TAURANGA ECOLOGICAL DISTRICT PHASE 1 PROTECTED NATURAL AREAS PROGRAMME REPORT

OCTOBER 2003

Contract Report No. 751

Report prepared for

ENVIRONMENT BAY OF PLENTY
P.O. BOX 364
WHAKATANE

Wildland CONSULTANTS

WILDLAND CONSULTANTS LTD, 99 SALA STREET, P.O. BOX 7137, TE NGAE, ROTORUA
Ph 07-343-9017, Fax 07-343-9018, email ecology@wildlands.co.nz, www.wildlands.co.nz

CONTENTS

APPENDICES

PROJECT TEAM

Sarah Beadel - Project supervision, report preparation.
Rhodri Harfoot - Report preparation.
W.B. Shaw - Report preparation.
Roger Bawden - Map production.

1. INTRODUCTION

The Protected Natural Areas Programme (PNAP) was established in 1983 to address Section 3(1)(b) of the Reserves Act 1977:

The preservation of representative samples of all classes of natural ecosystems and landscapes which in the aggregate originally gave New Zealand its own recognisable character.

New Zealand has been mapped into 286 ecological districts determined by landscape and ecological patterns. Ecological districts are grouped into 68 ecological regions, as the basis of the PNA Programme (McEwen 1987).

The Tauranga Ecological District is situated in the western Bay of Plenty, between the eastern foothills of the Kaimai-Mamaku range and the Pacific Ocean, encompassing the western half of the coastal dune systems that stretch between Waihi beach and Opotiki. The district includes three estuarine environments, including the entire expanse of the Tauranga Harbour. The ecological district is largely within the coastal bioclimatic zone, as only small portions of the area extend for more than approximately 1 km from the coastal or estuarine environments. Beyond the coastal zone, the rest of the ecological district is in the semi-coastal bioclimatic zone (refer to Figure 1).

This report presents a summary of existing information on the physical nature of the Tauranga Ecological District and identifies what is needed to complete a protected natural areas programme survey of the ecological district.

Implementation of a PNAP field survey for the Tauranga Ecological District will involve identification of natural areas that maintain the unique indigenous biotic character of the district.

2. LOCATION, GEOLOGY AND PHYSIOGRAPHY

The Tauranga Ecological District (*c*.85,670 ha) is situated in the western Bay of Plenty, between the eastern foothills of the Kaimai-Mamaku range and the Pacific Ocean, encompassing the western half of the coastal dune systems that stretch between Waihi beach and Opotiki.

The ecological district lies largely within the coastal bioclimatic zone, as only small portions of the area extend for more than approximately 1 km from the coastal or estuarine environments into the semi-coastal bioclimatic zone (refer to Figure 1).

The ecological district encompasses approximately 80 km of ocean beach and a large area of estuarine environment, comprising three estuaries, including the entire expanse of the Tauranga Harbour. The boundary skirts the lower slopes of the Kaimai – Mamaku Range and passes around the eastern side of the Mamaku plateau before joining the coast near Otamarakau. The altitudinal range is from sea level to approximately 300 m. Typically the land is of a shallow gradient, rising gradually to a series of rolling and moderately steep hills in the west.

Figure 1

Unless otherwise noted the following description has been compiled from Healy *et al*. (1974). A large proportion of the land area along the coast has an underlying geology of sand, mostly as fixed foredunes. Alluvial deposits adjoin this area, mostly undifferentiated. West of the Tauranga Harbour the geology is composed of intermixed fluviatile sands and silts with siltstones, sandstones and conglomerates and occasional pumiceous tuffs forming moderately steep undulating hill country. The western boundary of the ecological district is defined by the boundary between fluviatile deposits and the ignimbrites of the Kaimai range. Around the base of the Mamaku plateau, the boundary is most easily defined by two large hidden faults, on either side of the Mamaku Plateau that run slightly west of south, although the true boundary is again defined by the limits of the sedimentary deposits.

South and west of the Maketu and Little Waihi Estuaries flat to slightly undulating terraces are formed of fluviatile sands, silts and gravels. These have been overlain to form the southern boundary of the ecological district by the same ignimbrites that form the Mamaku Plateau and pumice breccias from the Rotoiti eruption. At the very eastern limit of the ecological district, there is a small area of pumice breccias with siltstones. In areas surrounding the Maketu and Little Waihi Estuaries are intermixed peat and alluvial beds, which rise to the west and merge into the fluviatile terraces described above. The estuaries of Maketu, Little Waihi and Tauranga Harbour are entirely composed of sediment deposited by the various rivers and streams that enter these areas. The sediments range between fine silts and sands, although most commonly it is a mixture of both. Hard mud and shell surfaces can be found in some areas of the Tauranga Harbour (Barker and Larcombe 1976).

Several rivers run through the ecological district, the most notable being the Kaituna River which drains into the Maketu Estuary. Many streams and rivers flow into Tauranga Harbour from the west, including the Wairoa River. Most streams and rivers originate outside the ecological district, on the heavily forested higher slopes of the Kaimai and Mamaku ranges. The lower slopes of the hills have had much of their native vegetative cover removed, which has resulted in an increase in erosion, especially along the banks of the watercourses in the district (Surman *et al*. 1999). The resulting increase in waterborne sediment has had an impact on the water quality and hence the wildlife within the streams and rivers, as well as increasing sedimentation in the estuaries.

3. LANDFORM UNITS

Eighteen landform units were identified in the ecological district. These are described below and mapped in Figure 2.

3.1 Coastal margin

1. Infilled harbour: Comprising one section of the Tauranga Harbour, namely Sulphur Point.

2. Intertidal Flats: Extensive areas between the mean high water spring and the mean low water spring tidal marks.

Figure 2

3. Oceanside sand beach: Found along the shores of the ocean, between the high tide mark and the dune systems that run along much of the ocean coastline in the ecological district.

4. Sand dune: Stretching along the ocean coast from Waihi Beach to the mouth of the Maketu Estuary. This is the dominant land form along the ocean beach and forms a critical part of the ecosystem.

5. Rocky shore: Very limited in its extent and restricted to small areas around Mauao, Bowentown Heads and at the base of the cliffs at the entrance to Maketu Estuary.

6. Harbour and estuary: Areas that are underwater at low tide.

3.2 Flat-shallow gradient land

7. Alluvial plains: Located around the banks of the Kaituna River. They are somewhat limited in extent and were formerly part of a large swamp which has now mostly been drained and cultivated.

8. Flat-undulating/undulating low hills: Located to the west and south of the Tauranga Harbour, in the gentle terrain below the steeper slopes of the Kaimai and Mamaku Ranges. These can be defined as hills with less than 100 m between the base and top. This landform grades into undifferentiated terraces towards the harbour.

9. Undifferentiated terrace: These are local or isolated terraces, which are indistinguishable from higher or lower terraces according to current data.

10. Higher terraces: There is a restricted area of this landform on the borders of the Mamaku range. Generally this landform has a gentle slope and is more or less modified by erosion.

11. Flats: These include riparian flats and are generally found near the lower reaches of streams and wetlands. Some peat swamp areas also form part of this landform unit.

3.3 Moderately steep land

12. Hills: There are occasional isolated moderately steep hills.

3.4 Steep land

13. Scarps, toeslopes and associated steep slopes: This landform includes the transition between terraces and flats, but also includes scarps and inland cliffs.

14. Very steep hills: There are isolated occurrences of very steep hills, the best example of which is Mauao.

15. Gorges: This landform is restricted to a small area on the eastern flanks of the Mamaku Plateau; it typically has very steep sides and an absence of streamside terraces.

16. Gullies: Steep-sided and narrow, these are similar to gorges, but are typically found in undulating or moderately hilly country.

17. Cliffs: There are small areas of very steep to sheer cliffs around the coast.

3.5 Other

18. Wetlands: Occur occasionally on the plains and riparian margins. The majority of these are less than 20 ha in area.

4. SPECIAL GEOLOGICAL FEATURES

Seven sites of geological importance are noted for the Tauranga Ecological District: the peak of Mauao, which is the remnant of a large rhyolite lava dome; Maketu Estuary lagoon; Maketu Hot Springs; the Woodlands and Sapphire Springs at Katikati; Waihi Beach; and Matakana Island and its associated tombolos. Mauao and Matakana Island are sites of national significance, and the other four are of regional significance (Kenny and Hayward 1996).

5. SOILS

The soils of the region are derived, for the most part, from a range of volcanic events that have showered the area in ash and tephra. The dominant soil-forming ashes are those from the Kaharoa eruption and the Waihi and Whakatane ashes, which form sandy soils that are well drained and have a high allophone content (Rijkse and Cotching 1995). Smaller areas of peat-based soils are found in the swamps adjoining the Maketu and Little Waihi Estuaries. These areas have been largely converted to farmland by draining and fertilisation (Town and Country Planning Branch, Ministry of Works, 1962).

Sand deposits stretch along the ocean beaches and some distance inland, forming deep, well drained soils that have been used for urban construction and development. The largest areas of intact habitat in this region are the dune systems that stretch along Waihi beach, Matakana Island, and from Mauao to the Kaituna River mouth (west exit) and beyond to Maketu Estuary (east exit).

The predominant soil type is a yellow brown loam, derived from the Whakatane and Waihi ashes, which extends across the ecological district to the west and south of the Tauranga Harbour, into the foothills of the Kaimai Range. Further south the dominant soil types are Kaharoa ash and yellow-brown pumice soils, mixed with organic (peat) soils. Along the coast there are large areas of recently formed soils, especially on Matakana Island. These are derived from the deposition of sand and include the dune systems along Papamoa Beach (Stokes, 1980; Rijkse and Cotching 1995).

Soils temperatures are on average 1-2 degrees Celsius above the average air temperature, and as such the ecological district is ideal for horticulture, of which kiwifruit production (*Actinidia chinensis*) forms a large part (Rijkse and Cotching 1995).

6. CLIMATE

The Tauranga Ecological District is sheltered to the west, south, and east by high country ranges and plateaux, which, with the predominantly westerly airflow over New Zealand, results in the region experiencing lower rainfall than many other areas, as well as higher temperatures and high sunshine hours (Rijkse and Cotching 1995). The mean annual temperature of the ecological district is approximately 14°C, with the maximum 34°C and the minimum just below -5°C. At Tauranga Airport, mean annual rainfall is 1,300 mm over 153 rain days (Tauranga District Council 1996), while the sunshine hours average 2200-2400 annually (Tauranga District Council website, accessed September 2003).

7. VEGETATION

7.1 Historical

Tall podocarp-broadleaved forest would have historically covered all of the hill country and some of the flat land, including the dune systems, with the exception of the foredunes and the extensive freshwater wetlands on the plains (Wildland Consultants Ltd 2000e) (refer to Figure 3). The vegetation would have been dominated by rimu (*Dacrydium cupressinum*)-tawa (*Beilschmiedia tawa*) type forest, with other podocarp species also common, such as miro (*Prumnopitys ferruginea*) and matai (*Prumnopitys taxifolia*). Kauri (*Agathis australis*) is likely to have been found in the northern end of this ecological district (Stokes 1980). The non-forested dune areas would have had some cover of sand binding species such as pingao (*Desmoschoenus spiralis*), pohuehue (*Muehlenbeckia complexa*) and spinifex (*Spinifex sericeus*), with low shrubland areas of *Coprosma* spp., kanuka (*Kunzea ericoides*), karo (*Pittosporum crassifolium*), and pohutukawa (*Metrosideros excelsa*) further back from the beach (Beadel 1995e). Pohutukawa forest would also have occurred on the headlands and hill slopes near the harbour.

Within the estuarine systems there would have been extensive saltmarshes and mangrove (*Avicennia marina* subsp. *australasica*) scrub, shrublands, and eelgrass beds.

Large freshwater wetlands also existed on the Kaituna-Pongakawa plain, and around the Maketu and Little Waihi Estuaries. These would have been dominated by kahikatea (*Dacrycarpus dacrydioides*) swamp forest with maire tawake (swamp maire; *Syzygium maire*) and large areas of kiekie (*Freycinetia banksii*), but extensive areas of flaxland and reedland would also have been present. Smaller wetlands

Figure 3

covered in a mixture of flaxland, reedland and swamp forest would have been found along the margins of the major river valleys such as the Wairoa, Kopurererua and Waimapu.

The arrival of Maori saw clearance of extensive areas of vegetation by burning, especially on the lower, more fire-prone flat lands and dune areas. Tall forest was replaced by a mixture of fernland, shrubland, remnant primary forest and secondary forest. The arrival of Europeans saw the introduction of a wide range of weed and cultivated species (see Appendix 2), as well as further clearance of the primary and secondary forest for farmland and timber production. Freshwater wetlands were also cleared and drained for farming, although this did not occur for some time after the arrival of Europeans.

As a result of human activity, there has been a significant reduction in the amount of indigenous vegetation cover in the Tauranga Ecological District. This is especially the case for wetland vegetation including tall swamp forest, which have largely been cleared and drained for agriculture, horticulture and urban development (Cromarty 1996).

7.2 Present day

The present day land cover of the ecological district is indicated in Figure 4. Most of the indigenous vegetation has been cleared and replaced with pastoral land use/horticulture/life style properties or residential/commercial/industrial development. Remaining areas of indigenous vegetation or mixtures of indigenous and exotic vegetation are concentrated on dunes along the coast, on harbour and estuary margins, and on Mauao (Mt Maunganui) and the Bowentown Headland. There are small scattered clumps of secondary vegetation inland of Tauranga Harbour and behind Te Puke, mainly in gullies. One or two kahikatea stands remain on the Pongakawa Plains; a relatively large freshwater wetland survives near the mouth of the Kaituna River, and several other much smaller areas of freshwater wetland exist in the vicinity of the Kaituna River. Freshwater wetlands, generally relatively small, but some larger areas occur near Tauranga Harbour and in places extending up some valleys that drain into the harbour. The only other examples of indigenous vegetation tend to be confined to scarps on the harbour margins and in adjoining valleys.

8. FLORA

A provisional list of the vascular plant species for the ecological district has been compiled (Beadel 2002). Of the 705 species listed, less than half (338/705) are indigenous and 367/705 are exotic species. Separate species lists for indigenous vegetation are available for several reserves and other sites within the area (see Beadel 1989b, 1992a, & 2004; Beadel *et al*. 1996; Shaw 1999a). Full species lists are provided in Appendices 1 and 2.

Figure 4

8.1 Threatened and local plants

There are several nationally, regionally or locally threatened and uncommon species present within the ecological district. There is an historical record of *Olearia pachyphylla* (Acutely Threatened - nationally endangered) from the ecological district (P. de Lange pers. comm.). *Pterostylis micromega* (classed as Acutely Threatened - nationally critical in Hitchmough 2002) was recorded from the Kaituna in 1983 (Miller 1983), but has not been resighted. *Ranunculus macropus* (classed as Chronically Threatened - serious decline by Hitchmough 2002) occurs in the wetlands at the northern end of Matakana Island. King fern (*Marratia salicina*; Chronically Threatened - serious decline) occurs inland from Te Puke. *Pimelea arenaria* (classed as Chronically Threatened - gradual decline by Hitchmough 2002), and in the Bay of Plenty known only from the Tauranga Ecological District. *Pimelea tomentosa* (classed as Gradual Decline by Hitchmough 2002) occurs on Mauao.

Large populations of pingao (*Desmoschoenus spiralis*; Chronically Threatened - gradual decline) are present on Matakana Island, with similar populations along the Papamoa and Kaituna Sand Dunes, and local populations elsewhere. A large population of hinarepe (or sand tussock, *Austrofestuca littoralis*; Chronically Threatened - gradual decline) occurs at Kaituna, and smaller populations at Pukehina and Papamoa. This species is known from only a handful of sites in the Bay of Plenty. Large populations of *Cyclosorus interruptus* and *Thelypteris confluens* (both Chronically Threatened - gradual decline) occur in the wetlands on Matakana Island with small populations in the Arawa Wetlands near Maketu.

Kohihi (NZ spinach, *Tetragonia tetragonioides*: At Risk - sparse) occurs at several sites in the ecological district, including Matakana Island, Bowentown, and Waikaraka Estuary. *Hypolepis dicksonioides* (At Risk - sparse) occurs at one site in the ecological district. *Mimulus repens* (At Risk - sparse) has only been recorded from one site in the ecological district near Maketu.

Two small stands of maire tawake (swamp maire, *Syzgium maire* are present, one at the northern end of the ecological district, and the other in the Kaituna Wetland. This species is only known from a few sites in the Bay of Plenty. *Psilotum nudum* is only known from Mauao in the ecological district, and whilst it occurs at several geothermal sites in the Bay of Plenty and at Putauaki, it is only know from one other coastal site, Moutohora - Whale Island.

Many other species are confined to only one site in the ecological district, reflecting perhaps a combination of gaps in the botanical knowledge of the district, and that very little remains of the natural vegetation in many parts of the district. One of these species is wire rush (*Empodisma minus*), a small population of which occurs on Matakana Island.

Melicytus novae-zelandiae occurs on Matakana Island and is present at the Mount (probably naturalised from plantings).

8.2 Distribution limits

Lepidosperma laterale approaches the southern limit of its distribution in the ecological district, where it is known from only two sites. Mangroves also approach their southern limit for the east coast here, although they are also found slightly further south at Ohiwa Harbour (Rasch 1989).

9. FAUNA

The indigenous fauna of the Tauranga Ecological District is diverse. The diversity of habitat types is reflected in the diversity of invertebrate and vertebrate species within the ecological district. As the ecological district encompasses a large section of shoreline and three estuarine environments, there are a large number of waders, although much habitat has been destroyed for development into farmland, urban areas and plantation forestry which has limited forest bird densities. A provisional list of fauna is provided in Appendix 3.

9.1 Avifauna

The Tauranga Ecological District supports a wide diversity of bird species, with nearly two thirds being indigenous. However, forest bird species have become relatively scarse due to habitat modification in the area. The large proportion of seabirds, shore birds, and waders listed in Appendix 3 reflects the presence of large saltwater wetlands in the form of estuaries, as well as a long sandy coastline. Several petrels and other seabirds breed or roost on the offshore islands just outside the Tauranga Ecological District, and grey-faced petrels (oi; *Pterodroma macroptera*) and northern blue penguins (*Eudyptula minor iredalei*) also breed on the mainland. Many species are migratory, of which several, such as the white heron, are only occasional visitors.

Over 20 threatened bird species are present in or visit the ecological district (refer to Table 1). These include 11 coastal and estuarine species, seven freshwater wetland species and five forest species. Some such as the Australasian bittern (*Botaurus poiciloptilus*) have nationally significant breeding populations within it. Other threatened species with important breeding areas in the district include northern blue penguin, banded dotterel (*Charadrius bicinctus*) and northern New Zealand dotterel (*Charadrius obscurus aquilonius*). Many other species of waders are non-breeding visitors from breeding grounds in central and southern New Zealand and from the northern hemisphere.

Table 1: Threatened avifauna species known to occur in Tauranga Ecological District

Species	Threat status*	Main habitat
White heron	Nationally critical	Wetlands
Black stilt	Nationally critical	Harbour, estuaries
Reef heron	Nationally endangered	Coast
Australasian bittern	Nationally endangered	Wetlands
North Island kaka	Nationally endangered	Forest
New Zealand falcon	Nationally vulnerable	Forest
Wrybill	Nationally vulnerable	Harbour, estuaries
Caspian tern	Nationally vulnerable	Coast
North Island kiwi	Serious decline	Forest
Black-fronted tern	Serious decline	Coast, estuaries
Grey duck	Serious decline	Wetland
Northern blue penguin	Gradual decline	Coast
Banded dotterel	Gradual decline	Beaches and estuaries
White-fronted tern	Gradual decline	Coast
Kereru	Gradual decline	Forest
Long-tailed cuckoo	Gradual decline	Forest
New Zealand dotterel	Sparse	Beaches, estuaries
Black shag	Sparse	Coastal
Pied shag	Sparse	Coastal
Banded rail	Sparse	Freshwater wetland
Marsh crake	Sparse	Freswater wetlands
Spotless crake	Sparse	Freshwater wetland
North Island fernbird	Sparse	Freshwater wetland

Note: * = Threat status follows Hitchmough 2002; grey duck and New Zealand dotterel are likely to have their status upgraded (R. Hitchmough, DOC pers. comm.).

Many of the species listed in Table 1 are the victims of localised habitat and breeding site destruction, and predation from introduced mammalian predators (e.g. Pierce 2002). Tauranga Harbour, Maketu Estuary and Little Waihi Estuary provide important habitat for some of these species. Tauranga Harbour is recognised by the RAMSAR convention as being a wetland of international significance for the protection of migratory and indigenous wetland bird species (Cromarty 1996).

9.2 Herpetofauna

Native lizard species include copper skink (*Cyclodina aenea*), shore skink (*Oligosoma smithii*), and moko skink (*Oligosoma moco*), which are predominantly found amongst the dune systems (Rasch 1989; Wildland Consultants Ltd 2000e). There is a high possibility that forest gecko (*Hoplodactylus granulatus*), common gecko (*Hoplodactylus maculatus*) and Pacific gecko (*Hoplodactylus pacificus*) are also

present (Wildland Consultants Ltd 2000e). Introduced rainbow skinks are well established in the Tauranga area.

9.3 Mammalian species

Feral cats (*Felis catus*), ship rats (*Rattus rattus*), Norway rats (*Rattus norvegicus*), goats (*Capra hircus*), pigs (*Sus scrofa*), house cats (*Felix catus*), stoats (*Mustela erminea*), ferrets (*Mustela furo*), weasels (*Mustela nivalis*), brush-tailed possums (*Trichosurus vulpecula*), dama wallabies (*Macropus eugenii*), European hedgehogs (*Erinaceus europaeus*), house mice (*Mus musculus*), brown hares (*Lepus europaeus*), and rabbits (*Oryctolagus cuniculus*) are present in the ecological district. Stray dogs (*Canis familiaris*) and cattle (*Bos taurus*) are occasionally recorded, but these have not established feral populations. Both short-tailed bats (*Mystacina tuberculata rhyacobia*; nationally endangered) and long-tailed bats (*Chalinolobus tuberculatus*; nationally vulnerable) have been recorded in the area infrequently (Rasch 1989).

9.4 Fish species

The native fish fauna of the Tauranga Ecological District is relatively diverse due to the proximity to the coast. Many of the native fish species are diadromous, requiring part of the life cycle in saltwater, and as such can be found in many rivers and streams that empty into the sea or harbours and which lack artificial or natural barriers (Beadel *et al*. 1999). Short-jawed kokopu (*Galaxias postvectis*), giant kokopu (*Galaxias argenteus*) and banded kokopu (*Galaxias fasciatus*) are all found in the ecological district (Rasch 1989; Wildland Consultants Ltd 2001b). The short-jawed kokopu, giant kokopu, and long-finned eels (*Anguilla dieffenbachii*) are all classed as chronically threatened - gradual decline (Hitchmough 2002). Common smelt (*Retropinna retropinna*), short-finned eels (*Anguilla australis*), red-finned bully (*Gobiomorphus huttoni*), common bully (*Gobiomorphus cotidianus*), torrentfish (*Cheimarrichthys fosteri*) and inanga (*Galaxias maculatus*) are also present. Yellow-eyed mullet (*Agonostomus forsterii*) can be found in the lower reaches of the waterways (Wildland Consultants Ltd 2000e). Rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) have been introduced to many streams and rivers in the area.

9.5 Invertebrate species

There is no published list of invertebrate species found in the Tauranga Ecological District (Rasch 1989). However, some notable indigenous invertebrates have been reported, including several species of minute snails in the vegetation at the base of Mauao, and *Mecodema atrox*, a type of ground beetle classified as sparse by Hitchmough (2002). Koura (*Paranephrops planifrons*) are present in freshwater streams, as is a wide range of caddis-flies, stoneflies, and mayflies (Hatton *et al.* 1975). Estuarine environments within the Tauranga Ecological District provide habitat for a wide range of intertidal fauna such as mud snails (*Amphibola crenata*), crabs (*Helice crassa*), and pipi (*Paphies australe*) (Barker and Larcombe 1976).

Watt (1982) considered that 80-90% of the estimated 20,000+ insect taxa in New Zealand are endemic. Several studies have found a high incidence of insect endemism in very small areas of indigenous habitat (e.g. Ramsay *et al.* 1988; Kuschel 1990;

May 1993). Therefore, it should be noted that with perhaps 50% of the insect species in New Zealand yet to be described, and many more than that are yet to be named (Beadel *et al*. 1999), it is likely that the Tauranga Ecological District contains several invertebrate species that are endemic to the district.

Introduced insects such as wasps (*Vespula germanica, V. vulgaris, Polistes chinensis*) and honey bees (*Apis mellifera*) are the most notable of the exotic species. Honey bees and bumble bees (*Bombus* spp.) are used commercially for the pollination of fruit crops in orchards, and honey bees for honey production. The introduced gorse seed weevil (*Apion ulicis*) is used to control gorse (*Ulex europaeus*).

10. HUMAN HISTORY AND LAND USE

The Bay of Plenty region was extensively settled by Maori, especially around the coastal margins, estuaries and major river valleys. The pattern of settlement reflects the availability of food, the suitability of soils for horticulture, and the situation of defensive sites for the building of pa (Beadel *et al*. 1999). Traditionally, the Bay of Plenty region is considered to be the landing place of seven of the original canoes from Hawaiki, of which at least two landed in the Tauranga Ecological District: Takitimu (Tauranga Harbour) and Te Arawa (Maketu Estuary). Several others are recorded by tradition as having passed by or called in briefly, leaving a few settlers and then passing on (Tauranga District Council 1996).

There is archaeological evidence that the Tauranga Ecological District has been occupied for approximately 1,000 years, although this is subject to some debate. Settlement was especially intensive, with archaeological sites highly concentrated about the Tauranga Harbour (Department of Conservation 1997), and over 30 kaainga (villages) in the region at 1840 (Stokes 1980). As a result of this there are many tribes which have established themselves in or around the district at one time or another and have tangata whenua status in the area. Mauao has three associated tribes in the area, all of whom consider it part of their whakapapa (heritage): Ngati Ranginui, Ngaiterangi and Ngati Pukenga. Other more or less related tribes also occupied Tauranga Harbour at the same time. Stokes (1980) provides a detailed account of the succession of tribal invasions and warfare that has occurred in this region.

The Maori occupiers built many pa and villages, and cultivated large tracts of land for kumara and taro. Kumara grew especially well in the fertile soils of the lowlands, where early European settlers found large areas under cultivation. Cultivation was carried out by a system of burning an area, planting for several seasons, and then leaving it to lie fallow for a period, after which any regenerating vegetation would be burnt and the ashes used as fertiliser (Stokes 1980). The remains of many of these sites of occupancy can be seen in the terraces and shell middens on hillsides in the area, but most lowland sites have been destroyed by subsequent land development (Stokes 1980).

European arrival saw the introduction of potatoes, pigs, corn, wheat, and cattle, as well as a variety of pest plants and animals such as rats and brush-tailed possums. Early European settlers lived in or near the local Maori villages, sometimes as part of the tribe (Stokes 1980). Later colonists lived in small villages, often at sites that are

now towns and cities. These people cleared the land in a similar fashion to the local Maori, by burning. However, the land was then sown in pasture species and grazed by cattle and sheep to keep down regenerating native species. At first little effort was made to log the native forest before clearing, although later arrivals would selectively log the podocarp species (Town and Country Planning Branch, Ministry of Works 1962). The arrival of Europeans also saw the introduction of money and firearms as well as the arrival of numerous diseases, each of which had a major impact on the local Maori population.

Today, agriculture and horticulture constitute the main land uses in the Tauranga Ecological District. However, there is a large and increasing urban area in Tauranga city and many other smaller towns in the area. These townships were originally established around mission stations and sites chosen especially for settlement, which was aided by distribution of land confiscated from the local Maori after land wars. Gold strikes at places such as Te Puke also enticed settlers from other parts of New Zealand and overseas (Stokes 1980).

Urban areas are focussed on the delivery of primary services to the surrounding rural areas, especially in the agricultural and horticultural regions. Plantation forestry is also an important land use in the Tauranga Ecological District, although this is insignificant in comparison to the plantation forests found in other parts of the Bay of Plenty region (Town and Country Planning Branch, Ministry of Works 1962). The Port of Tauranga also provides employment for many people, with large volumes of timber and other resources being shipped from here to destinations overseas.

11. FURTHER WORK

The following actions are required to complete a PNAP survey for Tauranga Ecological District.

- Prepare vegetation type map of Tauranga Ecological District using the RDAM as the base map:

  - Onscreen digitising.
  - Field checking as required.

- Undertake GIS analysis of 1840 vegetation cover, bioclimatic zones, landforms, present day vegetation cover, extent of protected areas.

- Identify RAPs and potential RAPs for field survey using PNAP evaluation criteria. Many RAPs will be able to be identified from existing information, but some will require field checking of site boundaries, and some sites, RAPs, and all potential RAPs will require full field surveys.

- Identify landowners.

- Prepare letter to landowners/managers/residents describing the survey.

- Prepare field survey record sheets.

- Undertake field survey.

- Input field data into GIS and re-run data analysis (bioclimatic zones, landforms, present day vegetation cover).

- Prepare RAP descriptions and maps.

- Prepare maps for final report:

  - PNAs and RAPs;
  - Current day vegetation cover;
  - Landforms;
  - Bioclimatic zone;
  - Vegetation history map.

- Prepare final report - a draft contents page for the final report is presented in Appendix 5.

12. THREATENING PROCESSES

Protected areas within the Tauranga Ecological District are very limited in extent. The Department of Conservation (DOC) administers only 0.7% of the total land area (Department of Conservation 1997), which is a miniscule proportion compared to ecological districts such as Rotorua Lakes, another relatively developed district, which has 14% land administered by DOC. Smaller areas within the district are protected by covenant, e.g. QEII open space covenant. With the limited area of natural environment in the Tauranga Ecological District, any process that threatens native flora or fauna is likely to be significant. At the present time the most serious issues are the invasion of plant pest species into many of the natural areas, the destruction of these areas by the brush-tailed possum, predation of indigenous species by mammal pest animal species (e.g. mustelids, rats, and mice), and disturbance of nesting and roosting areas.

Fire, urban development and mining pose a threat to dune vegetation and rare coastal forests, especially as unmodified vegetation of this type is extremely rare. There is a significant lack of formally protected areas of these two vegetation types in the Tauranga Ecological District, and they are significantly reduced on a national scale. Cosatal areas also see a significantly increasing conflict between a recreational focussed human community and the specialised nesting, feeding and roosting requirements of many threatened bird species.

Freshwater wetland vegetation and habitat are highly threatened by draining of the wetlands for agricultural purposes and encroachment by willows. This is especially an issue for sites like the Arawa wetland near Maketu Estuary, which was once part of a vast wetland stretching between Maketu and the Tauranga Harbour. The wetland now encompasses only 24 ha and has been substantially modified by the lowering of the watertable and invasion of weeds such as grey willow (*Salix cinerea*).

Nevertheless, the remaining wetland habitat is still used extensively by a range of bird species and contains two rare ferns; *Thelypteris confluens* and *Cyclosorus interruptus* (Beadel 1989b). Of the wetland vegetation types, kahikatea dominated wetland forest is the least common, as the majority of this forest type was on higher ground suitable for farming and consequently has largely been cleared for agriculture.

13. RELATION TO ADJOINING DISTRICTS

Three ecological districts share boundaries with the Tauranga Ecological District.

1. *Waihi Ecological District* shares only a very small portion of the boundary on the northern point of the Tauranga Ecological District and is demarcated by a change in geology from sedimentary rock types to rocks of volcanic origin.

2. *Te Aroha Ecological District* is situated to the west of the Tauranga Ecological District and south of the Waihi Ecological District. It comprises the northern half of the Kaimai Range, which is largely steep hill country of volcanic origin and is predominantly forest clad. The eastern side of the Kaimai Range within this ecological district demarcates the western boundary of the Tauranga Ecological District.

3. *Otanewainuku Ecological District* comprises the Mamaku Plateau to the west and south of Tauranga Ecological District. The boundary between the two is demarcated by the change between sedimentary rock types (Tauranga) and volcanic rock types (Otanewainuku).

A fourth ecological district (Motiti), to the north, is separated from the Tauranga Ecological District by a stretch of water. This ecological district consists of a group of small islands and Motiti itself, probably part of the same drowned volcanic plateau as Mauao.

SELECTED BIBLIOGRAPHY AND REFERENCES

Adams J.A. 1989: Tauranga Harbour and Little Waihi Estuary, proposed estuarine protection zone. *Wildlife Evidence for Tauranga County District Scheme Review 3*. Department of Conservation, Rotorua.

Akers A. 1998: Inanga spawning sites survey – Tauranga Management Area. *File Note RWL021*. 2 pp plus data sheets.

Anon 1998: A framework for monitoring ecological integrity in the Bay of Plenty region. *Lucas Associates*.

Barker M.F. and Larcombe M.F. 1976: Aspects of the ecology of Tauranga Harbour, Volumes 1 & 2. *Bioresearches Ltd.* Bay of Plenty Catchment Commission and Regional Water Board. Brownsey P.J. 1973.

Bay of Plenty Conservancy, Department of Conservation 1993: Land inventory systems, Tauranga Ecological District.

Bay of Plenty Regional Policy Statement: Environment Bay of Plenty, Whakatane.

Beadel S.M. 1987: An account of some sand dune communities of the eastern Bay of Plenty. *Rotorua Botanical Society Newsletter 11*: 29 - 39.

Beadel S.M. 1988a: A register of threatened and local plant taxa in the Eastern Region, Department of Conservation: Their distribution and status. *Technical Report Series No. 6.* Department of Conservation, Rotorua. 72 pp plus map.

Beadel S.M. 1988b: Maps of the proposed estuarine protection zones of Tauranga Harbour and Little Waihi Estuary. 1:10,000.

Beadel S.M. 1989a: Botanically significant areas within proposed purchase zone, Matakana Island. Department of Conservation, Rotorua. 4 pp plus map.

Beadel S.M. 1989b: Botanical values of the Arawa Wetlands, Maketu. Department of Conservation. 10 pp plus appendices.

Beadel S.M. 1989c: Notes on the vegetation and flora of the foredune system, seaward side of Matakana Island. Department of Conservation, Rotorua. 25 pp.

Beadel S.M. 1989d: Notes on the vegetation and flora of Tauranga Harbour and Little Waihi Estuary, Bay of Plenty. *Wildland Consultants Ltd.* Report prepared for Department of Conservation, Eastern Region.

Beadel S.M. 1989e: Tauranga Harbour and Little Waihi Estuary, proposed estuarine protection zone (Tauranga County Council): Botanical evidence presented at a district scheme hearing. Department of Conservation, Rotorua. 35 pp.

Beadel S.M. 1990: An account of the vegetation and flora of the north-western end of Matakana Island, Tauranga Harbour. *Rotorua Botanical Society Newsletter 19*: 24 - 35.

Beadel S.M. 1990: Problem plant strategy: Bay of Plenty Conservancy. Department of Conservation, Rotorua. *Wildland Consultants Ltd Contract Report.* 21 pp plus appendices.

Beadel S. M. 1991a: Botanical conservation values. Metal Haulage Ltd: Mining application. Katikati. Department of Conservation, Rotorua. 11 pp plus appendices.

Beadel S. M. 1991c: Vegetation and flora of Waihi Estuary Wildlife Management Reserve. Department of Conservation, Rotorua. 11 pp plus appendices.

Beadel S.M. 1992a: Eleven plant checklists for coastal Bay of Plenty. *Wildland Consultants Ltd Contract Report No. 375*.

Beadel S.M. 1992b: Tauranga Harbour wetland vegetation. Bay of Plenty Regional Council, Whakatane. *Wildland Consultants Ltd Contract Report.* 82 pp plus maps.

Beadel S.M. 1992c: Threatened and local plants of Bay of Plenty Conservancy. *Technical Report Series No. 13*. Department of Conservation, Rotorua. 77 pp plus maps.

Beadel S.M. 1992d: Vascular plant species lists of several sand dunes, estuaries and headlands in the Bay of Plenty. 12 pp.

Beadel S.M. 1992e: Vegetation and flora of Te Puna Quarry, Tauranga. *Wildland Consultants Ltd.* 10 pp.

Beadel S.M. 1993: Threatened and local plant inspection and management programme 1993/94. Tauranga Field Centre. Department of Conservation. 28 pp.

Beadel S.M. 1994a: Eastern Papamoa sand dunes – conservation assessment. *Wildland Consultants Ltd.* Report prepared for NIWA.

Beadel S.M. 1994b: Significant indigenous vegetation of the Bay of Plenty coastal zone. *Wildland Consultants Ltd.* Report prepared for Bay of Plenty Regional Council. 412 pp.

Beadel S.M. 1994c: Vegetation management, Waikareao Estuary, Tauranga Harbour. *Wildland Consultants Ltd.* Report prepared for Tauranga District Council. 36 pp.

Beadel S.M. 1994d: Waimapu Walkway vegetation management. *Wildland Consultants Ltd.* Report prepared for Tauranga District Council. 14 pp.

Beadel S.M. 1995a: Potential environmental weeds of the Bay of Plenty region. Environment Bay of Plenty, Whakatane. *Wildland Consultants Ltd Contract Report.* 133 pp.

Beadel S.M. 1995b: Vegetation and fauna habitats of Bay of Plenty region (preliminary scoping study). Environment BOP, Whakatane. *Wildland Consultants Ltd Contract Report No. 131*. 33 pp.

Beadel S.M. 1995c: Vegetation and flora of lands administered by Bay of Plenty Conservancy. Department of Conservation. Rotorua. *Wildland Consultants Ltd Contract Report No. 130*. 556 pp.

Beadel S.M. 1995d: Vegetation and Flora of 177 Hot Springs Road, Katikati. M. & N. Storey, Taupo. Contract Report No. 133. 16 pp.

Beadel S. M. 1995e: Vegetation and flora of Mount Drury, Moturiki, Ocean Beach, and Pilot Bay, Mount Maunganui. Tauranga District Council, Tauranga. 31 pp.

Beadel S.M. 1995f: Vegetation and flora of Tauranga District Council coastal reserves (Shark Alley to Papamoa). Tauranga District Council, Tauranga. 49 pp.

Beadel S.M. 1995g: The vegetation and flora of Te Irirangi Pa, Bay of Plenty. *Wildland Consultants Ltd*. 7 pp.

Beadel S.M. 1996: Vegetation and flora of Jess Road saltmarsh proposed restoration area. Department of Conservation, Rotorua. *Wildland Consultants Ltd Contract Report No. 136.* 19 pp plus maps.

Beadel S.M. 1998a: Digitisation of selected coastal ecological sites, Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 208*. 3 pp.

Beadel S.M. 1998b: Willow control in Matahora Reserve, Tauranga. *Wildland Consultants Ltd Contract Report No. 207*. 7 pp.

Beadel 2004: Mauao (Mount Maunganui). *Rotorua Botanical Society Newsletter No. 43*.

Beadel S.M., Adams J.S., Bennett S.A., Owen K.L. Taylor P.C. and Rasch G. 1989: Pingao survey, seaward side of Matakana Island, Tauranga. *Unpublished Data.* Department of Conservation, Rotorua. 26 pp.

Beadel S.M.; Cashmore P. and Bishop C. 1996: Vegetation monitoring, Waihi Wildlife Management Reserve. *Wildland Consultants Ltd Contract Report No. 152.* 35 pp.

Beadel S.M. and Gosling D.S. 2001: Te Puke sewage treatment plant wetland. *Wildland Consultants Ltd Contract Report No. 422*. Prepared for Duffill Watts & King Ltd, Tauranga. 14 pp.

Beadel S.M.; Mackinnon S.M. and Shaw W.B. 1996: Geothermal vegetation of the Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 155.* 234 pp.

Beadel S.M. and Shaw W.B. 1999a: Ecological aspects of the Katikati Urban Growth Study. *Wildland Consultants Ltd Contract Report 254.* Report prepared for Beca Carter Hollings and Ferner Ltd and Western Bay of Plenty District Council. 15 pp.

Beadel S.M. and Shaw W.B. 1999b: Ecological assessment of the proposed Omokoroa structure plan. *Wildland Consultants Ltd Contract Report No. 255*. 19 pp.

Beadel S.M. and Shaw W.B. 1999c: Katikati Urban Growth Study. *Wildland Consultants Ltd Contract Report No. 244.*

Beadel S.M. and Shaw W.B. 1999d: Omokoroa structure plan. *Wildland Consultants Ltd Contract Report No. 243.*

Beadel S.M. and Shaw W.B. 2000: Category one natural heritage sites in the Tauranga Ecological District and Te Aroha and Waihi Ecological Districts in the Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 353*. 17 pp plus maps.

Beadel S.M.; Shaw W.B. and Gosling D.S. 1999: Taneatua Ecological District. Survey report for the Protected Natural Areas Programme. Department of Conservation, Rotorua. 268 pp.

Beadel S.M. and Wallace S. 1989: The vegetation and flora of Waihi Estuary. *Rotorua Botanical Society Newsletter 18*: 14 - 20.

Beca Carter Hollings and Ferner (1986): Western Harbour recreation study. *Tauranga County Council.*

Bellamy A.C. (ed) 1982: Tauranga 1882 – 1982. Tauranga City Council. 296 pp.

Bergin D.O. 1991: Experimental restoration of indigenous saltmarsh species, Maketu Estuary. *Forest Research Institute Contract Report: FEW 91/31*. Prepared for Department of Conservation, Wellington. 19 pp.

Bergin D.O. 1994: Performance of transplanted indigenous saltmarsh species, Maketu Estuary. *Conservancy Advisory Science Notes No. 90.* Department of Conservation, Wellington. 16 pp.

Bioresearches Ltd 1976: Ecology of Maketu Inlet. *Unpublished report* to Bay of Plenty Catchment Board.

Bishop C. and Beadel S.M. 1997: Weed distribution on Mauao (Mount Maunganui) Historic Reserve. *Wildland Consultants Ltd Contract Report No. 197*. 17 pp plus maps.

Bibby C.J.; Shaw W.B.; Beadel S.M. and Hosking M.A. 1999: Vegetation and flora of Mauao Historic Reserve. Volumes 1 & 2. *Wildland Consultants Ltd Contract Report No. 266*. 57 pp plus maps.

Boffa Miskell Ltd 1998a: Candidate sites of ecological significance. Working report No.2. Possible sites for inclusion. Report Prepared for Western Bay of Plenty District Council. 62 pp. plus maps.

Boffa Miskell Ltd 1998b: Candidate sites of ecological significance. Working report No.2. Possible sites for inclusion. Report Prepared for Western Bay of Plenty District Council. 25 pp. plus maps.

Cameron E.K., de Lange P.J., Given D.R., Johnson P.N. and Ogle C.C. 1995: New Zealand Botanical Society threatened and local plant lists (1995 revision). *New Zealand Botanical Society Newsletter 39*: 15 – 28.

Campbell H.J. 1995: Compliance report. Resource consents to take water from streams under abstraction pressure in the Bay of Plenty region. *Environmental Report No. 95/18.* Environment Bay of Plenty, Whakatane. 62 pp.

Cromarty P. 1996: A directory of wetlands in New Zealand. D.A. Scott (ed.). *Department of Conservation.*

Champion P.D. and Sagar P.M. 1999: Investigation for Te Tawa rural residential subdivision: an inventory of wetland plants and birds. *NIWA Client Report: HDL 902049*. Prepared for Heybridge Developments Ltd.

Chudleigh B. 1999: Report on the Matua saltmarsh. *Unpublished report.* Prepared for Tauranga District Council.

Clarkson B.D. 1996: Evidence presented before the Environment Court, Tauranga. Appeal No. RMA 1331/95.

Cooper S. (et al.) 1998: Maketu Estuary bird life. An assignment as a requirement for the Diploma in Marine Studies. On Tauranga AO file BIRD01 F78.

Cunningham B and Musgrave K. 1989: A history of Mount Maunganui. *Printcorp Services Ltd.* 160 pp.

Department of Conservation 1994a: Draft conservation management strategy for East Coast Conservancy 1995 – 2005. Volumes 1 & 2.

Department of Conservation 1994b: Schedule of sites of significant conservation value, western Bay of Plenty. Volumes 1, 2a, 2b, 3.

Department of Conservation 1996: Conservation management strategy for Bay of Plenty Conservancy, 1997 – 2007. Volumes 1 & 2. *Department of Conservation*, Rotorua.

Environment BOP 1995a: Proposed Regional Coastal Environment Plan, Volumes 1 & 2. *Bay of Plenty Regional Council*. Whakatane.

Environment BOP 1995b: Proposed plant pest management strategy for the Bay of Plenty Region. *Operation Report 95/2*. Environment Bay of Plenty, Whakatane. 113 pp.

Froude V.A. 1989: Proposed estuarine protection zone, Tauranga Harbour and Little Waihi Estuary. *Planning Evidence for Tauranga County District Scheme Review 3*. Department of Conservation, Rotorua.

Gibb J. 1996: Tauranga Harbour coastal hazards scoping project. Prepared for Bay of Plenty Regional Council.

Gillespie P.A. 1988: Preliminary report on the feasibility of salt marsh restoration in the Maketu Estuary, Bay of Plenty. *Unpublished Cawthron Institute Contract report.* Prepared for the Department of Conservation, Rotorua.

Given D.R., Sykes W.R., Williams P.A., and Wilson C.M. 1987: Threatened and local plants of New Zealand. A revised checklist. *Botany Division Report.* Department of Scientific and Industrial Research. 16 pp.

Hatton C., Thomson M., Donovan W.F. and Larcombe M.F. 1975: Ecological monitoring of the lower reaches of the major Bay of Plenty Rivers, the Ohau Channel and parts of the Tauranga Harbour. Volume 3. *Bioresearches Ltd.* Report Prepared for the Bay of Plenty Catchment Commission and Regional Water Board

Healy J., Schofield J.C. and Thompson B.N. 1974: Geological map of New Zealand, sheet 5 – Rotorua. 1:250 000. *New Zealand Geological Survey*. Department of Scientific and Industrial Research, Wellington.

Hunt K. 1999: Summary of monitoring and surveys achieved in the Tauranga area. Report prepared for Department of Conservation, Bay of Plenty Conservancy, Rotorua and Tauranga.

Kenny J.A. and Hayward, B.W. (eds.) 1996: Inventory and maps of important geological sites and landforms in the Bay of Plenty region. *Geological Society of New Zealand Miscellaneous Publication 86.* Geological society of New Zealand, Lower Hutt. 47 pp plus maps.

Kuschel G. 1990: Beetles in a suburban environment: a New Zealand case study. *Department of Scientific and Industrial Research Plant Protection Report No. 3.*

McIntosh J. 1994: Water and sediment quality of Tauranga Harbour. *Environment Bay of Plenty Environmental Report 94/10*. Environment BOP, Whakatane.

May B.M. 1993: Larvae of Curculionoidea (Insecta: Coleoptera): a systematic overview. *Fauna of New Zealand 28*. Manaaki Whenua Press, Christchurch. 226 pp.

Miller N. 1984: Orokawa Scenic Reserve botanical survey. *Unpublished DSIR Report*. Prepared for the Department of Lands and Survey. 16 pp.

Miller N. 1985: Orokawa Scenic Reserve field trip. *Rotorua Botanical Society Newsletter 6*: 8.

Miller N.C. and Shaw W.B. 2003: Ecological assessment of a sea wall and beach replenishment at Sulphur Point, Tauranga. *Wildland Consultants Ltd Contract Report No. 658*. Prepared for Beca Carter Hollings and Ferner Ltd. 6 pp.

Milligan G. 1999: Bowentown Heads and sand dunes. *Rotorua Botanical Society Newsletter 33*: 49 - 50.

Mount Maunganui Borough Council 1989: Mount Maunganui recreation reserves. Management plans.

Murray K.N. 1978: Ecology and geomorphology of Maketu Estuary, Bay of Plenty. *Unpublished MSc Thesis*, University of Waikato.

Nicholls J.L. 1969: Forest types if proposed sanctuary in Katikati State Forest. *Unpublished Report*. Forest Research Institute, Rotorua. 3 pp.

Owen K.L. 1993: Protection and restoration of marshbird habitat in Tauranga Harbour, Volume 1. *Department of Conservation Technical Report Series 17.*

Park S.G. 1991: Bay of Plenty Regional Council Coastal Overview Report. *Bay of Plenty Regional Council Technical Publication No. 3.*

Park S.G. 1999: Changes in abundance of seagrass (*Zostera* spp.) in Tauranga Harbour from 1959-96. *Environmental Report 99/30*. Environment BOP, Whakatane. 19 pp.

Partridge T.R. 1992: The sand dune and beach vegetation inventory of New Zealand. *DSIR Land Resources Scientific Report Number 15*. Christchurch. 253 pp.

Patterson M.S. 1995: A survey of the sand dune vegetation within the eastern Bay of Plenty. Western Bay of Plenty District Council. 7 pp plus maps.

Pierce R.J. 2002: Distribution of North Island brown kiwi in the Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 528*. Report prepared for Environment BOP. 9 pp.

Power F.W., McIntosh J.J., O'Shaughnessy B.W. and Park S.G. 1991: Marine pollution and water quality of Tauranga Harbour, New Zealand. Paper delivered to "*Coastal Engineering – Climate for Change*". 10th Australasian Conference on Coastal and Ocean Engineering, Auckland, 2 – 6 December 1991.

Quayle A.M. 1984: The climate and weather of the Bay of Plenty Region. *New Zealand Meteorological Service Miscellaneous Publication 115(1) 2nd Edition.* Ministry of Transport, Wellington. 56 pp.

Ramsay G.W., Meads M.J., Sherley G.H. and Gibbs G.W. 1988: Research on terrestrial insects of New Zealand. Wildlife Research Liaison Group, *Research Review No. 10.* 49 pp.

Rasch G. 1989: Wildlife and wildlife habitat in the Bay of Plenty region. *Regional Report Series 11*. Department of Conservation, Rotorua. 136 pp.

Richmond C.J. and Forbes S.P. 1990: Maketu Estuary restoration strategy. *Technical Report Series No. 3.* Department of Conservation, Rotorua. 100 pp.

Rijske W.C. and Cotching W.E. 1995: Soils and land use of part Tauranga County, North Island New Zealand. *Landcare Research Technical Record*. Manaaki Whenua –Land Care Research, Hamilton. 111 pp.

Royal Forest and Bird Society of New Zealand Inc. 1991: Marram on Mount Maunganui sand dunes. *Unpublished Report*. Copy held by Department of Conservation. Tauranga. 3pp.

Shaw W.B. 1996a: Rural subdivision and natural heritage protection in the Western Bay of Plenty District. *Wildland Consultants Ltd Contract Report No. 171*. 46 pp.

Shaw W.B. 1996b: The conservation and related conservation values of the Dyet property, Tauranga. *Wildland Consultants Ltd Contract Report No. 158.* 10 pp.

Shaw W.B. 1997a: Rural subdivision and natural heritage protection in the Western Bay of Plenty District. *Wildland Consultants Ltd Contract Report No. 171*. 46 pp.

Shaw W.B. 1997b: Vegetation of a potential stormwater disposal site, Athenree Estuary. *Wildland Consultants Ltd Contract Report No. 203.* Report prepared for Dufill Watts and King Ltd. 4 pp.

Shaw W.B. 1998a: Tauranga strategic roading - Northern Arterial Proposal. *Wildland Consultants Ltd Contract Report No. 225.* 8 pp.

Shaw W.B. 1998b: Tauranga strategic roading - Route J proposal. *Wildland Consultants Ltd Contract Report No. 227.* 5 pp.

Shaw W.B. 1998c: Tauranga strategic roading - Route K proposal. *Wildland Consultants Ltd Contract Report No. 226.* 8 pp.

Shaw W.B. 1998d: Vegetation of the Shirley Property, Te Puna. *Wildland Consultants Ltd Contract Report No. 229.* Report prepared for G.D. & K.A. Shirley. 5 pp.

Shaw W.B. 1999a: Vegetation and fauna of the Whakaturou Trust Property, Taumata, Western Bay of Plenty District. *Wildland Consultants Ltd Contract Report No. 250.* Report prepared for Whakaturou Trust. 6 pp.

Shaw W.B. 1999b: Western BOP Plenty District Council evidence. *Wildland Consultants Ltd Contract Report No.242.* 27 pp.

Shaw W.B. 2001a: Ecological aspects of the proposed Tauranga eastern arterial. *Wildland Consultants Ltd Contract Report No. 428.* Prepared for Russell de Luca, Tauranga. 15 pp.

Shaw W.B. 2001b: Ecological assessment of the Warren property, Joyce Road, Western Bay of Plenty District. *Wildland Consultants Ltd Contract Report No. 371a*. Prepared for Andy Warren. 20 pp.

Shaw W.B. 2002a: Ecological assessment of saltmarsh on the Heybridge Developments property at Te Puna. *Wildland Consultants Ltd Contract Report No. 481*. Prepared for Heybridge Developments Ltd. 14 pp.

Shaw W.B. 2002b: Overview of ecosystems, habitats and species, and threats to indigenous biodiversity in the Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 537*. 8 pp.

Shaw W.B. 2002c: Western Bay of Plenty coastal structure resource consents: 1. Retaining wall at the Bowentown Boating and Sportfishing Club. *Wildland Consultants Ltd Contract Report No. 487*. Prepared for Beca Carter Hollings & Ferner Ltd. 8 pp.

Shaw W.B. 2002d: Western Bay of Plenty coastal structure resource consents: 2. Rock wall at the Kotuku Reserve, Te Puna estuary. *Wildland Consultants Ltd Contract Report No. 488*. Prepared for Beca Carter Hollings & Ferns Ltd. 7 pp.

Shaw W.B. 2002e: Western Bay of Plenty coastal structure resource consents: 3. Excavation of the Tanners Point boat ramp. *Wildland Consultants Ltd Contract Report No. 493*. Prepared for Beca Carter Hollings & Ferns Ltd. 8 pp.

Shaw W.B. and Allen R.B. 2002: Ecological impacts of sea couch and salt water paspalum in Bay of Plenty estuaries. *Wildland Consultants Ltd Contract Report No. 500*. Prepared for Department of Conservation. 14 pp.

Shaw W.B. and Beadel S.M. 1997a: Natural heritage of Tauranga District. A preliminary report. *Wildland Consultants Ltd Contract Report No. 172.* 20 pp.

Shaw W.B. and Beadel S.M. 1997: Vascular plant taxa of conservation concern in Whakatane Field Centre - a review. *Wildland Consultants Ltd Contract Report No. 186.* 24 pp.

Shaw W.B. and Beadel S.M. 1999: Bay of Plenty Region natural heritage information. *Wildland Consultants Ltd Contract Report No. 237.* Part 1 - Overview and future directions - 67 pp; Part 2 - Review - 213 pp.

Shaw W.B.; Grove P.B. and Chudleigh B.J. 1999: Ecological survey of the Park Road Estuary, Katikati. *Wildland Consultants Ltd Contract Report No. 298.* 18 pp.

Shaw W.B.; Grove P.B. and Hosking M.A. 1998: *Spartina* in the Maketu Estuary. *Wildland Consultants Ltd Contract Report No. 230.* 26 pp.

Shaw W.B. and Kusabs I.A. 2000: Ecological assessment of roading options at Omokoroa, Tauranga. *Wildland Consultants Ltd Contract Report No. 354.* 27 pp.

Shaw W.B.; Perfect A.J. and Beadel S.M. 1999: Survey and monitoring priorities for the Tauranga Area, Department of Conservation. *Wildland Consultants Ltd Contract Report No. 273.* Volume I - 50 pp; Volume II - 472 pp.

Stokes E. 1980: A history of Tauranga County. *Dunmore Press.* 489 pp.

Surman M., Clarke R. and Carter M. 1999: Tauranga Harbour sediment source survey. *Environment Bay of Plenty Operations Report 98/13.* Environment BOP, Whakatane. 141 pp

Tait D. 1993: *Austrofestuca littoralis*; Distribution and vulnerability on eastern Papamoa Beach, New Zealand. *Unpublished report.* Land Resource Management Course. Bay of Plenty Polytechnic, Tauranga. 42 pp.

Tauranga County Council 1986: Management plan for Papamoa Beach Reserve. Prepared by Trevor Thompson Ltd.

Tauranga District Council 1996: Draft Mauao management plan. *Tauranga District Council.* Tauranga. 101 pp.

Tauranga District Council 2003: Website: http://www.tauranga.govt.nz/. Website accessed September, 2003.

Town and Country Planning Branch, Ministry of Works 1962: National resources survey, part 2. Bay of Plenty Region. R.E. Owen, Government Printer, Wellington.

Watt J.C. 1982: New Zealand beetles. *New Zealand Entomologist 7(3)*: 213 – 221.

Wildland Consultants Ltd 1999: Physical barriers to domestic pets adjacent to the proposed Park Road subdivision. *Wildland Consultants Ltd Contract Report No. 270*. 1 p.

Wildland Consultants Ltd 2000a: Biodiversity monitoring for Tauranga District 2000 - category 1 significant ecological sites; ecological condition, photopoint monitoring. *Wildland Consultants Ltd Contract Report No. 315*. 158 pp.

Wildland Consultants Ltd 2000b: Ecological assessment of Papamoa East, Tauranga District. *Wildland Consultants Ltd Contract Report No. 358*. 55 pp.

Wildland Consultants Ltd 2000c: Indigenous biodiversity of Tauranga District - monitoring manual. *Wildland Consultants Ltd Contract Report No. 329*. 19 pp.

Wildland Consultants Ltd 2000d: Indigenous biodiversity of Tauranga District – Selection of indicators for state of the environment monitoring and report. *Wildland Consultants Ltd Contract Report No. 287*. 36 pp.

Wildland Consultants Ltd 2000e: Indigenous biodiversity of Tauranga District – State of the environment report. *Wildland Consultants Ltd Contract Report No. 309*. 191 pp.

Wildland Consultants Ltd 2000f: Sand dune vegetation of Tauranga District. *Wildland Consultants Ltd Contract Report No. 319*.

Wildland Consultants Ltd 2001a: An assessment of fisheries values and fish passage over the Raymond Dam, Whataroa Stream, Te Puke. *Wildland Consultants Ltd Contract Report No. 420*. Prepared for Western Bay of Plenty District Council. 10 pp.

Wildland Consultants Ltd 2001b: An assessment of vegetation, avifauna and fisheries and potential effects of lowering the Waihi Beach Reservoir. *Wildland Consultants Ltd Contract Report No. 427*. Report prepared for Western Bay of Plenty District Council. 28 pp.

Wildland Consultants Ltd 2001c: Ecological assessment of a proposed urban growth area at Waihi Beach. *Wildland Consultants Ltd Contract Report No. 389*. Prepared for Western Bay of Plenty District Council. 44 pp.

Wildland Consultants Ltd 2001d: Privately owned natural areas worthy of protection in the Bay of Plenty (BOP) Region. *Wildland Consultants Ltd Contract Report No. 370*. 16 pp.

Wildland Consultants Ltd 2001e: Restoration of part of the Kaituna wetland for cultural use. *Wildland Consultants Ltd Contract Report No. 446*. Prepared for Environment BOP. 35 pp.

Wildland Consultants Ltd 2001f: Review of ecological aspects of options for further subdivision at Park Road, on the Katikati Peninsula. *Wildland Consultants Ltd Contract Report No. 419*. Prepared for Western Bay of Plenty District Council. 20 pp.

Wildland Consultants Ltd 2002a: Anthenree Fisheries Inspection. *Wildland Consultants Ltd Contract Report No. 474.*

Wildland Consultants Ltd 2002b: Biodiversity monitoring for Tauranga District 2002 – Category 1 significant ecological sites: ecological condition assessment; photopoint monitoring. *Wildland Consultants Ltd Contract Report No. 483*. Prepared for Tauranga District Council. 6 pp plus appendices.

Wildland Consultants Ltd 2002c: Review of Environment BOP wetland database. *Wildland Consultants Ltd Contract Report No. 512*. Prepared for Environment BOP.

Wildland Consultants Ltd 2003a: Ecological constraints to development in the Western Bay of Plenty. *Wildland Consultants Ltd Contract Report No. 555*. Prepared for SmartGrowth, Tauranga. 19 pp.

Wildland Consultants Ltd 2003b: Landscape design for Park Road residential extension, Katikati Peninsula. *Wildland Consultants Ltd Contract Report No. 643*. Prepared for Western Bay of Plenty District Council. 9 pp.

Wilcox M. and Ecroyd C. 1984: Introduced plants on Mt Maunganui. *Rotorua Botanical Society Newsletter 3*: 6 - 7.

Willis D. 1994: New Zealand dotterel on Matakana Island. October 1992 – January 1993. *Technical Report Series No. 23.* Department of Conservation, Rotorua.

PROVISIONAL LIST OF INDIGENOUS VASCULAR PLANT TAXA OF TAURANGA ECOLOGICAL DISTRICT

Gymnosperms

Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Phyllocladus trichomanoides var. *trichomanoides*	tanekaha
Podocarpus totara	totara
Prumnopitys ferruginea	miro
Prumnopitys taxifolia	matai

Monocot. trees and shrubs

Cordyline australis	ti kouka
Cordyline banksii	ti ngahere, forest cabbage tree
Rhopalostylis sapida	nikau

Dicot. trees and shrubs

Alectryon excelsus var. *excelsus*	titoki
Aristotelia serrata	makomako, wineberry
Avicennia marina subsp. *australasica*	manawe, mangrove
Beilschmiedia tawa	tawa
Brachyglottis repanda s.s.	rangiora
Carmichaelia australis	makaka, maukoro
Carpodetus serratus	putaputaweta
Coprosma acerosa	
Coprosma acerosa x *C. repens*	
Coprosma grandifolia	kanono
Coprosma lucida	karamu
Coprosma propinqua subsp. *propinqua*	
Coprosma propinqua subsp. *propinqua* × *C. robusta*	
Coprosma repens	taupata
Coprosma rhamnoides	
Coprosma robusta	karamu
Coprosma tenuicaulis	hukihuki
Coriaria arborea var. *arborea*	tutu
Corynocarpus laevigatus	karaka
Dodonaea viscosa	akeake
Dysoxylum spectabile	kohekohe
Entelea arborescens	whau
Fuchsia excorticata	kotukutuku
Fuchsia perscandens	
Gaultheria antipoda	tawiniwini

Geniostoma rupestre var. *ligustrifolium*	hangehange
Griselinia lucida	puka
Hebe stricta var. *stricta*	koromiko
Hedycarya arborea	porokaiwhiri
Hoheria populnea var. *lanceolata*	houhere, lacebark
Knightia excelsa	rewarewa
Kunzea ericoides var. *ericoides*	kanuka
Laurelia novae-zelandiae	pukatea
Leptecophylla juniperina subsp. *juniperina*	prickly mingimingi
Leptospermum scoparium	manuka
Leucopogon fasciculatus	mingimingi
Leucopogon fraseri	patotara
Litsea calicaris	mangeao
Macropiper excelsum var. *excelsum*	kawakawa
Melicytus novae-zelandiae	coastal mahoe
Melicytus ramiflorus subsp. *ramiflorus*	mahoe
Metrosideros excelsa	pohutukawa
Myoporum laetum	ngaio
Myrsine australis	mapou
Olearia furfuracea	akepiro
Olearia pachyphylla (historic record, P. de Lange pers. comm.)	
Olearia rani	heketara
Olearia solandri	
Ozothamnus leptophylla	tauhinu
Pimelea arenaria	
Pimelea prostrata s.s.	pinatoro
Pimelea tomentosa	
Pittosporum crassifolium	karo
Pittosporum tenuifolium subsp. *tenuifolium*	kohuhu
Plagianthus divaricatus	marsh ribbonwood, makaka
Pomaderis kumerahou	
Pomaderris phylicifolia	
Pseudopanax arboreus var. *arboreus*	whauwhaupaku, five finger
Pseudopanax crassifolius	horoeka, lancewood
Pseudopanax crassifolius × *P. lessonii*	
Pseudopanax lessonii	houpara
Rhabdothamnus solandri	taurepo
Schefflera digitata	pate
Solanum aviculare var. *aviculare* (incl. *S. a.* var. *albiflorum* and *S. cheesemanii*)	poroporo
Syzygium maire	maire tawake, swamp maire
Vitex lucens	puriri
Weinmannia racemosa	kamahi

Monocot. lianes

Freycinetia banksii	kiekie
Ripogonum scandens	kareao, supplejack

Dicot. lianes

Calystegia sepium	pohue
Calystegia soldanella	panahi
Calystegia tuguriorum	
Calystegia sepium x *C. soldanella*	
Clematis cunninghamii	ngakau-kiore
Clematis paniculata	puawananga
Metrosideros diffusa	rata
Metrosideros fulgens	rata
Metrosideros perforata	aka
Muehlenbeckia australis	puka
Muehlenbeckia complexa	pohuehue
Muehlenbeckia australis x *M. complexa*	
Parsonsia capsularis	akakiore
Parsonia heterophylla	
Rubus australis	
Rubus cissoides	tataramoa
Rubus schmidelioides	akatataramoa

Lycopods and psilopsids

Huperzia varia	Whiri-o-Raukatauri
Lycopodium deuterodensum	puakarimu
Lycopodium volubile	waewaekoukou
Psilotum nudum	
Tmesipteris tannensis	

Ferns

Adiantum cunninghamii	huruhuru tapairu
Adiantum hispidulum	
Asplenium bulbiferum s.s.	mouku
Asplenium flaccidum s.s.	makawe
Asplenium oblongifolium	huruhuruwhenua
Asplenium polyodon	petako
Asplenium terrestre subsp. *maritimum*	
Azolla filiculoides	retoretore
Blechnum chambersii	rereti
Blechnum colensoi	
Blechnum filiforme	panako
Blechnum fluviatile agg.	kiwikiwi
Blechnum novae-zelandiae s.s.	kiokio
Blechnum novae-zelandiae (wetland form; *B. minus* of NZ authors)	
Cardiomanes reniforme	kidney fern
Crepidomanes venosum	
Ctenopteris heterophylla	
Cyathea dealbata	ponga
Cyathea medullaris	mamaku

Cyclosorus interruptus	
Deparia petersenii	
Dicksonia squarrosa	wheki
Diplazium australe	
Doodia australis	pukupuku
Gleichenia dicarpa	
Gleichenia microphylla	waewaekaka
Grammitis sp.	
Histiopteris incisa	matata
Hymenophyllum demissum	irirangi
Hymenophyllum dilatatum	matua mauku
Hymenophyllum multifidum	mauku
Hymenophyllum rarum	mauku
Hymenophyllum sanguinolentum	piripiri
Hymenophyllum scabrum	mauku
Hypolepis ambigua	
Hypolepis dicksonioides	
Hypolepis distans	
Hypolepis lactea	
Lastreopsis glabella	
Lastreopsis hispida	
Leptopteris hymenophylloides	heruheru
Lygodium articulatum	mangemange
Marratia salicina var. *salicina*	para, kingfern
Microsorum pustulatum	kowaowao (hounds tongue fern)
Microsorum scandens	mokimoki
Paesia scaberula	matata
Pellaea rotundifolia	tarawera (button fern)
Pneumatopteris pennigera	pakau
Polystichum richardii	pikopiko (hard shield fern)
Pteridium esculentum	rarahu (bracken)
Pteris comans	
Pteris comans x *P. macilenta*	
Pteris macilenta (of NZ authors)	
Pteris tremula	turawera (shaking brake)
Pyrrosia eleagnifolia	leather-leaf fern
Rumohra adiantiformis	
Thelypteris confluens	

Orchids

Bulbophyllum pygmaeum	piripiri
Caladenia sp.	
Corybas oblongus	
Corybas “Kaimai” (J.B. Irwin pers. comm.)	
Drymoanthus adversus	
Earina autumnalis	raupeka
Earina mucronata s.s.	peka-a-waka
Microtis unifolia	maikaika
Orthoceras novae-zeelandiae	maikaika

Pterostylis alobula	
Pterostylis banksii	tutukiwi
Pterostylis micromega (Miller 1983)	
Thelymitra longifolia	maikuku
Thelymitra pauciflora	
Winika cunninghamii	

Grasses

Austrofestuca littoralis	
Austrostipa stipoides	
Chionochloa flavescens	
Cortaderia fulvida	toetoe
Cortaderia toetoe	toetoe
Cortaderia fulvida x *C. toetoe*	
Deyeuxia avenoides	
Dichelachne crinita	patiti
Echinopogon ovatus	
Isachne globosa	swamp millet
Lachnagrostis billardierei	perehia
Lachnagrostis lyallii	
Lachnagrostis filiformis	
Microlaena avenacea	bush rice grass
Microlaena stipoides	patiti
Oplismenus imbecillis	
Poa anceps subsp. *anceps*	
Poa pusilla	
Rytidosperma gracile	
Spinifex sericeus	kowhangatara
Zoysia pauciflora	

Sedges

Baumea articulata	
Baumea anthophylla	
Baumea juncea	
Baumea rubiginosa	
Baumea tenax	
Baumea teretifolia	
Bolboschoenus caldwellii	
Bolboschoenus fluviatilis	ririwaka
Bolboschoenus medianus	ririwaka
Carex breviculmis	
Carex dipsacea	
Carex dissita	
Carex geminata	
Carex maorica	
Carex pumila	
Carex secta	purei
Carex sinclairii	

Carex solandri	
Carex subdola	
Carex testacea	
Carex virgata	purei
Cyperus ustulatus	toetoe upokotangata
Desmoschoenus spiralis	pingao
Eleocharis acuta	
Eleocharis gracilis	
Eleocharis sphacelata	
Gahnia lacera	tarangarara
Gahnia pauciflora	takahikahi
Gahnia setifolia	mapere
Gahnia xanthocarpa	tupari-maunga
Isolepis cernua	
Isolepis distigmatosa	
Isolepis habra	
Isolepis inundata	
Isolepis nodosa	wiwi
Isolepis prolifer	
Isolepis reticularis	
Lepidosperma australe	
Lepidosperma laterale	
Machaerina sinclairii	tuhara
Morelotia affinis	
Schoenoplectus pungens	
Schoenoplectus tabernaemontani	kapungawha
Schoenus maschalinus	
Schoenus tendo	wiwi
Tetraria capillaris	
Uncinia scabra	matau
Uncinia uncinata	kamu, matau a Maui

Rushes

Juncus caespiticius	
Juncus edgarae	wi
Juncus kraussii subsp. *australiensis*	wi (sea rush)
Juncus pallidus	wi
Juncus planifolius	
Juncus prismatocarpus	
Juncus sarophorus	wi
Luzula picta var. *picta*	

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

Apodasmia similis	oioi
Arthropodium cirratum	rengarenga
Athropodium candidum	
Astelia banksii	kakaha
Astelia fragans	

Astelia solandri	kowharawhara
Astelia trinervia	mauri
Collospermum hastatum	kahakaha
Collospermum microspermum	
Cordyline pumilio	ti rauriki
Dianella nigra	turutu
Empodisma minus	
Lemna minor	karearea
Libertia grandifolia	mikoikoi
Phormium cookianum	
Phormium tenax	
Potamogeton cheesemanii	
Potamogeton ochreatus	
Sparganium subglobosum	burr reed
Triglochin striata	arrow grass
Typha orientalis	raupo
Zostera meulleri	

Composite herbs

Cotula coronopifolia	bachelor's button
Euchiton audax	
Euchiton gymnocephalum	
Lagenifera pumila	papataniwhaniwha
Pseudognaphalium luteoalbum agg.	pukatea
Senecio hispidulum	
Senecio glomeratus	
Senecio lautus	
Senecio quadridentatus	
Senecio scaberulus	

Dicot. herbs (other than composites)

Acaena anserinifolia	piripiri
Apium prostratum	New Zealand celery
Callitriche petrei	
Centella uniflora	
Chenopodium glaucum subsp. *ambiguum*	
Dichondra repens	
Disphyma australe	horokaka
Drosera peltata subsp. *auriculata*	
Epilobium nerteroides	
Epilobium pallidiflorum	
Epilobium pedunculare	
Epilobium rotundifolia	
Euphorbia glauca (planted)	
Galium propinquum	mawe
Geranium solanderi	
Gonocarpus incanus	piripiri
Gonocarpus micranthus subsp. *micranthus*	

Gratiola sexdentata	
Haloragis erecta subsp. *erecta*	toatoa
Hydrocotyle heteromeria	
Hydrocotyle microphylla	
Hydrocotyle moschata	
Hydrocotyle novae-zeelandiae	
Hydrocotyle pterocarpa	
Hypericum japonicum	
Lilaeopsis sp.	
Limosella lineata	mudwort
Lobelia anceps	punakuru
Mimulus repens	
Myriophyllum propinquum	
Nertera depressa	
Nertera scapanioides	
Oxalis exilis	
Oxalis rubens	
Parietaria debilis	
Pelargonium inodorum	kopata
Peperomia urvilleana	
Persicaria decipiens	
Pratia angulata	panakenake
Ranunculus acaulis	
Ranunculus amphitrichus	
Ranunculus macropus	
Ranunculus reflexus	maruru
Rorippa palustris	
Samolus repens	makaokao
Sarcocornia quinqueflora	
Selliera radicans	remuremu
Solanum americanum	
Spergularia media	
Stellaria decipiens (incl. *S. minuta* and *S. parviflora*)	kohukohu
Tetragonia tetragonioides	kokihi
Urtica incisa	
Wahlenbergia violacea	

PROVISIONAL LIST OF ADVENTIVE PLANT TAXA OF TAURANGA ECOLOGICAL DISTRICT

Gymnosperms

Allocasuarina littoralis	she-oak
Araucaria heterophylla	Norfolk Island pine
Chamaecyparis lawsoniana	Lawsons cypress
Cupressus macrocarpa	macrocarpa
Pinus pinaster	maritime pine
Pinus radiata	radiata pine
Pseudotsuga menziesii	Douglas fir

Dicot. trees and shrubs

Acacia decurrens	green wattle
Acacia longifolia	Sydney golden wattle
Acacia mearnsii	black wattle
Acacia melanoxylon	Tasmanian blackwood
Acacia sophorae	
Acer pseudoplatanus	sycamore
Ailanthus altissima	tree of heaven
Albizia lophantha	brush wattle
Banksia intermedia	banksii
Berberis glaucocarpa	barberry
Betula pendula	silver birch
Buddleja davidii	buddleia
Callistemon sp.	bottlebrush
Chamaecytisus palmensis	tree lucerne
Chrysanthemoides monilifera	boneseed
Cotoneaster glaucophyllus	cotoneaster
Cotoneaster simonsii (Wilcox & Ecroyd 1984)	
Crataegus monogyna	hawthorn
Cyphomandra betacea	tamarillo
Cytisus scoparius	broom
Datura stramonium	thorn apple
Erica lusitanica	Spanish heath
Eriobotrya japonica	loquat
Eucalyptus botryoides	eucalyptus
Eugenia smithii	lillypilly
Euonymus japonicus	Japanese spindle tree
Fatsia japonica	fatsia
Feijoa sellowiana	feijoa
Ficus carica	fig

Hakea salicifolia	willow-leaved hakea
Hakea sericea	prickly hakea
Hydrangea macrophylla	hydrangea
Impatiens sodenii	shrub balsam
Impatiens sp.	dizzy lizzy
Jasminum mesnyi	primrose jasmine
Lantana camara	lantana
Leptospermum laevigatum	coastal tea tree
Leycesteria formosa	Himalayan honeysuckle
Ligustrum lucidum	tree privet
Ligustrum sinense	Chinese privet
Lupinus arboreus	lupin
Lycium ferocissimum	African boxthorn
Malus × *domestica*	apple tree
Myoporum insulare	Australian ngaio
Nerium oleander	oleander
Opuntia vulgaris	prickly pear
Paulownia tomentosa	paulownia
Pelargonium sp.	geranium
Persea americana	avocado
Philadelphus x *maxicanus*	mock orange
Populus nigra cv. Italica	Lombardy poplar
Prunus sp.	fruit tree
Quercus ilex	holly oak
Quercus robur	English oak
Rhamnus alaternus	Italian buckthorn
Ricinus communis	caster oil plant
Robinia pseudacacia	false acacia
Rosa rubiginosa	sweet brier
Rubus phoenicolasius	Japanese wineberry
Rubus sp. (*R. fruticosus* agg.)	blackberry
Salix cinerea	grey willow
Salix fragilis	crack willow
Salix matsudana cv. tortuosa	corkscrew willow
Senecio angulatus	Cape ivy
Solanum mauritianum	woolly nightshade
Tecomaria capensis	Cape honeysuckle
Teline monspessulana	Montpellier broom
Teucrium fruticans	teucrium
Ulex europaeus	gorse
Weigela florida	apple blossom

Ferns

Azolla pinnata	ferny azolla
Dryopteris fillixmas	male fern
Nephrolepis cordifolia	tuber ladder fern
Osmunda regalis	regal fern

Dicot. lianes

Actinidia chinensis	kiwifruit
Araujia sericifera	moth plant
Calystegia silvatica	greater bindweed
Clematis vitalba	old man's beard
Clematis sp.	ornamental clematis vine
Cymbalaria muralis	Kenilworth ivy
Dipogon lignosus	mile a minute
Galeobdolon luteum	artillery plant
Hedera helix	ivy
Ipomoea indica	blue morning glory
Lonicera japonica	Japanese honeysuckle
Passiflora edulis	black passionfruit
Passiflora mollissima	banana passionfruit
Rumex saggitattus	climbing dock
Senecio mikanioides	German ivy
Senecio petasitis	velvet groundsel
Solanum jasminoides	potato vine
Vinca major	periwinkle
Vitis vinifera	grape

Monocot. trees and shrubs

Phoenix canariensis	Phoenix palm
Tracycarpus fortunei	fan palm

Lycopods and psilopsids

Sellaginella kraussiana	creeping clubmoss

Grasses

Agrostis capillaris	browntop
Agrostis stolonifera	creeping bent
Aira caryophyllea	silvery hairy grass
Ammophila arenaria	marram
Anthoxanthum odoratum	sweet vernal
Aristida ramosa	Australian wire grass
Arrhenatherum elatius	tall oat grass
Arundo donax	giant reed
Axonopus fissifolius	narrow-leaved carpet grass
Briza maxima	quaking grass
Briza minor	shivery grass
Bromus diandrus	ripgut brome
Bromus hordeaceus	soft brome
Bromus willdenowii	prairie brome
Cortaderia jubata	pampas
Cortaderia selloana	pampas
Critesion murinum	barley grass

Cynodon dactylis	Indian doab
Cynosurus cristatus	crested dogstail
Dactylis glomerata	cocksfoot
Digitaria sanguinalis	summer grass
Echinochloa crus-galli	barnyard grass
Eleusine indica	crowfoot grass
Elytrigia pycnantha	sea couch
Eragrostis brownii	bay grass
Festuca rubra subsp. *rubra*	red fescue
Glyceria declinata	floating sweetgrass
Glyceria fluitans	sweetgrass
Glyceria maxima	reed sweetgrass
Holcus lanatus	Yorkshire fog
Lagurus ovatus	harestail
Lolium perenne	rye grass
Miscanthus nepalensis	Himalaya fairy grass
Panicum dichotomiflorum	smooth witchgrass
Paspalum conjugatum (Gardiner 1995)	
Paspalum dilatatum	paspalum
Paspalum distichum	Mercer grass
Paspalum vaginatum	saltwater paspalum
Pennisetum clandestinum	kikuyu grass
Phleum pratense	timothy
Poa annua	annual poa
Poa pratensis	Kentucky bluegrass
Polypogon monspeliensis	beard grass
Pseudosasa japonica	bamboo
Rytidosperma racemosum	
Schedonorus phoenix	tall fescue
Setaria viridis	green bristle grass
Spartina alterniflora	spartina
Spartina anglica	spartina
Spartina x *townsenii*	spartina
Sporobolus africanus	ratstail
Stenotaphrum secundatum	buffalo grass
Vulpia bromoides	vulpia hairgrass
Vulpia myuros	vulpia hairgrass

Sedges

Carex divulsa	
Carex lurida	
Carex ovalis	
Carex vulpinoidea	
Cyperus brevifolius	
Cyperus congestus	purple umbrella sedge
Cyperus eragrostis	
Cyperus involucratus	umbrella sedge
Cyperus tenellus	
Isolepis sepulcralis	

Rushes

Juncus acuminatus	sharp-fruited rush
Juncus articulatus	
Juncus bufonius	
Juncus bulbosus	
Juncus conglomeratus	
Juncus effusus	soft rush
Juncus microcephalus	
Juncus tenuis	track rush

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

Agapanthus praecox	agapanthus
Allium triquetrum	three-cornered garlic
Arum italicum	Italian arum
Aristea ecklonii	aristea
Asparagus asparagoides	smilax
Asparagus sprengeri	
Asparagus scandens	climbing asparagus
Canna indica	canna lily
Ceratophyllum demersum	hornwort
Colocasia esculenta	taro
Crocosmia × *crocosmiiflora*	montbretia
Egeria densa	egeria; oxygen weed
Elodea canadensis	Canadian pondweed
Freesia refracta	freesia
Hedychium gardnerianum	wild ginger
Ixia maculata	ixia
Kniphofia uvaria	red hot poker
Lagarosiphon major	lagarosiphon; oxygen weed
Leucojum aestivum	snowflake
Lilium formosanum	Easter lily
Narcissus pseudonarcissus	daffodil
Potamogeton crispus	curled pondweed
Scilla non-scripta	bluebell
Spirodela punctata	purple-backed duckweed
Tradescantia fluminensis	tradescantia
Watsonia meriana cv. Bulbillifera	watsonia
Zantedeschia aethiopica	arum lily

Composite herbs

Achillea millefolium	yarrow
Arctotheca calendula	cape weed
Aster subulatus	sea aster
Bellis perennis	daisy
Bidens frondosa	beggars' ticks
Carduus tenuiflorus	thistle

Chrysanthemum segetum	corn marigold
Cirsium arvense	California thistle
Cirsium vulgare	Scotch thistle
Conyza albida	fleabane
Crepis capillaris	hawksbeard
Erechtites hieraciifolia	American fireweed
Erigeron karvinskianus	Mexican daisy
Gaillardia × grandifolia	gaillardia
Gamochaeta spicata	cudweed
Gazania linearis	gazania
Hypochoeris radicata	catsear
Lactuca serriola	prickly lettuce
Leontodon taraxacoides	hawkbit
Leucanthemum vulgare	oxeye daisy
Matricaria dioscoidea	rayless camomile
Mycelis muralis	wall lettuce
Osteospermum fruticosum	rain daisy/dimorphotheca
Picris echioides	oxtongue
Senecio bipinnatisectus	Australian fireweed
Senecio elegans	purple groundsel
Senecio jacobaea	ragwort
Senecio skirrhodon	gravel groundsel
Senecio sylvaticus	wood groundsel
Senecio vulgaris	groundsel
Sonchus asper	prickly puha, prickly sow thistle
Sonchus oleraceus	puha
Taraxacum officinale	dandelion

Dicot. herbs (other than composites)

Acaena agnipila	Australian sheep's burr
Acaena novae-zelandiae	piripiri
Acanthus mollis	acanthus
Anagallis arvensis	scarlet pimpernel
Angelica pachycarpa	angelica
Anthemis arvensis	corn chamomile
Aphanes arvenis	parsley piert
Artemisia verlotiorum	Chinese mugwort
Atriplex prostrata	orache
Cakile edentula	sea rocket
Cakile maritima	sea rocket
Callitriche stagnalis	starwort
Cannabis sativa	hemp
Capsella bursa-pastoris	shepherd's purse
Cardamine hirsuta	bitter cress
Carpobrotus edulis	ice plant
Centaurium erythraea	centaury
Cerastium fontanum	mouse-ear chickweed
Chenopodium album	fathen
Chenopodium ambrosioides	Mexican tea

Conium maculatum	hemlock
Coronopus didymus	twin cress
Cotyledon orbiculata	pig's ear
Dianthus ameria	Deptford pink
Digitalis purpurea	foxglove
Dipsacus fullonum	wild teasel
Duchesnea indica	Indian strawberry
Epilobium ciliatum	willow herb
Euphorbia lathyris	caper spurge
Euphorbia peplus	milkweed
Fragaria vesca	wild strawberry
Foeniculum vulgare	fennel
Fumaria muralis	scrambling fumitory
Galeobdolon luteum	artillery plant
Galinsoga parviflora	galinsoga
Galium aparine	cleavers
Galium palustre	marsh bedstraw
Geranium molle	dove's foot
Geranium robertianum	herb Robert
Gunnera tinctorea	Chilean rhubarb
Hypericum perforatum	St John's wort
Lamium purpureum	red dead nettle
Lapsana communis	nipple wort
Lepidium sp.	
Linum bienne	
Lotus pedunculatus	lotus
Lotus suaveolens	hairy birdsfoot trefoil
Ludwigia palustris	water purslane
Lunaria annua	honesty
Lycopersicon esculentum	tomato
Lycopus europeaus	gypsywort
Lythrum hyssopifolia	hyssop loosestrife
Malva parviflora	mallow
Marrubium vulgare	horehound
Medicago arabica	spotted bur medick
Medicago nigra	bur medick
Medicago sativa	lucerne
Melilotus indicus	King Island melilot
Mentha pulegium	penny royal
Mentha x *piperita*	peppermint
Mimulus moschatus	musk
Modiola caroliniana	creeping mallow
Myosotis arvensis	forget-me-not
Myosotis sylvatica	garden forget-me-not
Nasturtium microphyllum	watercress
Nasturtium officinale	watercress
Oenothera stricta	evening primrose
Ornithopus perpusillus	seradella
Orobanche minor	broomrape
Osteospermum fruticosum	

Oxalis incarnata	lilac oxalis
Parentucellia viscosa	tarweed
Pastinaca sativa	wild parsnip
Physalis peruviana	cape gooseberry
Phytolacca octandra	inkweed
Plantago australis	swamp plantain
Plantago coronopus	buck's horn plantain
Plantago lanceolata	narrow-leaved plantain
Plantago major	broad-leaved plantain
Plectranthus ciliata	plectranthus
Polycarpon tetraphyllum	allseed
Polygonum aviculare	wireweed
Polygonum capitatum	pink-head knotweed
Polygonum hydropiper	water pepper
Polygonum persicaria	willow weed
Portulaca oleracea	wild portulaca
Primula sp.	primula
Prunella vulgaris	selfheal
Ranunculus acris	giant buttercup
Ranunculus flammula	spearwort
Ranunculus parviflorus	small-flowered buttercup
Ranunculus repens	creeping buttercup
Ranunculus scleratus	celery-leaved buttercup
Raphanus raphanistrum subsp. *raphanistrum*	wild raddish
Rumex acetosella	sheep's sorrel
Rumex conglomeratus	clustered dock
Rumex obtusifolius	dock
Sagina procumbens	pearlwort
Scrophularia auriculata	water figwort
Silene gallica	catchfly
Sisymbrium officinale	wild mustard
Solanum chenopodioides	velvety nightshade
Solanum linnaeanum	Apple of Sodom
Solanum marginatum	white-edged nightshade
Solanum nigrum	black nightshade
Solanum americanum	small-flowered nightshade
Solanum pseudocapsicum	Jerusalem cherry
Solanum tuberosum	potato
Soliva valdiviana	Onehunga weed
Spergula arvensis	spurrey
Stachys arvensis	staggerweed
Stachys sylvatica	hedge woundwort
Stellaria alsine	bog stitchwort
Stellaria graminea	stitchwort
Stellaria media	chickweed
Trifolium arvense	haresfoot trefoil
Trifolium pratense	red clover
Trifolium repens	white clover
Tropaeolum majus	garden nasturtium
Urtica dioca	stinging nettle

Verbascum thapsus	woolly mullein
Verbascum virgatum	moth mullein
Verbena bonariensis	purple-top
Verbena officinalis	vervain
Veronica anagallis-aquatica	water speedwell
Veronica arvensis	field speedwell
Veronica serpyllifolia	turf speedwell
Vicia sativa	vetch
Wahlenbergia sp.	harebell
Yucca sp.	yucca

FAUNA OF THE TAURANGA ECOLOGICAL DISTRICT

AVIFAUNA

List compiled from: Barker and Larcombe (1976); Rasch (1989); Owen (1993); Cromarty (1996); Department of Conservation (1996); Tauranga District Council (1996).

Native

Acanthasitta chloris granti	North Island rifleman
Anarhynchus frontalis	wrybill
Anas gracilis	grey teal
Anas rhynchotis variegata	New Zealand shoveler
Anas superciliosa superciliosa	grey duck
Anthornis melanura	bellbird
Anthus novaeseelandiae	New Zealand pipit
Ardea novaehollandiae	white-faced heron
Arenaria interpres	turnstone
Aythya novaeseelandiae	New Zealand scaup
Botaurus poicilioptilus	Australasian bittern
Bowdleria punctata vealeae	North Island fernbird
Calidris acuminata	sharp-tailed sandpiper
Calidris alba	sanderling
Calidris canutus	red knot
Calidris ferruginea	curlew sandpiper
Calidris ruficollis	red-necked stint
Charadrius bicinctus	banded dotterel
Charadrius melanops	black-fronted dotterel
Charadrius obscurus aquilonius	northern New Zealand dotterel
Chlidonias leucopterus	white-winged black tern
Chrysococcus lucidus	shining cuckoo
Circus approximans gouldi	Australasian harrier
Egretta alba modesta	white heron
Egretta sacra sacra	reef heron
Eudynamys taitensis	long-tailed cuckoo
Eudyptula minor iredalei	northern blue penguin
Falco novaeseelandiae	New Zealand falcon
Gallirallus philippensis	banded rail
Gallirallus phillippensis assimilis	banded rail
Gerygone igata	grey warbler
Haematopus ostralegus	South Island pied oystercatcher
Haematopus unicolor	variable oystercatcher
Hemiphaga novaeseelandiae	kereru,New Zealand pigeon
Himantopus himantopus leucocephalus	pied stilt
Himantopus novaezelandiae	black stilt
Hirundo tahitica	welcome swallow

Larus bulleri	black-billed gull
Larus dominicanus	southern black-backed gull
Larus novaehollandiae	red-billed gull
Limosa haemastica	Hudsonian godwit
Limosa lapponica	Asiatic bar-tailed godwit
Limosa lapponica baueri	eastern bar-tailed godwit
Mohua albicilla	whitehead
Morus serrator	Australasian gannet
Nestor meridionalis septentrionalis	North Island kaka
Ninox novaseelandiae	morepork
Numenius madagascariensis	eastern curlew
Numenius phaeopus	whimbrel
Petroica australis longipes	North Island robin
Petroica macrocephala toitoi	North Island tomtit
Phalacrocorax carbo	black shag
Phalacrocorax melanoleucos	little shag
Phalacrocorax sulcirostris	little black shag
Phalacrocorax varius	pied shag
Platalea regia	royal spoonbill
Pluvialis fulva	Pacific golden plover
Porphyrio porphyrio melanotus	pukeko
Porzana pusilla affinis	marsh crake
Porzana tabuensis plumbea	spotless crake
Prosthemadera novaeseelandiae	tui
Pterodoma macroptera	grey-faced petrel
Puffinus griseus	sooty shearwater
Rhipidura fuliginosa placabilis	North Island fantail
Sterna albifrons	little tern
Sterna albostriata	black-fronted tern
Sterna caspia	Caspian tern
Sterna hirundo	common tern
Sterna nereis davisae	New Zealand fairy tern
Sterna striata	white-fronted tern
Tadorna variegata	paradise shelduck
Todiramphus sanctus vagans	New Zealand kingfisher
Tringa brevipes	Siberian tattler
Tringa nebularia	greenshank
Vanellus miles	spur-winged plover
Zosterops lateralis	silvereye

Exotic

Acridotheres tristris	common myna
Alauda arvensis	skylark
Anas platyrhynchos	mallard
Anser anser	feral goose
Arenaria interpres	turnstone
Branta canadensis	Canada goose
Callipepla californica	California quail
Carduelis carduelis	goldfinch

Carduelis chloris	greenfinch
Carduelis flammea	redpoll
Columba livia	feral pigeon
Cygnus atratus	black swan
Emberiza citrinella	yellowhammer
Fringilla coelebs	chaffinch
Gallus gallus	domestic chicken
Gymnorhina tibicen	Australian magpie
Meleagris galloparvo	turkey
Passer domesticus	house-sparrow, dunnock
Phasianus colchicus	pheasant
Platycercus eximius	eastern rosella
Prunella modularis	hedge-sparrow
Sturnus vulgaris	starling
Synoicus ypsilophorus	brown quail
Turdus merula	blackbird
Turdus philomelos	song thrush

HERPETOFAUNA

List compiled from: Rasch (1989); Wildland Consultants Ltd (2000e).

Indigenous

Cyclodina aenea	copper skink
Hoplodactylus granulatus	forest gecko
Hoplodactylus maculatus	common gecko
Hoplodactylus pacificus	Pacific gecko
Leiolopisma moco	moko skink
Leiolopisma smithi	shore skink
Leiopelma hochstetteri	Hochstetter's frog

Exotic

Lampropholis delicata	rainbow skink

MAMMALS

Indigenous

Chalinolobus tuberculatus	long-tailed bat
Mystacina tuberculata rhyacobia	short-tailed bat

Exotic

Bos taurus	cattle
Canis familiaris	dog
Capra hircus	goat

Erinaceus europaeus	European hedgehog
Felis catus	feral cat
Lepus europaeus	brown hare
Macropus euginii	dama wallaby
Mus musculus	house mouse
Mustela erminea	stoat
Mustela nivalis	weasel
Mustela putorius furo	ferret
Oryctolagus cuniculus	rabbit
Rattus norvegicus	Norway rat
Rattus rattus	black (ship) rat
Sus scrofa	pig
Trichosurus vulpecula	brush-tailed possum

FISH

List compiled from: Rasch (1989); Cromarty (1996); Department of Conservation (1997); Wildland Consultants Ltd (2000e); Wildland Consultants Ltd (2001b).

Aldrichetta forsteri	yellow-eyed mullet
Anguilla australis	short-finned eel
Anguilla dieffenbachia	long-finned eel
Cheimarrichthys fosteri	torrentfish
Galaxias argenteus	giant kokopu
Galaxias fasciatus	banded kokopu
Galaxias maculatus	inanga
Galaxias postvectis	short-jawed kokopu
Gobiomorphus cotidienus	common bully
Gobiomorphus huttoni	red-finned bully
Oncorhynchus mykiss	rainbow trout
Retropinna retropinna	common smelt
Salmo trutta	brown trout

INVERTEBRATES

See Barker and Larcombe (1976) for more information on invertebrate species in the tidal zone.

Polistes chinensis	Asian paper wasp
Amphibola crenata	mud snail
Apion ulicis	gorse seed weevil
Apis mellifera	honey bee
Bombus spp.	bumble bee
Chione stutchburyi	cockle
Helice crassa	crab
(Amphidesina?) Paphies australe	pipi
Vespula vulgaris	common wasp
Vespula germanica	German wasp

LAND COVER AND LANDFORM OF THE TAURANGA ECOLOGICAL DISTRICT

4.1 Land cover in the semi-coastal bioclimatic zone of the Tauranga Ecological District

Landform Unit		Land Cover																					
		Bare ground		Coastal sands		Coastal Wetlands		Estuarine channels & intertidal flats		Horticultural & pastoral		Indigenous forest		Inland Wetland		Planted forest		Scrub		Urban & urban open space		TOTAL	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Alluvial plains	Historic												27	6,703	73			2,433	27			9,136	100
	Current	10				2				8,678	95	43		18				380	4	5		9,136	100
Flat undulating	Historic											356	92	14				4,410	92			4,780	100
	Current	11								4,130	86	422	9	9		36	1	101	2	72	2	4,780	100
Gullies	Historic											488	29					1,193	71			1,681	100
	Current									443	26	1,027	61	19	1	23	1	169	10			1,681	100
Higher terraces	Historic													40	8			455	92			496	100
	Current	22	5							449	91	5	1			1		18	4			496	100
Hill(s)	Historic											2,745	49					2,886	51			5,631	100
	Current	29	1							3,908	69	608	11	1		669	12	415	7			5,631	100
Intertidal flats	Historic																		100				100
	Current										100												100
River flats	Historic							1				234	6	435	12			3,026	82			3,696	100
	Current	16				1				3,136	85	262	7	4		29	1	140	4	109	3	3,696	100
Sand dunes	Historic													380	98			7	2			387	100
	Current	2	1							384	99									1		387	100
Undifferentiated terrace	Historic											66		698	5			13,145	95			13,909	100
	Current	51								11,965	86	479	3	1		61		257	2	1,095	8	13,909	100
Undulating low hills	Historic											7,931	39	174	1			12,335	60			20,441	100
	Current	41								15,959	78	3,030	15	7		94		870	4	439	2	20,441	100
Very steep hills	Historic											14	20					56	80			70	100
	Current									4	6	5	7			38	54	23	33			70	100
Water	Historic													27	71			11	29			37	100
	Current					1	1			22	58							15	41			37	100
GRAND TOTAL	**Historic**							**1**				**11,834**	**20**	**8,470**	**14**			**39,958**	**66**			**60,264**	**100**
	Current	**184**				**4**				**49,078**	**81**	**5,881**	**10**	**57**		**949**	**2**	**2,390**	**4**	**1,720**	**3**	**60,264**	**100**

4.2 Landcover in the coastal bioclimatic zone of the Tauranga Ecological District

Landform Unit		Land Cover																					
		Bare ground		Coastal sands		Coastal Wetlands		Estuarine channels & intertidal flats		Horticultural & pastoral		Indigenous forest		Inland Wetland		Planted forest		Scrub		Urban & urban open space		TOTAL	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Alluvial plains	Historic			143	17									665	79			32	4			841	100
	Current	30	4	3		16	2			578	69	13	2					187	22	14	2	841	100
Cliffs	Historic																	7	100			7	100
	Current	1	11	1	10					5	63							1	16	0		7	100
Flat undulating	Historic																	1,063	100			1,063	100
	Current	28	3			6	1			739	69	148	14			12	1	65	6	66	6	1,063	100
Gullies	Historic																	59	100			59	100
	Current		1							27	45	7	11					25	41	1	1	59	100
Higher terraces	Historic																	217	100			217	100
	Current	25	12	1		1				130	60	1						33	15	27	13	217	100
Hill(s)	Historic			56	44													71	56			127	100
	Current									40	32	20	16					67	52			127	100
Infilled harbour	Historic																	48	100			48	100
	Current																			48	100	48	100
Intertidal flats	Historic			16	17	5	5	1	1									72	77			94	100
	Current	1	1	1	1	26	28			28	30	3	3			14	15	7	7	14	15	94	100
Oceanside sand beaches	Historic			112	100																	112	100
	Current			78	70					4	3					12	11	14	13	3	3	112	100
River flats	Historic					107	10							153	15			781	75			1,041	100
	Current	3		38	4	91	9			558	54	85	8			35	3	150	14	80	8	1,041	100
Sand dunes	Historic			5,280	71	13								762	10			1,430	19			7,485	100
	Current	16		161	2	21				1,267	17	25		14		3,908	52	270	4	1,802	24	7,485	100
Undifferentiated terrace	Historic			296	4	14								372	5			7,300	91			7,982	100
	Current	63	1	8		209	3			5,875	74	264	3			149	2	375	5	1,039	13	7,982	100
Undulating low hills	Historic					2								10	1			1,511	99			1,523	100
	Current	11	1			8	1			807	53	133	9					111	7	453	30	1,523	100
Very steep hills	Historic																	72	100			72	100
	Current									29	41	28	39					15	20			72	100
Wetlands	Historic			223	43	45	9							169	33			80	15			517	100
	Current	5	1			146	28			179	35	1		5	1	102	20	77	15	3		517	100
GRAND TOTAL	**Historic**			**6,126**	**29**	**186**	**1**	**1**						**2,131**	**10**			**12,745**	**60**			**21,189**	**100**
	Current	**183**	**1**	**291**	**1**	**523**	**2**			**10,265**	**48**	**727**	**3**	**19**		**4,232**	**20**	**1,397**	**7**	**3,552**	**17**	**21,189**	**100**

4.3 Landcover in the lowland bioclimatic zone of the Tauranga Ecological District

Landform Unit		Land Cover																					
		Bare ground		Coastal sands		Coastal Wetlands		Estuarine channels & intertidal flats		Horticultural & pastoral		Indigenous forest		Inland Wetland		Planted forest		Scrub		Urban & urban open space		TOTAL	
		ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Undulating low hills	Historic											53	100									53	100
	Current											53	100									53	100
GRAND TOTAL	**Historic**											53	100									53	100
	Current											53	100									53	100

APPENDIX 5

TAURANGA ECOLOGICAL DISTRICT PNAP REPORT - DRAFT CONTENTS PAGE

FIGURES

TABLES