of a small stream that discharges into Tauranga Harbour near Tirohanga Point.

7. WATERWAYS

On the barrier island there is a limited number of small streams, and most are associated with wetlands that have previously been identified as natural areas (refer to Figure 1).

On the western lobe of the island, the streams are typically short, with relatively low flows that reflect the size of their catchments. Many of these occur in gullies dominated by grey willow wetlands. However, on the western side of the island, there are streams that flow through pasture and exotic scrub. The restoration project near the intersection of Matakana Road and Matakana Point Road is focussed on stream margins and associated wetlands, and the lower reaches of a stream that discharges south of Matakana Point is also within a restoration area. It appears unlikely that any of the streams on Matakana Island are managed with floodgates that may impede fish passage. Impediments may occur where streams are crossed by roads or farm tracks.

8. FLORA

A list of vascular plant species is provided in Appendix 1. It includes species recorded during numerous visits between 1988 and 2009 (Beadel 2009) and species recorded during the current study. No 'Threatened' or 'At Risk' species were observed during the current study in addition to those that had been recorded in earlier surveys (refer to Section 4.5 above).

9. AVIFAUNA

In addition to the 'Threatened' and 'At Risk' species which have been recorded on Matakana Island (refer to Section 4.3 above), a further 11 indigenous species and eight exotic species were observed during this study. The indigenous species were fantail (*Rhipidura fulginosa*), silvereye (*Zosterops lateralis*), grey warbler (*Gerygone igata*), paradise duck (*Tadorna variegata*), spur-winged plover (*Vanellus miles*), Australasian harrier (*Circus approximans*), welcome swallow (*Hirundo tahitica*), white-faced heron (*Ardea novaehollandiae*), kingfisher (kotare, *Halcyon sancta*), black-backed gull (*Larus dominicanus dominicanus*) and pukeko (*Porphyrio porphyrio*). All of these species are relatively common and none are regarded as threatened or uncommon (as per Miskelly *et al.* 2008).

The exotic species recorded were Australian magpie (*Gymnorhina tibicen*), house sparrow (*Passer domesticus*), mallard duck (*Anas platyrhynchos*), song thrush (*Turdus philomelos*), blackbird (*Turdus merula*), yellowhammer (*Emberiza citrinella*), starling (*Sturnus vulgaris*), and blackbird (*Turdus merula*).

10. ECOLOGICAL EVALUATION

The Western Bay of Plenty SmartGrowth Study used a three-tier system to assess the relative significance of ecological features:

1. Highly significant features: these include all remaining terrestrial indigenous vegetation in the Tauranga Ecological District, habitats for threatened species, dunelands, estuarine ecosystems, streams, rivers, and wetlands.
2. Moderately significant features: these include degraded natural areas that have potential for restoration, naturally established vegetation in the coastal and semi-coastal zone that is a mixture of indigenous and exotic species, and degraded drainage systems that may provide habitat for indigenous fish.
3. Not significant features: areas dominated by pasture, exotic trees, horticulture, and existing commercial and urban areas.

Based on these criteria, 16 of the sites described in Section 5 are of high ecological significance and three sites are of moderate ecological significance. Two sites, 'Blue Gum Bay 2' and 'Opureora Inlet', include predominantly indigenous wetlands that are of high ecological value and wetlands that include a higher component of exotic species, and which are of moderate ecological value.

Three of the five proposed covenant areas are of relatively high ecological value, and two are of moderate value. Of the vegetation and habitat classes outside of previously identified significant natural areas and proposed covenants, Vegetation Class 6 (pohutukawa forest) is of high ecological value. Vegetation Classes 7-11 are of moderate ecological significance because they are degraded natural areas, have potential for restoration, or are currently being restored. The remaining vegetation and habitat classes are of low ecological significance because they are dominated by exotic vegetation or human-made structures.

Table 1: Relative ecological values of previously identified natural areas, proposed covenant areas on Blakely Pacific Ltd land, and other vegetation and habitat classes on Matakana Island.

	High	Moderate	Low
Natural Areas			
Matakana Island 1	✓		
Matakana Wetlands A	✓		
Matakana Wetlands B	✓		
Matakana Wetlands C	✓		
Matakana Wetlands D	✓		
Matakana Island 3		✓	
Central Matakana Wetlands	✓		

	High	Moderate	Low
Matakana Island 2	✓		
Matakana Island 4	✓		
Duck Bay	✓		
Southeastern Matakana Wetlands		✓	
Blue Gum Bay 1	✓		
Blue Gum Bay 2	✓	✓	
Tirohanga Point Beach	✓		
Tirohanga Point Pohutukawa	✓		
Matakana Point	✓		
Tahunamanu Island	✓		
Opureora	✓		
Opureora Inlet	✓	✓	
Waihirere Road Wetland		✓	
Otapu Bay	✓		
Proposed Covenant Areas			
Proposed covenant area A		✓	
Proposed covenant area B		✓	
Proposed covenant area C	✓		
Proposed covenant area D	✓		
Proposed covenant area E	✓		
Vegetation and Habitat Classes (outside of previously identified natural areas)			
1. Exotic plantation forestry			✓
2. Pasture			✓
3. Horticultural land			✓
4. Buildings			✓
5. Exotic scrub and treeland			✓
6. Pohutukawa forest	✓		
7. Indigenous treeland		✓	
8. Grey willow dominated forest		✓	
9. Restoration plantings		✓	
10. Searush-oioi- <i>Baumea articulata</i> wetland		✓	
11. Manuka scrub		✓	

11. ECOLOGICAL CONSTRAINTS TO FUTURE DEVELOPMENT

The three-tiered SmartGrowth system for assessing the significance of ecological features (refer to Section 10 above) can also be used to identify levels of ecological constraint for future development. Thus, sites and vegetation classes of high ecological value are also highly constrained for development (Table 2). Areas of moderate ecological value are moderately constrained (Table 3), and may be suitable sites for undertaking restoration, for use in stormwater attenuation or treatment (subject to assessment on a case-by-case basis), or for low-impact recreation (e.g. boardwalks and tracks). Areas of low ecological value have a low level of constraint for future development (Table 3) and are potentially suitable for a range of more high-impact uses. However, some areas of relatively low ecological value may also have restoration potential (refer to Section 12 below). Levels of constraint are mapped in Figure 2.

Tauranga Harbour, which covers a total area of c.218 square kilometres is a wetland of international significance (Cromarty and Scott 1996) and has been recommended for Ramsar status Owen *et al.* (2006). It is a very important wintering site for black

stilt (Acutely Threatened-Nationally Critical), provides habitat for a suite of other 'Threatened' and 'At Risk' bird species, includes nationally and regionally significant estuarine wetlands (Wildland Consultants 2010), is habitat for estuarine and migratory fishes, and is an important source of kaimoana. Therefore, it is appropriate that the harbour margins of Matakana Island be regarded as having a moderate constraint for future development to provide a 'buffer' between the harbour and any future development. For the purpose of this study, a 40 m wide 'buffer' has been identified but more detailed information about vegetation and habitats and the type/intensity of any future proposed development could result in the width and/or the status of the buffer being revised.

Natural areas with high ecological values also need to be 'buffered' from future development. Therefore, a buffer at least 20 m wide around each high value site can be regarded being 'moderately constrained' for future development. The width of this buffer is indicative, and may need to be reviewed depending on the type of any development that may be proposed. A buffer of this width should also be applied to all streams on the island to enable habitat for indigenous species of fish, birds, and plants to be retained and/or enhanced.

Table 2: Previously identified natural areas, proposed covenant areas on Blakely Pacific Ltd land, and other vegetation and habitat classes on Matakana Island which have a high level of ecological constraint for future land development.

Natural Areas
Matakana Island 1
Matakana Wetlands A
Matakana Wetlands B
Matakana Wetlands C
Matakana Wetlands D
Matakana Island 2
Matakana Island 4
Central Matakana Wetlands
Duck Bay
Blue Gum Bay 1
Blue Gum Bay 2 (part)
Tirohanga Point Beach
Tirohanga Point Pohutukawa
Matakana Point
Tahunamanu Island
Opureora
Opureora Inlet (part)
Otapu Bay
Proposed Covenant Areas
Proposed covenant area C
Proposed covenant area D
Proposed covenant area E
Vegetation and Habitat Classes
6: Pohutukawa Forest
Streams
The beds of all streams

Table 3: Previously identified natural areas, proposed covenant areas on Blakely Pacific Ltd land, other vegetation and habitat classes on Matakana Island, and buffer zones which have a moderate level of ecological constraint for future development.

Natural Areas
Matakana Island 3
Blue Gum Bay 2 (part)
Opureora Inlet (part)
Southeastern Matakana Wetlands
Waihirere Road Wetland
Vegetation and Habitat Classes
7. Indigenous treeland
8. Grey willow dominated forest
9. Restoration plantings
10. Searush-oioi- <i>Baumea articulata</i> wetland
11. Manuka scrub
Proposed Covenant Areas
Proposed covenant area A
Proposed covenant area B
“Buffer Zones”
40m wide buffer adjacent to Tauranga Harbour.
20m wide buffer around areas of high ecological significance.
20m wide buffer along streams/waterways.

Table 4: Vegetation and habitat classes on Matakana Island which have a low level of ecological constraint for future land development.

Vegetation Classes
1. Exotic plantation forest
2. Pasture
3. Horticultural land
4. Buildings
5. Exotic scrub and treeland

Vegetation and habitat classes, previously identified natural areas, and proposed covenants were mapped and assessed based on existing information, aerial photographs and by viewing them from public land. If more detailed, ground-based surveys and/or aerial helicopter-based surveys were undertaken, the ecological significance and level of constraint of some sites may be revised and additional natural areas may be identified.

12. OPPORTUNITIES FOR ECOLOGICAL ENHANCEMENT

Much of Matakana Island has been modified by plantation forestry and agriculture, but it nevertheless retains various significant natural areas with high ecological values which can be enhanced, and sites which are degraded but which have restoration potential.

Weed control is required in all of the natural areas on Matakana Island. Among the most widespread weed species are marram (on sand dunes), grey willow, pampas, woolly nightshade, and brush wattle. Exotic pines (both planted and from wild stock) that are present within natural areas where the understorey is dominated by indigenous species could be removed. Marram, coastal tea tree, gorse, boxthorn, pines, and other pest plant species are present on the sand dunes, where coastal tea tree is already being controlled (Plate 16, Appendix 2). Saltwater paspalum has invaded a wetland at the northern end of the barrier island, covering a large area, and there are also infestations at other sites. Royal fern (*Osmunda regalis*) and reed sweetgrass (*Glyceria maxima*) are also present in some of these wetlands. Wild ginger and smilax (*Asparagus asparagoides*) are present on roadsides in Opureora Village, and may also be present elsewhere in natural areas. Any weed control in natural areas will need to be undertaken with care to ensure that indigenous species are not adversely affected.

At some wetland sites, where exotic tree species such as willows and pines are not a major component of the vegetation, or where indigenous species are already an important component of the understorey, it may not be necessary to plant indigenous species following tree removal. However, at other sites, planting of appropriate, locally-sourced, indigenous species will be required following weed control, to restore and enhance biodiversity values. Sites which would benefit from planting could include willow-dominated wetlands that are currently being grazed by domestic stock and stream margins that are currently pasture.

In 2008, a study was undertaken of Blakely Pacific Ltd land to identify opportunities for restoration (Wildland Consultants 2008b). Potential restoration sites that were identified during that study are mapped in Figure 3.

Domestic stock cause grazing and trampling, but they do not currently have access to many of the natural areas on Matakana Island. Where they do have access, fences should be constructed to exclude them. Indigenous vegetation may also be flattened and damaged by humans and vehicles. This is a particular risk on the dunes, where nesting birds may also be adversely affected.

Streams on the island have a high level of constraint for future development and their riparian margins are potential restoration sites. Ecological enhancement could be part of any plans to use existing streams as components of stormwater detention and treatment systems, with associated riparian planting and enhancement and removal of barriers to fish passage. All gullies and streams warrant ongoing protection and improved riparian management.

13. CONCLUSIONS

Much of Matakana Island has been modified by plantation forestry and agriculture, but it retains natural areas with high ecological values which could be protected and enhanced, and sites which are degraded but which have restoration potential. Twenty-one (21) natural areas that have been identified and described in earlier reports (most recently in Wildland Consultants 2010) and many of them are identified as significant

natural areas in the Western Bay of Plenty District plan and/or the Regional Coastal Environment Plan. There are also five additional natural areas identified as proposed covenant areas on Blakely Pacific land. In this study, an additional eleven broad vegetation and habitat classes were mapped outside of the previously identified natural areas and proposed covenants. Relative ecological values were assessed of the 21 sites, the five proposed covenants, and the 11 vegetation and habitat classes. Relative ecological significance was used as the basis for identifying levels of constraint for future development: sites of high ecological value are highly constrained, moderate value sites are moderately constrained, and low value sites have a low level of constraint.

Sixteen (16) of the previously identified natural areas have a high level of ecological constraint for future development, three sites are moderately constrained, and two sites includes parts that are highly constrained and more modified portions that are moderately constrained. Three proposed covenant areas on Blakely Pacific Land are highly constrained and two are moderately constrained. Of the eleven vegetation and habitat classes outside of previously identified natural areas, one type (pohutukawa forest), is highly constrained, and five (indigenous treeland, grey willow wetlands, searush-oioi-*Baumea articulata* wetland, restoration areas, and manuka scrub) are moderately constrained. The remaining vegetation and habitat classes comprise pasture, orchards, exotic scrub, and residential areas that have a low level of constraint. Buffers around highly constrained areas, the harbour margins and streams are moderately constrained. Natural areas, proposed covenants and vegetation and habitat classes are mapped in Figure 1. Levels of ecological constraint for future development are mapped in Figure 2, and Figure 3 shows potential restoration areas on Blakely Pacific land.

Weed control is required in all natural areas on Matakana Island. Among the most widespread weed species are marram (on sand dunes), grey willow, pampas, woolly nightshade, brush wattle, and exotic pines. Marram, coastal tea tree, gorse, boxthorn, and pines are present on the sand dunes, and royal fern, reed sweetgrass and saltwater paspalum are present in the wetlands at the northern end of the barrier island. Wild ginger and smilax are present on roadsides in Opureora Village, and wild ginger is also present at the northern end of the barrier island, and may be present elsewhere. Any weed control in natural areas will need to be undertaken with care, to ensure that indigenous species are not adversely affected.

Restoration projects associated with streams and wetlands are underway at four sites on the western lobe of Matakana Island. All streams have a high level of constraint for future development and their riparian margins are potential restoration sites. Ecological enhancement could be part of any plans to use existing streams as components of stormwater detention and treatment systems, with associated riparian planting and enhancement and removal of barriers to fish passage. All gullies and streams warrant ongoing protection and improved riparian management.

This analysis of ecological values and constraints has found:

- Areas assessed as having high ecological value and a high level of ecological constraint are generally not suitable for urban lifestyle development. Limited

areas may be suitable for localised development but these would require detailed assessment, and customised management methods (including tenure restrictions) appropriate to the natural values present. Although not suitable for significant infrastructure, these areas can be utilised and enjoyed as part of amenity or conservation activities. Indigenous vegetation and habitats should be retained and, ideally, ecologically enhanced, e.g. by undertaking control of weeds and/or pest animals. A potential change of land use through a structure plan may provide the opportunity to achieve legal protection of these areas.

- Areas assessed as having moderate ecological value could sustain some limited lifestyle development, papakainga, and small scale rural settlement, however would need to be the subject of further evaluation and would also need to be constrained by appropriate management methods (management plans and tenure restrictions).
- A potential change of land use provides an opportunity to actively manage areas of moderate ecological value through ongoing enhancement over time, combined with education programmes and information about the best means to enhance ecological values.
- Relatively little constraint exists for land use changes within areas of low ecological value, although opportunities also exist for integration of land use change with management methods for these areas, and to allow enhancement of indigenous biodiversity.
- A potential change of land use through a structure plan may provide opportunities for legal protection for areas that warrant it, if the land is either developed or subdivided.

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**CHECKLIST OF INDIGENOUS AND NATURALISED
PLANTS OF MATAKANA ISLAND
SARAH BEADEL 2009**

Based on numerous visits between 1998 and 2009 (Beadel 2009)
with additions from current study

Key

1. Planted.
2. Occurs naturally and planted.

INDIGENOUS SPECIES

Gymnosperms

<i>Agathis australis</i> ²	kauri
<i>Dacrydium cupressinum</i> ¹ (current study)	rimu
<i>Dacrycarpus dacrydioides</i> ²	kahikatea
<i>Podocarpus totara</i> var. <i>totara</i> ¹ (current study)	totara

Monocot. trees and shrubs

<i>Cordyline australis</i> ²	ti kouka, cabbage tree
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Dicot. trees and shrubs

<i>Aristotelia serrata</i> ¹ (current study)	makomako, wineberry
<i>Avicennia marina</i> subsp. <i>australasica</i>	manawe, mangrove
<i>Brachyglottis repanda</i>	rangiora
<i>Coprosma acerosa</i> s.s	sand coprosma, tarakupenga
<i>Coprosma lucida</i>	karamu, glossy karamu
<i>Coprosma repens</i> ²	taupata
<i>Coprosma robusta</i> ²	karamu
<i>Coprosma tenuicaulis</i>	hukihuki, swamp coprosma
<i>Coprosma propinqua</i> × <i>C. repens</i>	
<i>Coriaria arborea</i>	tutu
<i>Corynocarpus laevigatus</i> ²	karaka
<i>Dodonaea viscosa</i> ²	akeake
<i>Entelea arborescens</i> ²	whau
<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	hangehange
<i>Hebe stricta</i> var. <i>stricta</i> ²	koromiko
<i>Hoheria populnea</i> ¹ (current study)	houhere
<i>Knightia excelsa</i>	rewarewa
<i>Kunzea ericoides</i> ²	kanuka
<i>Laurelia novae-zelandiae</i>	pukatea
<i>Leptospermum scoparium</i> agg. ²	manuka

<i>Leucopogon fasciculatus</i>	mingimingi
<i>Leucopogon fraseri</i>	patotara
<i>Macropiper excelsum</i> subsp. <i>excelsum</i>	kawakawa
<i>Melicytus novae-zelandiae</i>	coastal mahoe
<i>Melicytus ramiflorus</i> subsp. <i>ramiflorus</i>	mahoe
<i>Metrosideros excelsa</i> ²	pohutukawa
<i>Myoporum laetum</i> ²	ngaio
<i>Myrsine australis</i> ²	mapou
<i>Olearia solandri</i>	
<i>Ozothamnus leptophyllus</i>	tauhinu
<i>Pimelea villosa</i> s.s.	autetaranga
<i>Pittosporum crassifolium</i> ²	karo
<i>Pittosporum eugenioides</i> ¹ (current study)	tarata
<i>Pittosporum tenuifolium</i> ²	kohuhu
<i>Plagianthus divaricatus</i>	marsh ribbonwood, makaka
<i>Pomaderris amoena</i>	tauhinu
<i>Pseudopanax arboreus</i> ²	whauwhaupaku, five finger
<i>Pseudopanax crassifolius</i>	horoeka, lancewood
<i>Pseudopanax lessonii</i> ²	houpara
<i>Vitex lucens</i> ²	puriri

Dicot. lianes

<i>Calystegia sepium</i> subsp. <i>roseata</i>	
<i>Clematis paniculata</i>	puawananga
<i>Muehlenbeckia australis</i>	puka
<i>Muehlenbeckia complexa</i>	pohuehue

Lycopods and psilopsids

<i>Lycopodium volubile</i>	waewaekoukou
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Ferns

<i>Adiantum cunninghamii</i>	huruhuru tapairu
<i>Adiantum hispidulum</i>	
<i>Asplenium appendiculatum</i> subsp. <i>maritimum</i>	
<i>Asplenium bulbiferum</i>	mouku, hen and chicken fern
<i>Asplenium flaccidum</i>	makawe
<i>Asplenium oblongifolium</i>	huruhuruwhenua
<i>Asplenium polyodon</i>	petako
<i>Azolla filiculoides</i>	retoretore
<i>Blechnum filiforme</i>	panako
<i>Blechnum minus</i>	swamp kiokio
<i>Blechnum novae-zelandiae</i>	kiokio
<i>Blechnum vulcanicum</i>	korokio
<i>Cardiomanes reniforme</i>	kidney fern, konehu
<i>Ctenopteris heterophylla</i>	
<i>Cyathea dealbata</i>	ponga, silver fern

<i>Cyathea medullaris</i>	
<i>Cyclosorus interruptus</i>	
<i>Deparia petersenii</i> subsp. <i>congrua</i>	
<i>Dicksonia squarrosa</i>	wheki
<i>Diplazium australe</i>	
<i>Doodia australis</i>	pukupuku
<i>Gleichenia dicarpa</i>	tangle fern
<i>Gleichenia microphylla</i>	waewaekaka, swamp umbrella fern
<i>Histiopteris incisa</i>	matata, water fern
<i>Hymenophyllum demissum</i>	irirangi, filmy fern
<i>Hymenophyllum multifidum</i>	mauku, filmy fern
<i>Hymenophyllum sanguinolentum</i>	piripiri, filmy fern
<i>Hymenophyllum scabrum</i>	mauku, filmy fern
<i>Hypolepis ambigua</i>	
<i>Hypolepis distans</i>	
<i>Microsorium pustulatum</i>	kowaowao, hounds tongue fern
<i>Paesia scaberula</i>	matata
<i>Pellaea rotundifolia</i>	tarawera, button fern
<i>Pneumatopteris pennigera</i>	pakau
<i>Pteridium esculentum</i>	rarahū, bracken
<i>Pteris macilenta</i>	sweet fern
<i>Pteris tremula</i>	turawera, shaking brake
<i>Pyrrhosia eleagnifolia</i>	leather-leaf fern
<i>Rumohra adiantiformis</i>	
<i>Thelypteris confluens</i>	

Orchids

<i>Earina autumnalis</i>	raupeka
<i>Earina mucronata</i>	peka-a-waka
<i>Microtis unifolia</i> agg.	maikaika
<i>Thelymitra longifolia</i>	maikuku
<i>Thelymitra pauciflora</i>	slender sun orchid
<i>Winika cunninghamii</i>	

Grasses

<i>Austrostipa stipoides</i>	
<i>Cortaderia fulvida</i> ²	toetoe
<i>Deyeuxia avenoides</i>	
<i>Deyeuxia quadriseta</i>	
<i>Dichelachne crinita</i>	patiti, plume grass
<i>Isachne globosa</i>	swamp millet
<i>Lachnagrostis billardierei</i>	perehia
<i>Lachnagrostis filiformis</i>	perehia
<i>Microlaena stipoides</i>	patiti, meadow rice grass
<i>Oplismenus hirtellus</i> subsp. <i>imbecillis</i>	
<i>Poa anceps</i> agg.	
<i>Poa pusilla</i>	

<i>Rytidosperma gracile</i>	
<i>Spinifex sericeus</i> ²	kowhangatara, spinifex
<i>Zoysia pauciflora</i>	

Sedges

<i>Baumea arthropylla</i>	
<i>Baumea articulata</i>	
<i>Baumea juncea</i>	
<i>Baumea rubiginosa</i>	
<i>Baumea tenax</i>	
<i>Baumea teretifolia</i>	
<i>Bolboschoenus fluviatilis</i>	purua grass
<i>Bolboschoenus medianus</i>	purua grass
<i>Carex breviculmis</i>	
<i>Carex geminata</i> agg.	rautahi
<i>Carex maorica</i>	
<i>Carex pumila</i>	
<i>Carex secta</i>	purei
<i>Carex testacea</i>	
<i>Carex virgata</i>	purei
<i>Cyperus ustulatus</i> f. <i>ustulatus</i>	toetoe, upokotangata
<i>Eleocharis acuta</i>	
<i>Eleocharis sphacelata</i>	giant spike sedge, ngawha
<i>Ficinia nodosa</i>	wiwi
<i>Ficinia spiralis</i> ²	pingao
<i>Isolepis cernua</i>	
<i>Isolepis inundata</i>	
<i>Isolepis prolifera</i>	
<i>Lepidosperma australe</i>	
<i>Morelotia affinis</i>	
<i>Schoenoplectus pungens</i>	
<i>Schoenoplectus tabernaemontani</i>	kapungawha
<i>Schoenus apogon</i>	
<i>Schoenus maschalinus</i>	
<i>Schoenus nitens</i>	
<i>Schoenus tendo</i>	wiwi
<i>Tetraria capillaris</i>	
<i>Uncinia uncinata</i>	kamu matau a Maui

Rushes

<i>Apodasmia similis</i>	oioi
<i>Empodisma minus</i>	wire rush
<i>Juncus caespiticus</i>	
<i>Juncus edgariae</i>	wi
<i>Juncus kraussii</i> var. <i>australiensis</i>	wi sea rush
<i>Juncus pallidus</i>	wi
<i>Juncus planifolius</i>	

<i>Juncus prismatocarpus</i>	
<i>Juncus sarophorus</i>	wi
<i>Luzula picta</i> var. <i>picta</i>	

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Arthropodium cirratum</i>	rengarenga
<i>Astelia banksii</i>	
<i>Astelia solandri</i>	kowharawhara
<i>Astelia trinervia</i>	mauri
<i>Collospermum hastatum</i>	kahakaha
<i>Dianella haemata</i>	
<i>Dianella nigra</i>	turutu
<i>Lemna minor</i>	karearea
<i>Phormium tenax</i>	harakeke, flax
<i>Potamogeton cheesemanii</i>	manihi
<i>Sparganium subglobosum</i>	maru, burr reed
<i>Triglochin striata</i>	arrow grass
<i>Typha orientalis</i>	raupo

Composite herbs

<i>Cotula coronopifolia</i>	bachelor's button
<i>Euchiton audax</i>	
<i>Euchiton collinus</i>	
<i>Euchiton sphaericus</i>	
<i>Lagenifera pumila</i>	papataniwhaniwha
<i>Pseudognaphalium luteoalbum</i> agg.	pukatea
<i>Senecio biserratus</i>	
<i>Senecio glomeratus</i>	pukatea
<i>Senecio lautus</i> var. <i>lautus</i>	
<i>Senecio minimus</i>	
<i>Senecio quadridentatus</i>	cotton fireweed, pekapeka

Dicot. herbs (other than composites)

<i>Apium prostratum</i> subsp. <i>prostratum</i> var. <i>filiforme</i>	tuutae kooau, New Zealand celery
<i>Callitriche stagnalis</i>	starwort
<i>Calystegia soldanella</i>	panahi, shore bindweed
<i>Centella uniflora</i>	
<i>Chenopodium ambiguum</i>	
<i>Dichondra repens</i>	Mercury Bay weed
<i>Disphyma australe</i> subsp. <i>australe</i>	horokaka
<i>Epilobium nummulariifolium</i>	
<i>Epilobium pallidiflorum</i>	tawarewa
<i>Galium propinquum</i>	mawe
<i>Gonocarpus incanus</i>	piripiri
<i>Gonocarpus micranthus</i>	piripiri
<i>Haloragis erecta</i> subsp. <i>erecta</i>	toatoa

<i>Hydrocotyle heteromeria</i>	
<i>Hydrocotyle novae-zeelandiae</i> var. <i>novae-zeelandiae</i>	
<i>Hydrocotyle pterocarpa</i>	
<i>Lilaeopsis novae-zeelandiae</i>	
<i>Limosella lineata</i>	mudwort
<i>Lobelia anceps</i>	punakuru
<i>Lobelia angulata</i>	panakenake
<i>Myriophyllum propinquum</i>	
<i>Nertera depressa</i>	
<i>Oxalis rubens</i>	sand oxalis
<i>Pelargonium inodorum</i>	kopata
<i>Persicaria decipiens</i>	tutunawai
<i>Ranunculus acaulis</i>	
<i>Ranunculus amphitrichus</i>	kawariki
<i>Ranunculus macropus</i>	raoriki
<i>Ranunculus reflexus</i>	maruru
<i>Rorippa palustris</i>	hanea
<i>Samolus repens</i> var. <i>repens</i>	makaokao
<i>Sarcocornia quinqueflora</i>	ureure, glasswort
<i>Selliera radicans</i>	remuremu
<i>Solanum americanum</i>	raupeti
<i>Stellaria parviflora</i>	kohukohu
<i>Tetragonia implexicoma</i>	
<i>Tetragonia tetragonioides</i>	
<i>Wahlenbergia violacea</i>	rimuroa

NATURALISED SPECIES

Excludes planted species such as garden plants, crops, and shelterbelts

Gymnosperms

<i>Pinus patula</i>	patula pine
<i>Pinus pinaster</i>	maritime pine
<i>Pinus radiata</i>	radiata pine

Dicot. trees and shrubs

<i>Acacia mearnsii</i> (current study)	black wattle
<i>Acacia sophorae</i>	coastal wattle
<i>Aira caryophyllea</i> subsp. <i>caryophyllea</i>	silver hairy grass
<i>Banksia integrifolia</i>	banksia
<i>Berberis glaucocarpa</i>	barberry
<i>Buddleja davidii</i>	buddleia
<i>Cestrum elegans</i> (current study)	red cestrum
<i>Chamaecytisus palmensis</i> (current study)	tree lucerne
<i>Chrysanthemoides monilifera</i>	boneseed
<i>Cotoneaster glaucophyllus</i>	cotoneaster
<i>Elaeagnus</i> × <i>reflexa</i>	elaeanus
<i>Erica caffra</i>	hedge heath

<i>Erica lusitanica</i>	Spanish heath
<i>Eriobotrya japonica</i> (current study)	loquat
<i>Eucalyptus</i> sp. (current study)	eucalyptus
<i>Juglans</i> sp. (current study)	walnut
<i>Leptospermum laevigatum</i>	coastal tea tree
<i>Leycesteria formosa</i>	Himalayan honeysuckle
<i>Ligustrum lucidum</i>	tree privet
<i>Ligustrum sinense</i>	Chinese privet
<i>Lupinus arboreus</i>	lupin
<i>Lycium ferocissimum</i>	boxthorn
<i>Paraserianthes lophantha</i>	brush wattle
<i>Paulownia tomentosa</i>	paulownia
<i>Pelargonium</i> sp.	geranium
<i>Populus</i> sp. (current study)	poplar
<i>Prunus campanulata</i> (current study)	flowering cherry
<i>Rhamnus alaternus</i>	Italian evergreen buckthorn
<i>Ricinus communis</i>	
<i>Rosa</i> sp. (current study)	climbing rose
<i>Rubus</i> sp. (<i>R. fruticosus</i> agg.)	blackberry
<i>Salix cinerea</i>	grey willow
<i>Solanum mauritianum</i>	woolly nightshade
<i>Tecomaria capensis</i>	Cape honeysuckle
<i>Ulex europaeus</i>	gorse

Dicot. lianes

<i>Actinidia deliciosa</i>	kiwifruit
<i>Anredera cordifolia</i>	madeira vine
<i>Araujia sericifera</i>	moth plant
<i>Hedera helix</i>	ivy
<i>Jasminum polyanthum</i>	jasmine
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Passiflora edulis</i>	black passionfruit
<i>Rumex sagittatus</i>	climbing dock

Ferns

<i>Azolla pinnata</i>	ferny azolla
<i>Osmunda regalis</i>	royal fern

Grasses

<i>Agrostis capillaris</i>	browntop
<i>Agrostis stolonifera</i>	creeping bent
<i>Ammophila arenaria</i>	marram
<i>Anthoxanthum odoratum</i>	sweet vernal
<i>Avena sativa</i> ²	wild oat
<i>Axonopus fissifolius</i>	narrow-leaved carpet grass
<i>Briza minor</i>	shivery grass

<i>Bromus diandrus</i>	ripgut brome
<i>Bromus willdenowii</i>	prairie grass
<i>Catapodium rigidum</i>	hard grass
<i>Cortaderia selloana</i>	pampas grass
<i>Dactylis glomerata</i>	cocksfoot
<i>Ehrharta erecta</i>	veld grass
<i>Elytrigia pycnantha</i>	sea couch
<i>Elytrigia repens</i>	couch
<i>Entolasia marginata</i>	bordered panic grass
<i>Eragrostis brownii</i>	bay grass
<i>Glyceria fluitans</i>	floating sweetgrass
<i>Glyceria maxima</i>	reed sweetgrass
<i>Holcus lanatus</i>	Yorkshire fog
<i>Lagurus ovatus</i>	haretail
<i>Lolium perenne</i>	rye grass
<i>Miscanthus nepalensis</i>	Himalaya fairy grass
<i>Paspalum dilatatum</i>	paspalum
<i>Paspalum vaginatum</i>	saltwater paspalum
<i>Pennisetum clandestinum</i>	kikuyu grass
<i>Poa annua</i>	annual poa
<i>Poa pratensis</i>	Kentucky bluegrass
<i>Schedonorus arundinaceus</i>	tall fescue
<i>Sporobolus africanus</i>	ratstail
<i>Stenotaphrum secundatum</i>	buffalo grass
<i>Vulpia bromoides</i>	vulpia hair grass

Sedges

<i>Cyperus congestus</i>	purple umbrella sedge
<i>Cyperus eragrostis</i>	umbrella sedge
<i>Cyperus involucratus</i>	umbrella sedge

Rushes

<i>Juncus acuminatus</i>	sharp-fruited rush
<i>Juncus articulatus</i>	jointed rush
<i>Juncus bufonius</i> var. <i>bufonius</i>	toad rush
<i>Juncus effusus</i> var. <i>effusus</i>	soft rush, leafless rush
<i>Juncus tenuis</i> var. <i>tenuis</i>	track rush

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Agapanthus praecox</i>	agapanthus
<i>Asparagus asparagoides</i>	smilax
<i>Canna indica</i>	canna lily, Indian shoot
<i>Colocasia esculenta</i>	taro
<i>Crocasmia ×crocosmiiflora</i>	montbretia
<i>Hedychium gardnerianum</i>	kahili ginger, wild ginger
<i>Kniphofia uvaria</i>	red hot poker

Tradescantia fluminensis
Zantedeschia aethiopica

tradescantia
arum lily

Composite herbs

Achillea millefolium (current study)
Aster subulatus
Cirsium arvense
Cirsium vulgare
Conyza parva
Conyza sumatrensis
Crepis capillaris
Erigeron karvinskianus
Gamochaeta coarctata
Hypochoeris radicata
Jacobaea vulgaris
Lactuca serriola
Lapsana communis
Leontodon taraxacoides
Leucanthemum vulgare
Mycelis muralis
Osteospermum fruticosum
Senecio bipinnatisectus
Senecio elegans
Senecio skirrhodon
Senecio sylvaticus
Sonchus asper
Sonchus oleraceus
Taraxacum officinale

yarrow
sea aster
California thistle
Scotch thistle
smooth fleabane
broad-leaved fleabane
hawksbeard
Mexican daisy
purple cudweed
catsear
ragwort
prickly lettuce
nipplewort
hawkbit
oxeye daisy
wall lettuce
rain daisy, dimorphotheca
Australian fireweed
purple groundsel
gravel groundsel
wood groundsel
prickly puha
puha, sow thistle
dandelion

Dicot. herbs (other than composites)

Anagallis arvensis
Atriplex prostrata
Beta vulgaris
Brassica sp.
Cakile edentula
Cakile maritima
Cannabis sativa
Carpobrotus edulis
Cerastium glomeratum
Chenopodium album
Chenopodium ambrosioides
Conium maculatum
Daucus carota
Digitalis purpurea
Epilobium ciliatum
Euphorbia lathyris
Euphorbia peplus

scarlet pimpernel
orache
silverbeet

sea rocket
sea rocket
hemp, cannabis
ice plant
annual mouse-ear chickweed
fathen
Mexican tea
hemlock
wild carrot
foxglove
tall willow herb
caper spurge
milkweed

<i>Foeniculum vulgare</i>	fennel
<i>Fumaria muralis</i>	scrambling fumitory
<i>Galium aparine</i>	cleavers bedstraw
<i>Galium palustre</i>	marsh bedstraw
<i>Lotus angustissimus</i>	slender birdsfoot treefoil
<i>Lotus pedunculatus</i>	lotus
<i>Ludwigia palustris</i>	water purslane
<i>Lunaria annua</i>	honesty
<i>Lycopus europaeus</i>	gypsy wort
<i>Malva parviflora</i>	small-flowered mallow
<i>Mentha pulegium</i>	penny royal
<i>Modiola caroliniana</i>	creeping mallow
<i>Myosotis arvensis</i>	field forget-me-not
<i>Nasturtium officinale</i>	watercress
<i>Orobanche minor</i>	broomrape
<i>Oxalis pes-caprae</i>	
<i>Pastinaca sativa</i>	wild parsnip
<i>Persicaria hydropiper</i>	water pepper
<i>Persicaria maculosa</i>	willow weed
<i>Phytolacca americana</i>	pokeweed
<i>Phytolacca octandra</i>	inkweed
<i>Plantago lanceolata</i>	narrow-leaved plantain
<i>Polycarpon tetraphyllum</i>	allseed
<i>Polygonum aviculare</i>	wireweed
<i>Prunella vulgaris</i>	selfheal
<i>Ranunculus acris</i>	giant buttercup
<i>Ranunculus flammula</i>	spearwort
<i>Ranunculus repens</i>	creeping buttercup
<i>Ranunculus sceleratus</i>	celery-leaved buttercup
<i>Raphanus raphanistrum</i> subsp. <i>maritimus</i>	
<i>Raphanus raphanistrum</i> subsp. <i>raphanistrum</i>	wild radish
<i>Rumex acetosella</i>	sheep's sorrel
<i>Rumex obtusifolius</i>	broad-leaved dock
<i>Silene vulgaris</i> subsp. <i>vulgaris</i>	bladder campion
<i>Sisymbrium officinale</i>	wild mustard, hedge mustard
<i>Solanum chenopodioides</i>	velvety nightshade
<i>Solanum nigrum</i>	black nightshade
<i>Stellaria alsine</i>	bog stitchwort
<i>Stellaria media</i>	chickweed
<i>Trifolium pratense</i>	red clover
<i>Trifolium repens</i>	white clover
<i>Tropaeolum majus</i>	garden nasturtium
<i>Verbena bonariensis</i>	purple-top
<i>Veronica arvensis</i>	field speedwell
<i>Vicia sativa</i>	vetch
<i>Viola</i> sp.	

SELECTED
SITE PHOTOGRAPHS



Plate 1: The foredune of the beach that faces the Pacific Ocean is dominated by spinifex and pingao with patches of marram.



Plate 2: Sand daphne is an 'At Risk' species that is present on the foredune of the beach.



Plate 3: This dune lake is at the northern end of the barrier island.



Plate 4: *Cyclosorus interruptus* is found in several of the wetlands at the northern end of the barrier island in the following sites: Matakana Island 1, Matakana Wetlands A, Matakana Wetlands B, Matakana Wetlands C, and Matakana Wetlands D.



Plate 5: In some areas, such as the northern end of 'Matakana Island 1', pines are emergent above a much lower canopy of indigenous species such as *Baumea juncea*, *Ficinia nodosa*, and oioi.



Plate 6: Manuka dominated wetlands with ti kouka and pampas occur in wetlands on the western side of the barrier island.



Plate 7: Much of the barrier island comprises planted forests of radiata pine and eucalyptus (Vegetation Type 1). Pampas is common in the understorey and on road verges.



Plate 8: Much of the western lobe of the island comprises pasture (Vegetation Type 2), with smaller areas of kiwifruit orchards (Vegetation Type 3b). Gorse and woolly nightshade are common on the roadsides.



Plate 9: Maize cropping is also a common land use (Vegetation Type 3a). Scrub dominated by woolly nightshade and gorse (Vegetation Type 5a) is present on the hillside in the rearground.



Plate 10: Patches of scrub dominated by exotic species (Vegetation Type 5) are common on steeper slopes and the margins of the western lobe of the island.



Plate 11: Grey willow forest (Vegetation Type 8) occurs in gullies within pasture and land that is cropped for maize.



Plate 12: A restoration project (Vegetation Type 9) is underway on the margin of Waihirere Wetland. Fences have been constructed and indigenous species planted.



Plate 13: Gullies and stream margins are also being restored near the intersection of Matakana Road and Matakana Point Road.



Plate 14: A gully and estuarine wetland (Vegetation Type 10) south of Matakana Point are being restored.



Plate 15: A wetland on the edge of Opureora village, is being created/restored.



Plate 16: Coastal tea tree, a pest plant species that is native to Australia, is being controlled on the sand dunes.