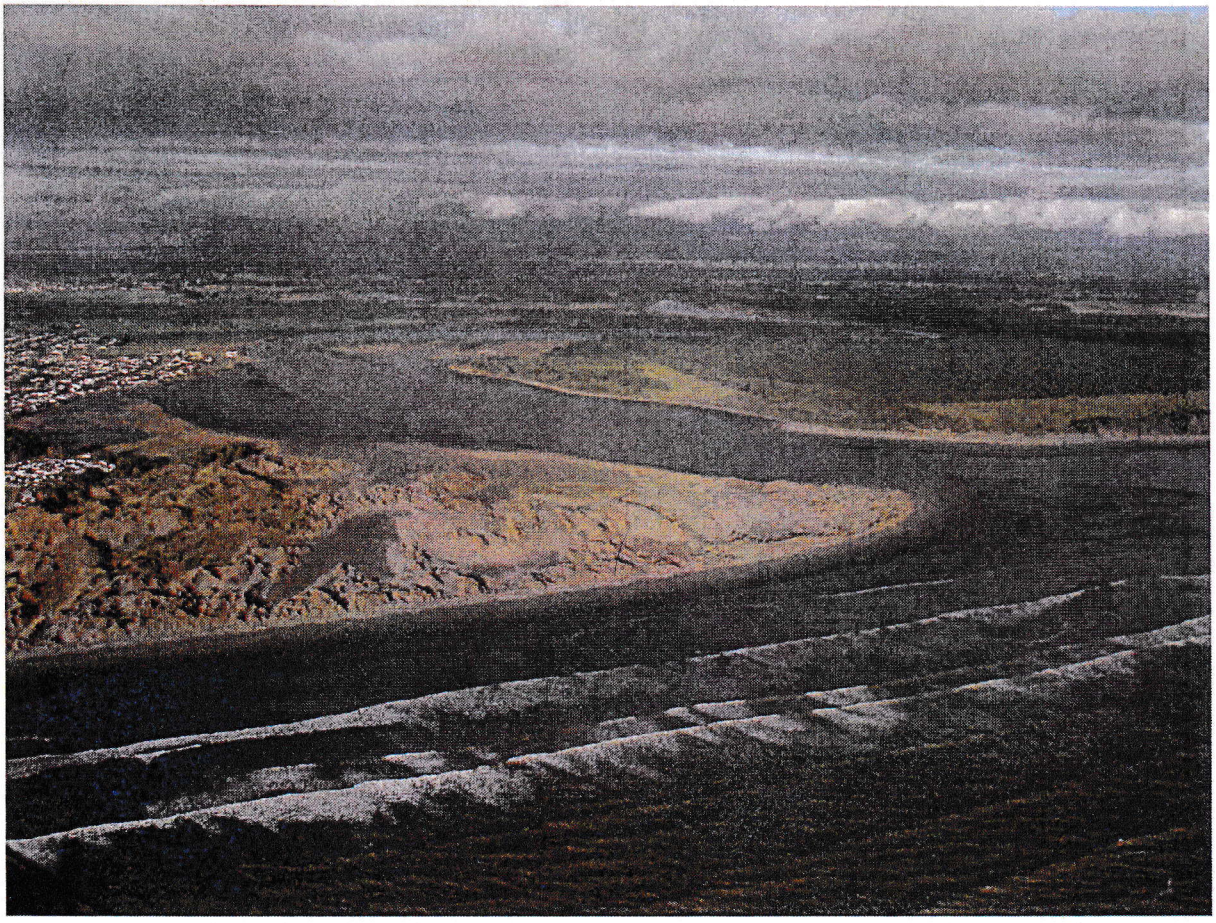
MANAWATU RIVER ESTUARY

RAMSAR MANAGEMENT PLAN

2007-2012



Prepared for the Manawatu Estuary Management Team
to fulfill the requirements of the
Ramsar Convention

MANAWATU RIVER ESTUARY

RAMSAR MANAGEMENT PLAN 2007 – 2012

by Don Ravine, with funding from
Horizons Regional Council

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Cover photo: Manawatu Estuary and Foxton Beach township with the Tararua Range in the background. **Photo:** Don Ravine

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SUMMARY

In July 2005 the Manawatu Estuary was declared a Wetland of International Importance under the Ramsar Convention Treaty of 1971. This was possible because of the efforts of the Manawatu Estuary Trust and the Royal Forest and Bird Protection Society of New Zealand. This nomination acknowledges the ecological importance of the Manawatu Estuary which is the largest estuary in the lower North Island of New Zealand and has been recognized as an important area for wading birds, as well as for its vegetation and landform values.

In partial fulfilment of the requirements to be a Wetland of International Importance under the Ramsar Convention, a management plan has been prepared by Don Ravine in collaboration with the Manawatu Estuary Trust, Horowhenua District Council, Horizons Regional Council and the Department of Conservation in consultation with local iwi, community groups and landowners.

The management of the Manawatu Estuary will be guided by five main objectives:

1. Establish current values of the estuary; these include ecological, cultural and social values and will be done by surveys and research of current knowledge;

2. Protect and enhance the ecological values of the estuary; surveys and monitoring will be undertaken to successfully increase the protection of the natural values;

3. Promote wise use; the estuary will be valued and used wisely

4. Encourage learning; the estuary will be a place for learning about the natural environment and estuarine processes; and

5. Respect cultural heritage values; people's historic and current cultural use of the estuary will be respected.

This plan will involve the community, and will establish awareness of the important values of this wetland. It is intended that this first management plan will cover a five year term and serve as a guiding tool through which the different parties can learn, understand and improve the area for its overall sustainability. As this period is very much an information gathering time, it is possible that sections will need to be updated from time to time as more knowledge is gained about the estuary.

The aims of this plan are to produce a single document under which the Manawatu Estuary is to be managed. This is to be achieved through subsidiary aims as follows:

1. To coordinate responsibilities for management of the Manawatu Estuary among the government agencies, regional and local authorities, private and traditional landowners and public interest groups with an interest in the wetland. As there is currently no single controlling authority, this aim is central to the success of this plan;

2. To ensure protection of special features of the Manawatu Estuary which have led to the application to have it listed under the Ramsar Convention. This is addressed through a number of management objectives;

3. To provide a framework for assessment of current and future management. This is addressed via actions for each objective; and

4. To provide a reference document for management issues, both for agencies charged with management tasks and for other interested parties.

To comply with these objectives and aims the following five issues are addressed.

1. **Administration** – Coordination of Responsibilities and Reclassification of Estuary

   Objectives:
   - A clear management structure is established for the Manawatu Estuary.
   - The Ramsar area has a clear legal status.

2. **Ecology/Conservation of Nature** – Management of Birds, Plants, Fish and Water Quality

   Objectives:
   - Populations of indigenous species are stable or increasing
   - Weeds such as cordgrass, sharp rush, tall fescue and marram are contained or eradicated.
   - Other weeds are discovered and controlled before they can become a problem
   - Available habitat is increased in the Manawatu Estuary.
   - Water quality remains at or improves to a suitable level to maintain recognised values of the Manawatu Estuary.

3. **Social/Cultural** – Raised Awareness of the Wise Use of the Estuary and Respect for Each Others Values.

   Objectives:
   - Public have access to the estuary without endangering special features.
   - Fishing and whitebaiting continue in a sustainable fashion.
   - Gamebird shooting is permitted in suitable locations.
   - Boating activities are safe and none destructive.
   - Use of recreational, land based vehicles is safe and non-obtrusive.
   - Cultural and historical values are recognised and protected.
   - Amenity values are understood and maintained.

4. **Research and Education** – Establish the Estuary as a Place for Learning

   Objectives:
   - Non-intrusive research is encouraged and coordinated.
   - Non-intrusive educational activities are encouraged.

5. **Future Needs – Recognition of Immediate Needs**

   Objectives:
   - A visitor centre is established.

The Manawatu Estuary is a complex ecosystem and factors that affect one aspect of its ecology may, in fact, indirectly affect other aspects. Therefore, even though these factors are broken down into individual issues and objectives, correct management will consider them all as an interrelated whole.

It is worth noting that there is very little published information available on the habitats and species in the Estuary. This plan has drawn on local knowledge as well as pointing out where further information is needed. Because of this lack of information as well as the recent Ramsar listing status much of this plan is oriented towards research and monitoring over the next 5 years so that management actions can be more clearly targeted in the next management plan. However this approach does not preclude action being taken where it becomes necessary to maintain the values of the Estuary.

Photo 1: Fernbird Flat – the saltmarsh of the Manawatu Estuary.

ACKNOWLEDGMENTS

I would first of all like to thank Joan Leckie and the other members of the Manawatu Estuary Trust for their efforts to achieve a suitable protected status for the Manawatu Estuary, for honouring me by inviting me to prepare this plan and for their continual support during this process.

Horizons Regional Council has financed this plan, through their Regional Initiatives Grant Scheme. I would like to thank the council and their staff, who have supported this project.

This task has been made considerably easier because of the willing cooperation of the Department of Conservation. I would particularly like to thank Viv McGlynn of the Palmerston North office, who has graciously provided me with a great deal of information and several resources, and Phil Mohi, Area Manager, Palmerston North, who has also been very supportive.

The Horowhenua District Council has provided considerable support towards protection of the Manawatu Estuary, for which I am very grateful. I would also like to thank the staff of the Horowhenua District Council, particularly Peter Shore, the Reserves Manager, who has encouraged me with this work and provided further resources, and counter staff who allowed me access to various documents.

Morice Crandall of Foxton Beach has provided advice for aspects of this work and has challenged me generally, for which I am more grateful than she might expect!

Finally, I would like to thank Warwick and Wendy Allen for providing me a place to write this plan.

Don Ravine.

1. TERM OF THIS PLAN

It is intended that this first management plan for the Manawatu Estuary will cover a five year term. As this period is very much an information gathering time, it is possible that sections will need to be updated from time to time as more knowledge is gained about the estuary.

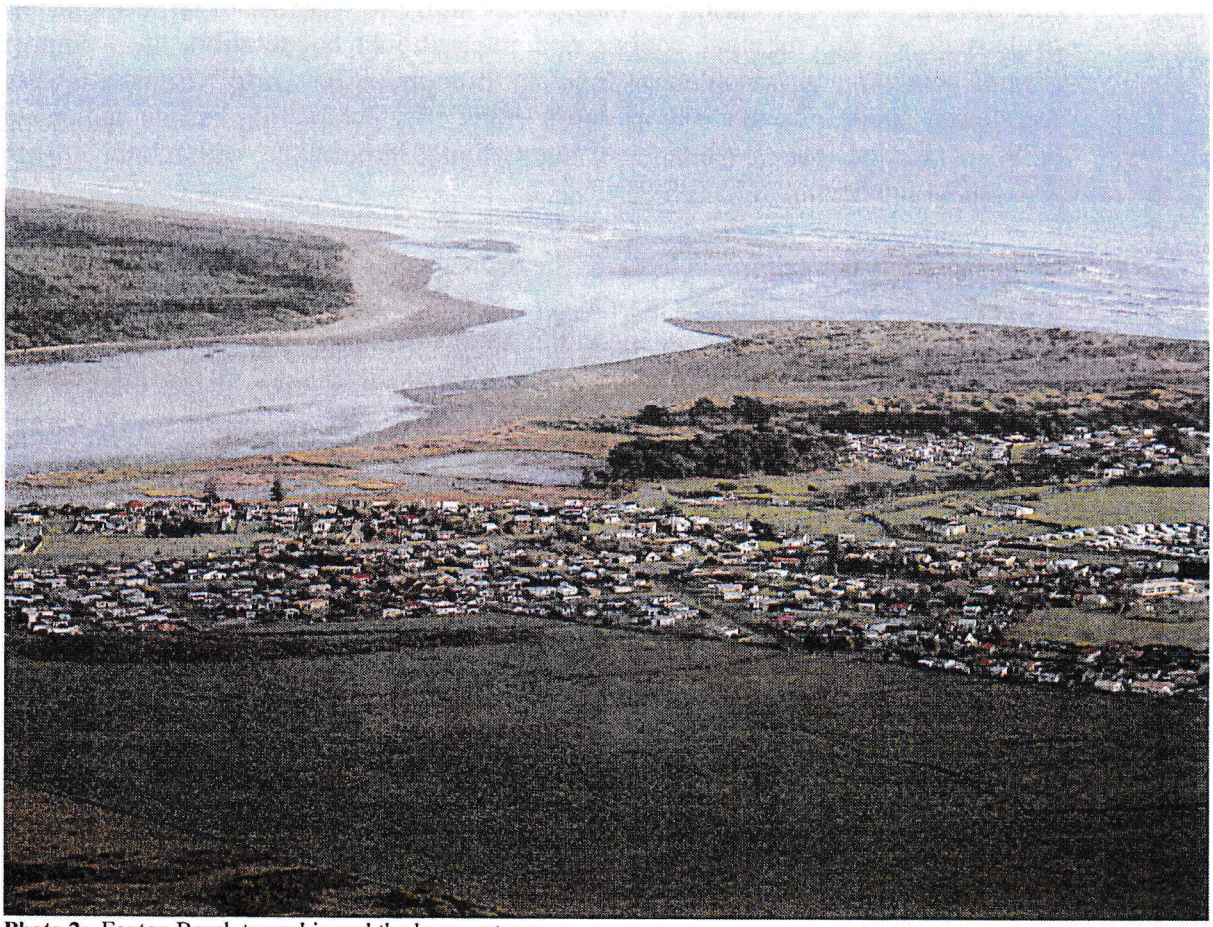

Photo 2: Foxton Beach township and the lower estuary.

2. INTRODUCTION

CONVENTION ON WETLANDS
CONVENTION SUR LES ZONES HUMIDES
CONVENCIÓN SOBRE LOS HUMEDALES
(Ramsar, Iran, 1971)

2.1 The Ramsar Convention

The International Convention on Wetlands of International Importance was signed at Ramsar, Iran, on the 2nd of February 1971. It was subsequently amended in 1982, 1987 and 1994. This management plan has been prepared in response to the amended Convention on Wetlands of International Importance especially as Waterfowl Habitat, signed in Paris on the 13th of July, 1994 (UNESCO 1994).

The mission of the convention is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world" (Ramsar Convention Secretariat, 2004). By the 20th of April, 2005, 145 Contracting Parties had designated 1429 sites for the List of Wetlands of International Importance, with a total surface area of 125,032,800 hectares (UNESCO 1994).

Article 1 of this convention defines wetlands as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres." The Manawatu Estuary meets this definition of wetland.

Under the convention, each contracting party (of which New Zealand is one) "shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance" (Article 2). The convention sets several criteria which a wetland needs to meet before it is included in this list. The Manawatu Estuary meets criteria 1, 2, 3, 4, 6 and 8 (R.F.B.P.S. 2004; see below) and was listed under the Ramsar convention in 2006.

2.2 Ramsar Criteria met by the Manawatu Estuary

(Taken from R.F.B.P.S. 2004; refs provided)

1. A wetland should be considered internationally important if it contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographical region.

   The Manawatu Estuary is a representative example of a natural coastal estuary within the ecological region of Foxton. It is the largest estuary and wading bird feeding grounds in the lower half of the North Island of New Zealand, and retains a high degree of naturalness and biodiversity. It has been recognized by

the Department of Conservation as a wetland of national importance, recommended for protection (Ravine, 1992).

2. A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species, or threatened ecological communities.

The ecological communities of the Manawatu Estuary include salt marsh and mudflat feeding grounds for migratory and local water birds and breeding grounds for native fish. There are 13 species of birds, 6 species of fish and 4 species of plants listed in the Threatened Species List, which rely on the Manawatu Estuary ecological area.

3. A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of this biographical region.

The upper reaches of the Manawatu Estuary are comprised of the river channel and large areas of saltmarsh with some open ponds and channels. As access to this area is difficult, it supports a large colony of Fernbird, as well as Royal Spoonbill, Australasian Bittern and Marsh Crake. As the largest saltmarsh in the biogeographical region, these species are important for maintaining the biological plant and animal diversity.

The Manawatu Estuary has the most diverse range of birds to be seen in any one place in New Zealand. The number of species identified at the Estuary is 93. A current list of bird species is attached, taken from the records of the Ornithological Society of New Zealand, Manawatu Branch, who regularly monitor the estuary (Appendix II). As access to see the waders at high tide is quite convenient, a great many bird-watchers are attracted to visit, from many parts of New Zealand as well as from overseas.

4. A wetland should be considered internationally important if it supports plants and/or animals at a critical stage in their life cycles, or provides refuge during adverse conditions.

Flocks of 200-300 of New Zealand Shoveller and New Zealand Grey Teal have been seen sheltering in the estuary in the duck-shooting season, (June and July) well away from the maimais and duck shooters.

The estuary is also a shelter for wading birds in times of storms when the prevailing westerly winds hammer the coast – on one occasion 800 Wrybill used the Estuary for this purpose (>20% of the world population).

5. A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of the one species of water bird

The Manawatu Estuary regularly supports at least 1% of the world species of Wrybill over the winter months. Reports during the winter of 2006 have stated as many as 70 birds have been seen feeding on the shallows of the estuary, and the total world population is only c.4200.

The wrybill (Anarhynchus frontalis) is endemic to New Zealand, a small grey and white plover with a bill about 2.5cm long, which is unique because the tip turns to the right. It is known to breed only on the shingle of some of the large riverbeds in Canterbury and Otago in the South Island of New Zealand where its breeding success is threatened by floods and pests such as mustelids. Between 30 and 70 of these birds spend the winter months at Manawatu Estuary feeding on the mudflats. It is usually tame and approachable, running across the flats with its head tucked close to its body. With only 4200 wrybills left in the world, a safe winter feeding ground is critical to its survival.

The Manawatu Branch of the Ornithological Society of New Zealand has regularly kept records of wrybills present at the Estuary, and has made the following recent records:

23rd August 1998	51 birds
From Feb to Aug 1999.	between 32 and 42 birds
From Feb to Aug 2000	between 45 and 48 birds
From Feb to Aug 2001	between 35 and 42 birds
From Jan to Jul 2002	between 34 and 71 birds
20th January 2003	24 birds (Just starting to return from breeding grounds)
21st January 2003	56 birds
23rd March 2003	47 birds
18th May 2003	42 birds

6. A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

The Manawatu River supports a wide range of indigenous fish, and a list of species is attached (Appendix III). The Estuary is both a spawning ground, and a migration path for the native fish in the river.

Many species of freshwater fish spend part of their life histories in the sea. There are five different species in the whitebait fishery (inanga, koaro, banded kokopu, giant kokopu and shortjaw kokopu) and all move to and from the sea. No less than 17 endemic species spend a significant part of their life in the sea. They return in spring traveling on the incoming tides to breed in the reeds and marshes of small side streams and the estuary.

It is a culture in New Zealand for people to go 'whitebaiting' for inanga, and the estuary is popular for this activity. There is a season in the early spring within which whitebaiters are allowed to net for these fish in daylight hours only. Also, local fisherman recall how, in some places in the upper estuary, they have seen the water teeming with thousands of tiny black flounders about 2-3 cm long.

The impact of human civilisation on the environment in New Zealand has stripped the land of its forests, drained its swamps and wetlands, and discharged effluents and fertilisers into waterways. This has severely reduced

the breeding grounds of our native fish, making the protection of the Manawatu Estuary and its tidal salt meadows very important.

Photo 3: Migratory birds from the Arctic rely on the Manawatu Estuary.

2.3 Management vision

This plan has been prepared as a requirement of the Ramsar convention. It is also intended to be a guiding tool through which the different parties can learn, understand and improve the area for its overall sustainability.

The management of the Manawatu Estuary will be guided by five main objectives:

1. Establish current values of the estuary; these include ecological, cultural and social values and will be done by surveys and research of current knowledge;

2. Protect and enhance the ecological values of the estuary; surveys and monitoring will be undertaken to successfully increase the protection of the natural values;

3. Promote wise use; the estuary will be valued and used wisely

4. Encourage learning; the estuary will be a place for learning about the natural environment and estuarine processes;

5. Respect cultural heritage values; people's historic and current cultural use of the estuary will be respected.

2.4 Aims of This Plan

The principle aim of this plan is to produce a single document under which the Manawatu Estuary is to be managed. This is to be achieved through four subsidiary aims, as follows:

1. To coordinate responsibilities for management of the Manawatu Estuary among the government agencies, regional and local authorities, private and traditional landowners and public interest groups with an interest in the wetland. As there is currently no single controlling authority, this aim is central to the success of this plan.

2. To ensure protection of special features of the Manawatu Estuary which have led to the application to have it listed under the Ramsar Convention. This is addressed through a number of management objectives.

3. To provide a framework for assessment of current and future management. This is addressed via actions for each objective.

4. To provide a reference document for management issues, both for agencies charged with management tasks and for other interested parties.

2.5 Manawatu Estuary - Legal Description

No one body has sole actual or vested ownership of the proposed management area. Cadastral information is not totally reliable, due to the fluctuating bed of the river.

The bulk of the proposed management area of the Manawatu Estuary is unallocated riverbed (technically seabed under the Foreshore and Seabed Act 2004) or foreshore. The largest blocks of allocated land are as follows:

Spit area -	Pt. Sec. 3, Block II, Moutere Survey District, SO 26064 Sec. J, Moutere Survey District, SO 26064
Mudflats -	Sec. 1, Block II, Moutere Survey District, SO 12963 Lot 3, DP 11478, Moutere Survey District, SO 10773, 23692

Smaller blocks adjoining the estuary may or may not also be within the proposed management area but this cannot be accurately established without survey.

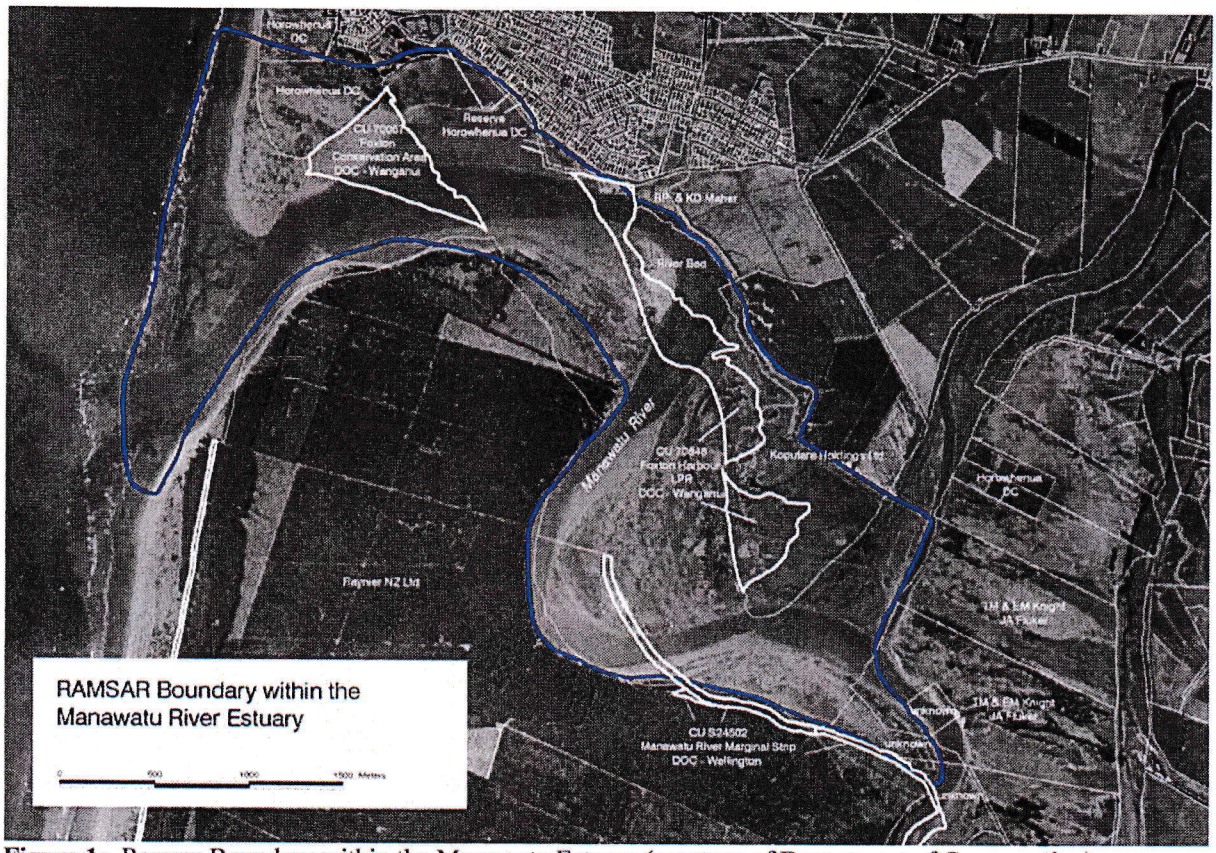

Figure 1: Ramsar Boundary within the Manawatu Estuary (courtesy of Department of Conservation)

2.6 Manawatu Estuary – Physical Description

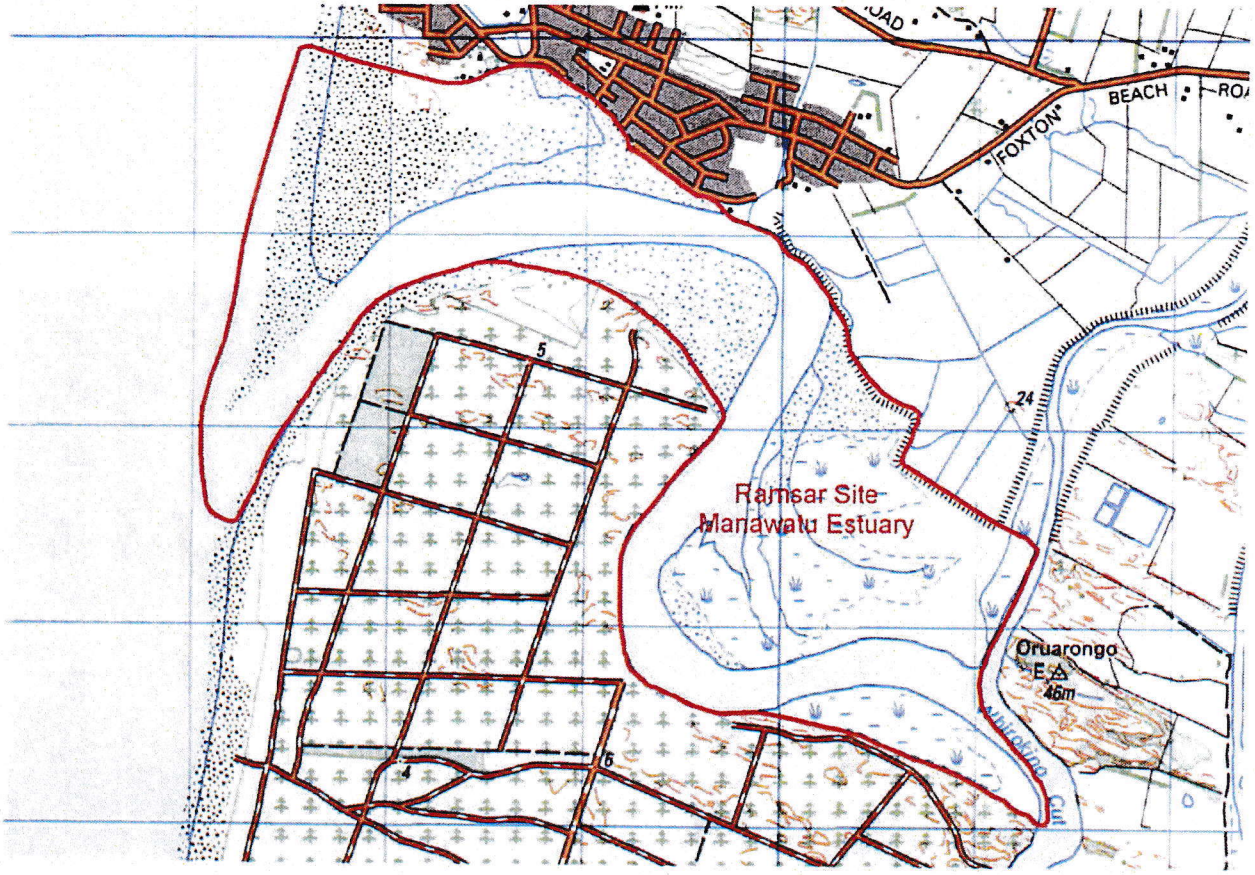

Figure 2: Topographical map showing location of the Ramsar Site within the Manawatu Estuary.

2.6.1 Location

The Manawatu River flows almost due west into the Tasman Sea just to the south of Foxton Beach township, on the west coast of the North Island of New Zealand. The estuary it forms, which is the subject of this plan, goes inland from this point for a distance of up to four kilometres. The centre of the estuary is located at a latitude of approximately 40o 28' 30" South and a longitude of 175o 14' 30" East. The area of estuary which has been included for listing as a Ramsar site is around 250 hectares (note that this differs from the 200 hectares quoted in earlier Documents. The exact area has not been established by survey).

The Manawatu Estuary is in the Foxton Ecological District, which is the western and coastal part of the Manawatu Ecological Region.

2.6.2 Geology and Landform

Ravine (1992) describes the geology of the estuary as "estuarine muds, silts and clays" and the soils as "saline soils". There is also a small amount of wind-blown sand on the western edges.

The Manawatu Estuary consists mainly of an "S" bend of the Manawatu River and its associated tidal mudflats. The extent of these mudflats is highly variable, depending on tide and river flow. They range from non-existent at times of high tide and floods to over a hundred hectares at very low tides and low river flows. They are located on the

inside curves of the river and along the northern bank near Foxton Beach township. The river itself is relatively slow-moving and level, being tidal for up to twenty kilometres inland. It carries no gravels to its lower reaches but does carry a considerable quantity of silt. It is a permanently flowing river, subject to flood episodes, of varying intensity, on a frequent basis.

There are also a number of saltmarshes within the estuary. The largest is found on the eastern edge of the proposed management area and on the north (true right) side of the river. It is about 100 ha in extent, while the smaller saltmarshes are mostly along the southern bank and total a further 40 ha (Ravine 1992).

There is a highly dynamic dune area of around 50 ha on the north side of the river mouth. While this is not specifically part of the wetland area, it affects, and is affected by, the river. Accretion of sand to this dune area is by a general north to south coastal drift and regular moderate to high winds in a west-south-west direction. Some of this sand spills into the river, where a proportion is washed out to sea again. During constant conditions, this process pushes the river mouth south at up to 15m per year. Periodic flood events erode the spit formed by this process and move the river mouth north, as was seen during major floods of 2004. There is physical evidence at Foxton Beach that the river mouth has been two kilometres further north at times. While this is a very dynamic process, it has been partially arrested within some of this area through planting of exotic vegetation at various times.

The course of the Manawatu River inland of the estuary proper has been altered by creation of an artificial channel, known as the Whirokino Cut. The former river path now effectively only has a tidal flow and is known as the Foxton Loop. Both these water courses are beyond the proposed management area but have directly impacted on the estuary. They can now be considered relatively stable.

2.6.3 Vegetation

The vegetation of the Manawatu Estuary has been described by Ravine (1992) as being divided into four main groups. That Document described the extensive mudflats as being covered largely by the exotic cordgrass (Spartina anglica) but this weed has been mostly controlled and the dominant plant is now bachelor's button (Cotula corinopifolia), in areas which are not just open mud, with smaller areas dominated by three-square (Bolboschoenus caldwellii).

Where the influence of river and tide is less strong, particularly in the west where there is some wind-blown sand, there are herbfields dominated by halfstar (Seliera radicans but may also include S. rotundifolia), shore primrose (Samolus repens) and glasswort (Sarcocornia quinqueflora).

In more stable parts of the estuary, saltmarshes have formed. There is a gradual pattern in these areas, moving away from the main river channel, of increasing domination of larger plant species. Thus there are distinct bands of up to 100m width where dominant bachelor's button gives way to the native sea rush (Juncus maritimus) or the aggressive, exotic sharp rush (Juncus acutus).

The fourth vegetation grouping described by Ravine (1992) is found further inland, as these rushes give way to jointed wire rush (Leptocarpus similis), which in turn is overtopped by salt-marsh ribbonwood (Plagianthus divaricatus). This is slightly complicated in localised places where artificial ponds have been dug, encouraging

establishment of New Zealand flax (Phormium tenax varieties) and raupo (Typha orientalis).

The dune area at the mouth of the river has remnant communities of indigenous sand binding plants. The silver sand grass (Spinifex serricius) is dominant, though there are healthy populations of the locally uncommon pingao (Desmoschoenus spiralis) and sand daphne (Pimelea arenaria) and other indigenous shrubs. Much of the northern and coastal part of this dune area has been planted with exotics. Consequently, only the southern half remains more or less natural. Within the dune area are large patches of bare sand. Off-road vehicles may be responsible for limiting the spread of plants (both exotic and indigenous) into these places.

R.F.B.P.S. (2004) list the following plants of the Manawatu estuary as nationally or regionally threatened: Selliera rotundifolia (only historic records exist within the estuary but it may likely still be there); Carex litorosa; Bolboschoenus caldwellii; Leptinella dioica subsp. monoica; Mimulus repens; and Ruppia polycarpa. In addition to these, the endangered herb, Sebaea ovata has previously been recorded from Foxton (Ravine 1992) and the dunes at the mouth of the estuary was the type location of the rare native sand iris (Libertia peregrinans; Central Herbarium Record, 1928). The large saltmarshes, dominated by salt-marsh ribbonwood, are the biggest in the Foxton Ecological District (Ravine 1992).

2.6.4 Birds

The dominant feature of the fauna of the Manawatu Estuary is the large number of wading birds which are present at certain times of the year. The Ornithological Society of New Zealand have recorded 95 bird species from the estuary (unpublished O.S.N.Z. records quoted in R.F.B.P.S. 2004). These include 12 endemic shorebird species and 26 migratory species. The estuary is particularly important for indigenous shorebirds as an overwintering area.

It is the presence of large, invertebrate-rich, tidal flats within the estuary which makes it so important for wading bird species, being the largest such area in the southern, west coast of the North Island. Some species are benefitted further by driftwood which provides roosting sites, or by protective vegetation, sand flats or shallow water, which provide alternative feeding areas.

The areas of salt-marsh ribbonwood and rushes provide habitat for the southernmost and largest population of the sparse North Island fernbird (Bowdleria punctata vealeae) in the ecological district and are important sites for the nationally endangered Australasian bittern (Botaurus poiciloptilus) and sparse spotless crake (Porzana tabuensis).

Appendix B in R.F.B.P.S. (2004) details the avifauna of the estuary. Part of this is reproduced as Appendix II in this Document.

Seven species of bird were singled out for special consideration in the original application to have the estuary listed under the Ramsar convention, in particular the wrybill (Anarynchus frontalis). Thirteen bird species listed as having some threatened status in Hitchmough (2002) have been recorded in the Manawatu Estuary. These are:

Nationally Critical	fairy tern (Sterna nereis)
	white heron (Egretta alba)

	New Zealand shore plover (Thinornis novaeseelandiae)
Nationally Endangered	Australasian bittern (Botaurus poiciloptilus)
Nationally vulnerable	wrybill (Anarynchus frontalis) Caspian tern (Sterna caspia)
Serious Decline	black-billed gull (Larus bulleri) black-fronted tern (Sterna albostriata)
Gradual Decline	banded dotterel (Charadrius bicinctus) white-fronted tern (Sterna striata)
Sparse	North Island fernbird (Bowdleria punctata vealeae) little black shag (Phalacrocorax sulcirostris) spotless crake (Porzana tabuensis)

2.6.5 Fish

Many of New Zealand's fish species are diadromous, making all estuaries important for them. Because the Manawatu River has such a large catchment, taking in much of the east and west sides of the lower North Island (Ravine 1992) and consequently has the largest estuary in the ecological district, it is of vital importance to these species. In some cases, particularly migratory galaxid species, it is also a vital breeding ground. The estuary provides habitat for a range of other fish species (see Appendix III).

R.F.B.P.S list twenty one fish species which have been recorded from the estuary or which are likely to be resident in the estuary. The estuarine star gazer (Leptoscopus macropygus) was also recorded by Hicks and Bell (2003). Various pelagic species may also use the estuary during periods of incoming tide, though these have not been documented. Four fish species identified within the estuary are listed as threatened in Hitchmough (2002 and updates). These are:

Gradual Decline:	longfin eel (Anguilla dieffenbachia) giant kokopu (Galaxias agrenteus) dwarf galaxid (Galaxias divergens) shortjaw kokopu (Galaxias postvectus)
Sparse:	Lamprey (Geotria australis)

Kahawai, mullet species, black flounder and brown trout are caught as part of an established recreational fishery. Juveniles of various galaxid species, notably inanga (Galaxius maculatus) are more commonly referred to as "whitebait" and are subject to seasonal fishing.

2.6.6 Invertebrates

Despite the general conviction that invertebrates found in the Manawatu Estuary are partly responsible for the large numbers of shorebirds found there, very little had been done to record which species are present. At least two surveys were commissioned by the Department of Conservation as part of their monitoring for Spartina control (Asher and and Stark, 1988; Stringer et al., 1992), though neither provided definitive species lists. Asher and Stark measured densities of "nineteen different kinds of macrofauna" collected in core samples and showed these reached over 23,000 individuals per square

metre. Groups of invertebrates recorded by Stringer et al. included slaters, ants, beetles, bugs, mites, spiders, crabs, sandhoppers, polychaete worms, molluscs, mud-snails, pond-snails and bloodworms. Polychaete worms were identified as particularly significant.

More recently, Maddison (2004) was commissioned to undertake a field study of invertebrates in the estuary. His data are partially presented as Appendix E in R.F.B.P.S. (2004) and in the species list in Appendix IV to this report.

The endangered katipo spider (Latrodectus katipo) was once common in the dunes at the mouth of the estuary (Ward 1998). They have recently been rediscovered (Joan Leckie, pers. comm.).

New Zealand's only native land mammals are bats. None have been reported in the vicinity of the estuary. While there are several records on Department of Conservation files of species of whale being washed up near the estuary, there is no record of any using the estuary, though it is always possible that dolphins may chase fish into the estuary. In the same way, seals are often reported from the vicinity and could well use the estuary, though this would be a very rare occurrence.

Several introduced mammals occur in the general vicinity of the estuary. These include cattle, feral cats, ferrets, hedgehogs, rats, rabbits and possibly stoats and weasels (Ravine 1992).

There seems to be no information at all about reptiles found in the estuary. A gecko was reported to the Department of Conservation in the early 1990s (Department of Conservation files) which had been caught near Foxton and species of these could exist in the saltmarsh area. It is also possible that species of skink may be found in the estuary thought there is no evidence of any surveys having been undertaken. The amphibian and reptile distribution scheme of New Zealand (quoted in Ravine 1992) records northern grey gecko, common skink and leathery turtle within the ecological district. The turtle was recorded from nearby Waitarere Beach though it was dead when found.

Photo 4: High tide at the Manawatu Estuary.

2.7 Human Disturbance and Modification

Though Ravine (1992) described the Manawatu Estuary as having "a high natural quality", this does not mean it is in an unmodified condition. It is possible to have a general conception that such a large area is geologically stable but this is not the case at all. The course of the river itself is known to move through the processes of bank erosion and sand deposition along the coast, as well as the effects of major flood events. As the river moves, this affects the mudflats and saltmarshes and the subsequent vegetation composition. Left alone, however, such an area is in a dynamic equilibrium, with most resident taxa maintaining fluctuating but persistent populations.

There is no evidence that early Maori settlers did anything to greatly change this, though burning of surrounding vegetation and hunting must have affected local species composition. A more significant side effect of vegetation clearance is outlined in Cowie (1963). He describes how evidence suggests vegetation clearance by early Maori destabilised the sand country (the Motuiti Phase of dune building). However, the impact of this on the estuary would have probably been to only move the river mouth a little.

This pattern of vegetation disturbance and sand movement was repeated by early European settlers (the Waitarere dune building phase in Cowie 1963). Visible evidence of a relatively recent river channel, which would have exited three kilometres north of the current river mouth, indicates how much sand movement has occurred on this coast.

The most dramatic modification to the Manawatu Estuary was the formation of the Whirokino cut in the 1930s (R.F.B.P.S. 2004). Originally done as a means of reducing flooding in Foxton township, this quickly became the main course of the river. The original course of the river, known as the Foxton Loop, largely silted up, though it is still navigable for most of its distance in a small boat. What this cut did was to effectively create new tidal flats and to accelerate erosion in some places while reducing it in others. Overall, though, the character and location of the Manawatu Estuary remain unchanged.

Current flood control also affects the estuary in two ways. One is that construction of floodbanks and similar structures now restricts the flow of the river. The effect of this is really only seen near Foxton Beach township. The other is that floodwaters are controlled via the Moutoa floodway. This is only opened during peak water flows. The effect at the estuary may be no more than a peak flow wave of water in an already flooded area.

There are small-scale human modifications. These include a wharf and boat ramp (a second boat ramp has been constructed just north of the proposed management area), drains and storm water pipes.

Human disturbance occurs mainly through the use of boats and motorised vehicles, as well as walking (which can involve uncontrolled dogs), fishing and shooting. These activities are discussed below.

3. CURRENT MANAGEMENT

3.1 The Department of Conservation

The Department of Conservation administers a 25 ha block within the Manawatu Estuary (Foxton Conservation Area, Conservation Unit 70067 in Department of Conservation 1997) and a strip of land reserved from sale under Section 58 of the Land Act 1948 (Manawatu River Marginal Strip, Conservation Unit S24502 in Department of Conservation 1996) under the Conservation Act 1987, as well as the 41 hectare Foxton Harbour Local Purpose Reserve (Conservation Unit 70848 in Department of Conservation 1997). These areas include mud and sand areas and some of the bed of the river and are the justification behind the department's successful control programme for cordgrass (Spartina anglica).

Under the Foreshore and Seabed Act 2004, the beds of rivers which are part of coastal marine area are administered by the Crown. This includes most of but not the entire estuary. Some responsibilities under this legislation lie with the Department of Conservation.

The Conservation Act also charges the department with an advocacy function, which would involve it in any process which seeks to protect natural features of the estuary.

Most of the birds found in the estuary are legally protected under the Wildlife Act 1953. The Department of Conservation is the body which administers this act. Under the Whitebait Regulations 1994, there is some protection for juveniles of some indigenous fish species. The department also administers these regulations.

The Manawatu Estuary is specifically identified under the Regional Coastal Plan (Horizons.MW 2002). This Document has been prepared in accordance with the New Zealand Coastal Policy Statement, 1994, under the Resource Management Act, 1991. This statement regulates some permitted activities within most, but not all, of the estuary.

The Manawatu Estuary has been recommended for protection in the Foxton Ecological District Protected Natural Areas Programme Report (Ravine 1992), and the Department has advocated for the protection of private land within the estuary.

Finally, the Department of Conservation is the administering agency for the Ramsar Convention on Wetlands of International Importance in New Zealand.

3.2 Horizons Regional Council

The role and responsibilities of Horizons Regional Council are prescribed by the Resource Management Act 1991. The two principal areas of the council's responsibilities within the estuary are documented under the Regional Coastal Plan (Horizons 2001) and the Manawatu Water Catchment Water Quality Regional Plan (M.W.R.C. 1998). Because the Manawatu Estuary has been identified as a protection area under the Regional Coastal plan, some of the provisions of the Resource Management Act, as far as they relate to the estuary, are now covered by the Foreshore and Seabed Act 2004. Protection areas listed in the Regional Coastal Plan have specific provisions which serve to protect important natural and ecological features from inappropriate use.

The regional council is responsible for granting of resource consents for activities, such as discharges, which relate to water quality in the estuary. It is also responsible for consents which affect sand or soil stability. Council staff are responsible for monitoring water levels and quality and sand activity. They also maintain stopbanks and other flood protection works.

The harbour master for the Foxton area is responsible to Horizons Regional Council. He oversees shipping in the estuary under the Manawatu River Harbour Bylaws 1998, pursuant to the Harbours Act 1950. This includes small boat activities.

3.3 The Horowhenua District Council

The Horowhenua District Council is the territorial authority for the Manawatu Estuary. It specifically administers the sand dune area and esplanade reserves and road along the north side of the estuary. The council operates under the Horowhenua District Plan (1998), prepared in accordance with Part V of the Resource Management Act 1991. The purpose of this plan, under the act, is to promote sustainable management of natural and physical resources.

Section 3.1 of the plan seeks to protect significant natural features from inappropriate subdivision, use and development. The plan lists the estuary as a significant natural feature. Objective 4 of this section charges that the council "avoid, remedy and mitigate adverse effects of activities on landscapes, natural habitats, indigenous vegetation and wetlands of ecological significance to the district".

Sec 5.2 of the plan prescribes protection of the natural character of the coastal environment, which also includes part of the estuary. Policy 6.4 prescribes protection of native wildlife habitats, which includes the Manawatu Estuary. Section 11; Issue 27 - charges the council to take into account the effects "activities on the surface ..... can have on intrinsic ecological or natural habitat .... values of lakes, rivers and margins".

The mechanism of theses requirements is both through council activities on land it directly administers and through the resource consent process for activities in other areas.

3.4 Iwi

Most legislation which controls activities within the Manawatu Estuary, such as the Resource Management Act 1991, the Conservation Act 1987 and the Foreshore and Seabed Act 2004 requires the Crown to take into account the Treaty of Waitangi. This requires that the Crown, regional and local authorities consult with the indigenous Maori people who hold authority in the affected area.

The land which includes the Manawatu Estuary was subject to a forced sale, in which traditional owners were obliged to sell the land without their total consent. It is still subject to a claim or claims before the Waitangi tribunal. While legal ownership has been described above (Section 2d), there is still traditional ownership of the area. This ownership is held by three hapu affiliated to Ngati Raukawa. These hapu have chosen a representative to the management team. Other groups who have expressed a connection to the Manawatu Estuary are Te Mauri o Rangitaane o Manawatu and Te Eru Tehopu Trust Inc..

The Manawatu River is of considerable significance to Maori. [While this has been outlined in R.F.B.P.S. (2004), it must be noted that the commentary in that Document does not fully reflect the viewpoint of the traditional owners, though parts of it are generally accepted.] The whole region is named "Manawatu" after the river, which signifies just how important the river, and therefore the estuary are.

The view of traditional owners is that the estuary is a part of the coast and of the river and that the river connects the coastal lands and sea with the land and the people further inland. In the case of the Manawatu River, this land includes the Manawatu, Oroua, Pohangina, Mangahao and Mangatainoka catchments. These catchments extend over a hundred kilometres inland and include land on both sides of the Ruahine and Tararua Ranges. Management of the estuary can only be successfully achieved with cooperative management of its catchment. This view is also held by other groups with responsibilities for managing the estuary.

The record of Maori tradition and law in terms of resource management is more oral than written. The people do possess considerable knowledge, both historical and biological, which would be of great value in ensuring the Manawatu Estuary is preserved within the requirements of the Ramsar Convention. To ensure that this knowledge is readily available, managers must respect the status of traditional owners and communicate effectively at all times. This is facilitated through these people having representation on the management team.

3.5 Private Landowners

A small part of the northeastern end of the estuary is in private ownership. This is part of the "fernbird area" identified by Ravine (1992). This land is designated as "rural" under the Horowhenua District Plan and is technically used for grazing. However, current owners are aware of the ecological and wildlife significance of the land and only graze it lightly with cattle. Currently they do allow limited access to conservation managers, duck shooters and interested groups.

While both the District Plan and Regional Coastal Plan limit what activities landowners may undertake in this area, it is legal to graze it with stock. Grazing has already had minor deleterious effects on this area, by enhancing the spread of some weeds, particularly tall fescue (Festuca arundinacea) and causing localised pugging (Ravine 1992). A change in the future management of this area would be worked towards and encouraged.

3.6 Forest Owners/Lessees

The entire south boundary of the proposed management area of the Manawatu Estuary is crown land under a long-term lease to a private forestry company for production forestry. No adverse effects of this operation have been currently identified in terms of management of the estuary. However, the lessees do control access to a large part of the estuary. They also have fire control responsibilities which may affect small areas of shrubland on the edge of the proposed management area.
Although pine forests are known to extract water from catchments by lowering water tables (Cromarty and Scott, 1996) the management of this forest is not expected to change in the near future.

3.7 The Manawatu Estuary Trust

The Manawatu Estuary Trust was formed by members of The Royal Forest and Bird Protection Society of New Zealand, Inc. and The Ornithological Society of New Zealand. It now has members from several different bodies with an interest in the Manawatu Estuary. The Trust supported the Royal Forest and Bird Protection Society's application to list the Manawatu Estuary under the Ramsar Convention. It has undertaken the responsibility to carry out various tasks, such as public education, advocacy, preparation of this management plan, coordination between public authorities, interest groups and the community, fundraising and construction of information signs and a visitor centre. It has the written support of all relevant groups (R.F.B.P.S. 2004).

3.8 The Ministry of Fisheries

The Ministry of Fisheries is responsible for administering the Fisheries Act 1983. This act regulates the recreational fishery, other than the whitebait and game fisheries, in the Manawatu Estuary. Fishing of several species of finfish, shellfish and rock lobsters is controlled by the ministry under this act. Many of these species are found within the proposed management area.

3.9 Other Groups with an Interest in the Estuary

Many community groups have a direct interest in the area and would like to be involved in the co-ordination of activities within the estuary. The regulations governing the estuary are set by Horizons Regional Council, Horowhenua District Council and the Department of Conservation.. However user groups should meet twice a year to discuss any problems with management agencies and co-ordinate their activities. Membership of this User Group should be open to all who wish to be involved.

Fish & Game NZ, Wellington Branch is responsible, under the Wildlife Act 1953, for management of waterfowl shooting and, under the Freshwater Fisheries Regulations 1983, the fishing of some species. The only fish species under their control which has been recorded from the estuary is brown trout. This species is not generally targeted by local fishermen. The Manawatu Estuary does support many species of waterfowl which may be legally shot in the season. Fish and Game monitor and regulate hunting of these species.

The Ornithological Society of New Zealand has a long history of counting, monitoring and studying birds within the estuary. Their records are the only long-term database of which species have been recorded and population trends, which are invaluable to any effective management of the estuary.

The Royal Forest and Bird Protection Society of New Zealand, Inc. has an interest in conservation in New Zealand. They have been an effective lobby group for many years. As well as this, members actively participate in conservation projects of many types having particular skills in bird and plant identification and conservation. They have been, and continue to be, active in advocating for protection of the Manawatu Estuary, particularly through formation of the Manawatu Estuary Trust (see above).

The River Users Advisory group, under the harbour master, regulate boat use within the estuary. This can have a direct impact on certain, sensitive bird species and is important

for effective management of the estuary. Noise issues are policed by wardens, appointed by the harbour master.

The Manawatu Marine Boating Club own large clubrooms on the wharf. They have a large membership which is active within the estuary waters.

The Foxton Community Board provides a communication path, particularly between residents of Foxton Beach Township and the Horowhenua District Council. This may, from time to time, relate to issues relevant to management of the estuary.

Local beach wardens, Police, Foxton Coast Care and vehicle organisations have an influence on certain issues within the Manawatu Estuary (particularly vehicle use in the dune area), without necessarily being directly involved in management. It is anticipated that these groups will be consulted from time to time.

4. MANAGEMENT ISSUES

4.1 Objectives and Actions

The management of the estuary will be guided by five main objectives and these constitute the overarching vision:

1. Establish current values of the estuary; these include ecological, cultural and social values and will be done by surveys and research of current knowledge;

2. Protect and enhance the ecological values of the estuary; surveys and monitoring will be undertaken to successfully increase the protection o the natural values;

3. Promote wise use; the estuary will be valued and used wisely

4. Encourage learning; the estuary will be a place for learning about the natural environment and estuarine processes;

5. Respect cultural heritage values; people's historic and current cultural use of the estuary will be respected.

It is worth noting, before considering the issues discussed below, that the estuary is a complex ecosystem and factors which obviously affect one aspect of its ecology may, in fact, indirectly affect other aspects. Therefore, even though these factors are broken down into individual issues and objectives, correct management will consider them all as an interrelated whole. Nevertheless, to keep management realistic and this document remotely usable, an attempt has been made to isolate particular issues and objectives, with accompanying actions, and are as follows:

4.2 Issues

1. **Administration** – Coordination of Responsibilities and Reclassification of Estuary

   Objectives:

   - A clear management structure is established for the Manawatu Estuary.

2. **Ecology/Conservation of Nature** – Management of Birds, Plants, Fish and Water Quality

Objectives:

- Populations of indigenous species are stable or increasing.
- Populations of indigenous plant species are stable or increasing.
- Sharp rush and tall fescue are contained or eradicated.
- Cord grass and Marram are eradicated.
- Other weeds are discovered and controlled before they can become a problem.
- Available habitat is increased in the Manawatu Estuary.
- Water quality remains at or improves to a suitable level to maintain recognised values of the Manawatu Estuary.

3. **Social/Cultural** – Raised Awareness of the Wise Use of the Estuary and Respect for Each Others Values.

Objectives:

- Public have access to the estuary without endangering special features.
- Fishing and whitebaiting continue in a sustainable fashion.
- Gamebird shooting is permitted in suitable locations.
- Boating activities are safe and non destructive.
- Use of recreational, land based vehicles is safe and non-destructive.
- Cultural and historical values are recognised and protected.
- Amenity values are understood and maintained.
- The estuary and its wise use is actively promoted.

4. **Research and Education** – Establishment of the Estuary as a Place for Learning

Objectives:

- Research is encouraged and coordinated.
- Educational activities are encouraged.

5. **Future Needs** – Recognition of Immediate Needs

Objectives:

- A visitor centre is established.
- Future protection options are evaluated.

Photo 5: Rare habitat for fernbirds and bittern at Fernbird flat.

4.3 Administration

Objective **A clear management structure is established for the Manawatu Estuary.**

At the time of writing, the Manawatu Estuary does not have a fully protected, legal status. Because the proposed protection area is mostly within the coastal marine area, as defined in the Regional Coastal Plan, it receives considerable protection under the Resource Management Act 1991 and the Foreshore and Seabed Act 2004. The dune area also receives some protection under the Horowhenua District Plan. However, while the sum of this protection is significant, it does not prescribe active management of the area. The privately owned parts of the estuary receive very little legal protection.

Furthermore, there are three separate governing bodies with responsibilities for the area (Department of Conservation, Horizons Regional Council and Horowhenua District Council), as well as private and traditional landowners (hapu) who also have a legitimate say in the management of the area. This is also recognised under Ramsar guidelines for management. In the past, there was cooperation between most of these parties but this was always on an informal basis. In order to effectively manage the Manawatu Estuary on a long-term basis under the Ramsar Convention, coordination of responsibilities must be on a formal basis with each party making an undertaking which is recognised as binding.

This has now largely been done, with the above-named parties meeting on a regular basis, agreeing to manage the estuary together in a cooperative fashion, along with other interested parties from time to time. It is expected that this will lead to a memorandum of understanding, at least between government agencies, by the time this plan is published. This collection of groups can be considered a management team, which is able to consult with and take advice from other groups and the community at large.

Actions:

1. The management team needs to be formally established. This includes agreement on membership already reached. Further to this, each party must agree on its responsibilities within this management plan. **Groups responsible**: Department of Conservation; Horizon Regional Council; Horowhenua District Council; Koputara Holdings; hapu.
2. A memorandum of understanding should be signed between the national, regional and local government agencies. This would be optional for private and traditional landowners. **Groups responsible**: Department of Conservation; Horizons Regional Council; Horowhenua District Council; Koputara Holdings; hapu.
3. Regular meetings of this management team need to be scheduled to ensure continued coordination of responsibilities and effective adoption of this plan. **Groups responsible**: Department of Conservation; Horizons Regional Council; Horowhenua District Council; Koputara Holdings; hapu

4.4 Ecology/ Conservation of Nature

Objective Populations of indigenous species are stable or increasing.

4.4.1 Birds

The major thrust behind seeking to list the Manawatu Estuary under the Ramsar Convention is to protect the very significant avian fauna (R.F.B.P.S. 2004). Most of these species are fully protected under the Wildlife Act 2004 (administered by the Department of Conservation) but this act only applies to taking or disturbing birds, their remains and their nests. This act does not protect habitat values (except in the case of wildlife refuges or reserves).

The Resource Management Act 1991 does provide, indirectly, a significant amount of protection for the bird habitat within the Manawatu Estuary. There is further protection under the Horowhenua District Plan. However, the estuary does not have an effective protected status which would prescribe active management of the bird habitat. Some active management has been done anyway, notably the Department of Conservation's Spartina control operation which has opened up around 80 ha of mudflats for feeding.

To a large extent, this Spartina control operation has addressed, and continues to address, the issue of maintaining the present size and quality of mudflats, used as feeding grounds for migratory bird species. There is currently no evidence that habitat quality is deteriorating in any way. Wind-blown sand near the river-mouth is covering bird feeding habitat, though it is impossible to tell if this natural process has been accelerated by human disturbance. To effectively manage the estuary, a system of monitoring available bird habitat and the quality of the habitat must be introduced.

A key issue with bird management is disturbance, either by people, dogs, vehicles or boats. These issues are dealt with separately below.

A crucial part of bird protection is monitoring. Without reliable, long-term population data, it is impossible to tell whether each species is stable or declining, essential information to guide management efforts. Most bird species found in the estuary are migrants and subject to pressures not directly within the control of estuary managers. The local branch of the Ornithological Society of New Zealand (O.S.N.Z.) has records dating back over thirty years, which document species and numbers of wading birds and their annual times of arrival and departure. This information is still incomplete. Nevertheless, it is important that the value of this data is recognised and a prescription drawn up which ensures at least one group takes formal responsibility for this work.

It is vital to establish some base data, particularly for rarer or more vulnerable species, which can be used to determine if and what management will be needed in the future. A start can be made using O.S.N.Z. data, if it is available. Following that, a regular and systematic monitoring programme, particularly for rare and vulnerable species, must be established. It is informally acknowledged that the O.S.N.Z. has the greater expertise to undertake regular monitoring of bird populations in the Manawatu Estuary. This expertise, however, does not necessarily extend to monitoring of disturbance or other specific, project-orientated monitoring. However, a more formal arrangement could be entered into with O.S.N.Z. and the Department of Conservation for obtaining such information, overseen by the Department. It may be that no further management is needed but that cannot be determined with current information.

Any further action will be determined by the outcome of this monitoring work (acknowledging that these trends may be due to influences outside the estuary itself and may therefore require an advocacy function).

As well as monitoring numbers, a system for monitoring bird condition is desirable, particularly for migratory birds. Migrating birds are particularly vulnerable to things like reduced food supplies, parasitism or other diseases, as they need to be fully fit to undertake their long migratory flights. It may be possible to predict stresses on populations of these species through observations of the condition of individual birds, but only if this can be done without major disturbance. Advice should be sought from experienced ornithologists both within New Zealand and internationally to see if and how this should be done.

4.4.2 Birds specific to Ramsar criteria

R.F.B.P.S. (2004) highlights specific species, particularly wrybills, as being of particular importance within the Manawatu Estuary. It would seem logical, therefore, to target specific management at these species. However, there are no issues specific to these species which do not affect other species. Management outlined in this plan which seeks to monitor and protect bird species and their habitat in general terms will, therefore, also protect wrybills and other species named in that document.

Monitoring, as prescribed below, may highlight issues specific to these species, in which case appropriate management will need to be initiated.

4.4.3 Predator and pest control

There is no doubt at all that various predators, including ferrets, cats, rats, stray dogs and possibly hedgehogs, stoats, weasels and mice are found within the Manawatu Estuary. The impact of these species is completely unknown. To a large extent, wading species, which flock in large groups, are not vulnerable to these species, other than the nuisance value of dog disturbance. This is due to the open habitat, which provides plenty of warning, and the wet and muddy nature of the ground which does not suit land-based predators.

The situation may be different in the denser vegetated saltmarshes, where species such as fernbirds may be more at risk. Periodic flooding of the river would prevent such predators establishing in the saltmarsh but would not stop opportunistic predation.

While nothing is known about the effects of predators, general monitoring may show decline in some species which can be attributed to predation. If this proves to be the case, specific predator control will be warranted. Unless such information comes to light, it is probably not an efficient use of resources to undertake a general predator control programme.

A more obvious problem is posed by rabbits, particularly in the dune areas. Attempts at replanting have been seriously impacted by rabbit browse. Rabbits do build up in numbers on a regular basis and, at times, can browse heavily on species such as pingao, particularly as seedlings. Control options are available if rabbits are considered to be a serious threat.

Because so many species which use the estuary are migratory, it would be desirable to establish communication with site managers in other parts of New Zealand and other

countries so that species management takes into account all stages of the species involved. To this end, effective advocacy would also be desirable.

Actions:

1. Establish a formal monitoring programme for indigenous bird populations within the Manawatu Estuary, based on original O.S.N.Z. data, and continue this until population trends can be fully established. This work should concentrate on rare and vulnerable species but should also include other species. **Groups responsible:** Department of Conservation; Ornithological Society of New Zealand
2. Following results obtained under Action 1) above, undertake whatever management is necessary or possible to counter any downward trends in bird populations. This may include advocacy overseas. **Groups responsible:** Department of Conservation; other parties depending on what work is required.
3. Investigate practicality of monitoring bird health. **Groups responsible:** Department of Conservation; other parties depending on what work is required.

4.4.4 Fish

Objective: Populations of indigenous fish species are stable or increasing.

Unlike indigenous bird species, fish receive limited protection through regulation of fishing and habitat protection by the Ministry of Fisheries, Wellington Fish and Game Council and Department of Conservation. This extends to fishing quotas on some species (administered by the Ministry of Fisheries) and protection of migrating juvenile galaxiids, known as whitebait (administered by the Department of Conservation). Currently there is little or no data available to indicate whether these populations are stable, decreasing or increasing. Some species may be present in such low numbers that they would be very hard to detect anyway. Nevertheless, it is vital to good management to establish which way fish populations are trending. This requires establishment of a monitoring programme. Current techniques involve random sampling through trapping or electric fishing although the latter is generally ineffective in an estuarine environment but can be used in some circumstances. These techniques tend not to be species specific so a broad approach may be needed.

Habitat protection prescribed in this plan may indirectly benefit fish. The only specific protection which directly benefits fish is to protect vegetation in whitebait spawning sites. This is indirectly achieved through effective stock control.

The effectiveness of habitat protection and fishing regulations on fish populations can only be established by monitoring of those populations. Once such a programme has produced results, it should be possible to determine what management is necessary, if any, to improve fish populations. Again, factors outside the estuary could well be influencing fish populations, requiring an advocacy function.

Actions:

1. Establish a formal monitoring programme for indigenous fish populations within the Manawatu Estuary. Continue this programme until population trends can be established. Seek information from local fishers about catch levels and history for recreational or commercial species. **Groups responsible:** Department of Conservation; Ministry of Fisheries; Fish and Game Council, Manawatu Freshwater Anglers Club is a possible source of catch levels.
2. Following results obtained under Action 1 above, undertake whatever management is necessary or possible to counter any downward trends in fish populations. **Groups responsible:** Department of Conservation; Ministry of Fisheries; Fish and Game Council; others as dictated by results of monitoring

4.4.5 Plants

Objective: Populations of indigenous plant species are stable or increasing.

Habitat restoration

Management needs to be in three parts: inventory, monitoring and management response to trends unveiled through monitoring. This is particularly important following any weed control or restoration. This work needs to adequately cover mudflats, saltmarshes and dune areas.

Indigenous plant information for the estuary is still incomplete (R.F.B.P.S. 2004). The first requirement for effective management of the flora is therefore to survey areas which have not yet been studied. Monitoring then needs to be established to ascertain whether plant populations are declining or stable. This is particularly important for rare or threatened species. The results of initial monitoring may indicate that active management is needed.

Because the sand dune area was the type locality for the sand iris (Libertia peregrinans) it may be desirable to attempt to reintroduce this plant, once causal factors for its decline have been identified and controlled.

Perhaps fortunately, conditions for plants within much of the estuary are very harsh. Salinity varies with tides and floods. Plants are alternately submerged and left dry. In sunny, windy conditions this difference becomes extreme. Nutrient supply is very rich but this is countered by the effects of flood conditions which prevent plants with a larger stature establishing. These conditions favour various indigenous species and prevent the spread of most weed species over much of the estuary. However, there are other areas where the conditions are less harsh, such as the dune area and fernbird area. In these locations, native species compete with weeds (see below). Monitoring of sensitive species in these areas is particularly important. Some active management may prove to be necessary.

The use of vehicles in the dune area and on mudflats (see below) may be adversely affecting the flora. This needs to be studied and active management may be called for as a result.

Habitat restoration may prove to be desirable in certain areas. This could be particularly true following weed control. How or when this should happen is dependent on the

results of monitoring, which should also ascertain the rate of natural recolonisation by indigenous species. Two submissions noted in R.F.B.P.S. (2004) wanted specific areas restored. These submissions could be followed up.

Actions:

1. Undertake a systematic survey of the flora of the Manawatu Estuary, with particular emphasis on sites which historically contained rare or endangered species, sites which have had weed control or other restorative work carried out and sites for which there is no current information. **Groups responsible**: Department of Conservation; other groups could assist with field work
2. Based on the information gained under Action 1, design a repeatable and robust system for sampling selected, representative areas of the estuary, using the best available techniques (these could include fixed plots, random plots, transects or a combination of techniques) for each location. Use this system to design and implement a long term monitoring programme for indigenous plants, particularly those considered rare or vulnerable. **Groups responsible**: Department of Conservation; other groups could assist with field work
3. Undertake any remedial work or enhancement of rare populations indicated by the results of Action 2. **Groups responsible:** Department of Conservation; other groups could assist with field work

4.4.6 Exotic Plants

Objectives: **Cordgrass is eradicated;**
Marram is eradicated;
Sharp rush and tall fescue are contained or eradicated;
Other weeds are discovered and controlled before they can become a problem.

Cordgrass

Historically, the greatest weed problem in the Manawatu Estuary has been the exotic cordgrass (Spartina anglica), which was introduced to help recover mudflats for grazing land. This plant traps river-born silt and forms dense mats, which reduces the feeding area available for several bird species. In places, it also gradually alters the local environment, which excludes certain plant species, such as bachelor's button (Coronopus coronopifolia). By the mid 1980s, this species had covered some 80 ha of the estuary.

The Department of Conservation has been actively controlling this species since the late 1980s (Department of Conservation files), adapting its technique over the years. It now has very effective techniques which make eradication from the estuary feasible. At the time of writing, there are only isolated pockets of cordgrass left but it is imperative this work is completed and that a monitoring programme is established to ensure that it does not reestablish. This monitoring could be part of a general plant monitoring programme.

Marram
The dune area has been intentionally modified through the planting of marram grass (Ammophila arenaria) for sand stabilisation. This has had the unfortunate effect of creating steeper dunes (Esler 1970), which are, ironically, less stable and prone to blowouts. Marram slowly outcompetes indigenous sand-binders, such as spinifex (Spinifex sericius) and pingao (Desmoschoenus spiralis). This complex situation is further complicated by the intense use of recreational vehicles in the dune area (see below). My personal observation over eighteen years is that vehicles discourage marram more than indigenous species. Ideally, management would encourage the indigenous species and eradicate or seriously control marram. Unfortunately, there is a strong public perception that marram is beneficial rather than detrimental. Therefore weed control and monitoring need to be supplemented by advocacy. It is not difficult to kill and can be easily controlled. Therefore, it is better to eradicate this weed from the estuary, rather than to just try to control it.

Sharp rush and tall fescue
Ravine (1992) identified two other major weeds as sharp rush (Juncus acutus) and tall fescue (Festuca arundinaceae). The former occurs in drier locations at the edge of saltmarshes and has a very dense habit which excludes most indigenous plants. Because it is on the edge of the fernbird area, it may reduce the amount of habitat available to this important population. It would be desirable to monitor this species to see if it is spreading and then investigate techniques for eradication if this is subsequently deemed necessary.

Tall fescue has spread into the fernbird area from adjacent farmland. Cattle are implicated in this spread (Ravine 1992). It is also found in localised places elsewhere in the estuary. It forms dense swards which progressively exclude indigenous vegetation. It may be impossible to eradicate this plant now but it is vital to at least contain it. There is limited information about selective control techniques for grasses in an estuarine habitat, so some research will be required first. Herbicide control techniques are available. Again, it would be desirable to monitor the spread of this plant.

Other weeds
While no other species have been considered major weeds within the Manawatu Estuary, there may, in fact be unknown weed problems. Other weeds which may need controlling include blackberry (Rubus fruticosa ag.), gorse (Ulex europaeus), tree lupin (Lupinus arboreus) and pampas grass (Cortaderia selloana). A comprehensive survey would benefit management considerably, while continued monitoring under the same objective would reveal if these species are spreading. Any control action would depend on the results of that work.

Actions:

Cordgrass
1. Complete the current cordgrass eradication programme.
2. Establish long-term monitoring to detect any new infestations and eradicate these when found.

Groups responsible: Department of Conservation; other groups could assist with field work

Marram 1. Design and implement an eradication programme for marram grass in the dune area of the estuary (this may include a public awareness component). **Groups responsible:** Horowhenua District Council; other groups could assist with field work
Sharp rush and tall fescue 1. Monitor sharp rush populations to determine if this weed is confined or spreading 2. Investigate control techniques and then apply them appropriately. 3. Investigate the use of Gallant and other chemicals or techniques for controlling tall fescue within the saltmarsh area and implement these techniques to prevent spread of this plant. 4. If initial control is successful, consider the possibility or eradication of tall fescue from the estuary. **Groups responsible:** Department of Conservation; other groups could assist with field work
Other weeds 1. Survey and monitor the estuary for weeds in general. 2. Design and implement control programmes as indicated by the results of Action 1. **Groups responsible:** Department of Conservation; Horowhenua District Council, Horizons Regional Council; other groups could assist with field work

Objective Available habitat is increased in the Manawatu Estuary.

In recent years, control of cordgrass has cleared tens of hectares of tidal flats. Though much of this land has been recolonised by indigenous plants, the feeding area available for birds has also increased. However, when other weeds are removed from drier parts of the estuary, they may just allow space for further weed infestations. This particularly applies to marram in the dune area and tall fescue and sharp rush in the tidal flat areas. Therefore it would be appropriate to instigate a restoration programme of suitable replanting and monitoring in these areas. Replantings have been thwarted by rabbits. Therefore they need protecting, either through poisoning techniques or by temporary enclosure in cages.

The issue of stock in the proposed management area is a sensitive one because, to all practical intents and purposes, grazing within the area is deliberate. The private landowners are completely within their rights, though stock do then move out onto unfenced public land. Stock not only eat some indigenous plant species, but they also introduce weeds, pug the soil (which adversely affects smaller plant species) and may disturb birds.

The private landowners acknowledge the conservation values of the estuary and so limit this grazing but, while there is any grazing at all, there is a conflict of interest with conservation managers. There is a possibility that the land can be sold to the Crown, which would remove this conflict. There has not been any monitoring done to measure whether the effect of grazing is increasing or is relatively stable. Therefore this is as much an issue of advocacy and monitoring as one of direct management. It may eventually be necessary to fence some of the estuary off, though this is not an ideal situation.

Actions:

1. Undertake appropriate replanting following weed control in saltmarsh and dune areas. 2. Monitor plantings to ensure they are successful. **Groups responsible**: Department of Conservation; Horowhenua District Council, Horizons Regional Council; other groups could assist with field work
3. Stop or restrict grazing in the estuary, e.g. by fencing **Groups responsible:** Koputara Holdings or management team if land is purchased; Management team to negotiate for compensation, etc. otherwise.
4. Control rabbits when they reach high numbers. Alternatively, cage plantings **Groups responsible**: Horowhenua District Council, Horizons Regional Council; other groups could assist with field work

Objective: Water quality remains at or improves to a suitable level to maintain recognized values of the Manawatu Estuary.

4.4.7 Pollution

It would be fair to say that water is the life-blood of any estuary. While there are many factors which lead to formation of the saltmarshes and mudflats, it is the water which has spread the very substrate. The water also brings with it much of the food at the heart of the food chains within the estuary and removes much of the waste products formed as a result. To say that water quality is important is an understatement. Ironically, there is very little which happens within the estuary itself which affects water quality on a significant scale. However, management of plants, birds and recreational activities will at least allow natural processes to continue.

There is some doubt about whether or not water quality is of sufficient quality in the Manawatu Estuary. On the one hand, plants, birds and fish appear to be thriving and people eat fish caught there. On the other hand, people no longer swim in the estuary, fearing the water quality is not what it could be.

The quality of water within the Manawatu Estuary is directly affected by discharges upstream. The water quality is monitored and regulated by the Horizons Regional Council under its Manawatu Catchment Water Quality Plan. This plan is largely effective. Managers of a protected Manawatu Estuary should seek to be involved in any reviews of this plan.

The practice of spraying treated effluent into pine forest is practiced on a small scale within the Foxton Ecological District. This is done within the Waitarere Forest, to the south of the Manawatu Estuary. This could increase nutrients within the estuary. It would be prudent for managers of a protected estuary to be involved in the planning process for these discharges.

The old Foxton Beach rubbish dump lies in the dunes adjacent to the proposed management area. This has been capped and is not currently an issue. However, the dune country is notoriously unstable and there remains potential for pollution from this site in the future, particularly as some people illegally operate off-road vehicles around

the site. The Horowhenua District Council is responsible for policing this. Estuary site managers need to be aware of this potential problem.

Factors affecting water quality are beyond the control of estuary managers, being largely influenced by upstream activities, such as discharges. This ties in with the Maori vision of the estuary being part of the whole river system and the need to manage the whole catchment. The responsibilities for estuary management, in this respect, are to collect information and to use that information to influence bodies that have the power to control water quality, as well as to educate people about the impact of upstream activities.

4.4.8 Upstream Effects

By its very nature, an estuary can never be considered an isolated unit. It is more than just an area where a river meets the sea. Many factors affect that meeting, some of them having their origins a surprising distance away. In the case of the Manawatu Estuary, it is the impact of a coastal dune system which dictates its size and shape, yet the sand which forms the dune system has its origins as far away as Taranaki and the central North Island. In a similar way, the river itself, unique amongst major New Zealand rivers, has its origins on both sides of the main divide and extends as far as southern Hawkes Bay.

Activities and happenings some distance from the estuary itself can have direct effects on it. Siltation following large scale land clearance, water quality issues from spillages and discharges and accidental or deliberate release of exotic fish or plant species are just some examples. Few of these are within the power of estuary managers to control. That is why it is important for them to be aware of potential problems and to advocate in support of the estuary. This would be considerably easier if lines of communication are established beforehand. To a certain extent, this has already happened, as the Department of Conservation and the Horizons Regional Council, both part of the management team, have direct upstream responsibilities.

Local hapu are affiliated to Ngati Raukawa, who have an influence over much of the catchment. This communication needs to be extended to other territorial authorities, farm and forestry managers and other groups representing Maori interests.

The Manawatu Estuary is partly contained by stopbanks (or floodbanks), which protect Foxton Beach township and constrain the flow of the river during floods. Even well upstream from the estuary itself, stopbanks directing the flow of the river influence how the water arrives at the estuary. It is possible that this containment of the river has limited dynamic processes which have shaped its ecology but, given the size of the estuary, this effect has probably been very minor. In any case, it is impossible to measure now and there is no justification on ecological grounds for removal or modification of the stopbanks.

Stopbanks are regularly maintained to protect farmland and homes. It is unlikely that any of this work will adversely impact the estuary in the foreseeable future. However, the management team are an affected party in the resource consent process for this work and need to keep informed if changes are about to occur.

It is worth noting that the power of such a large river is difficult to control. Evidence suggests its course has wandered greatly over the years. It is possible that, despite stopbanks and other maintenance, the river could drastically alter its course following a

massive flood event. If this happens, the estuary will reform naturally but outside the managed area. It is impossible to plan for such an eventuality. However, the river does move a small amount regardless, particularly through erosion of the southern bank and changes in the spit at its mouth. A flexible management approach will allow for this

Actions:

1. Establish acceptable parameters for water quality within the Manawatu Estuary. **Groups responsible:** Horizons Regional Council
2. Make submissions on the Manawatu River Water Quality Plan with the aim of keeping water quality within these parameters. **Groups responsible:** Horizons Regional Council; Department of Conservation; Manawatu Estuary Trust
3. Undertake a public education campaign to solicit public cooperation on water quality issues. **Groups responsible:** Horizons Regional Council; Department of Conservation; Manawatu Estuary Trust

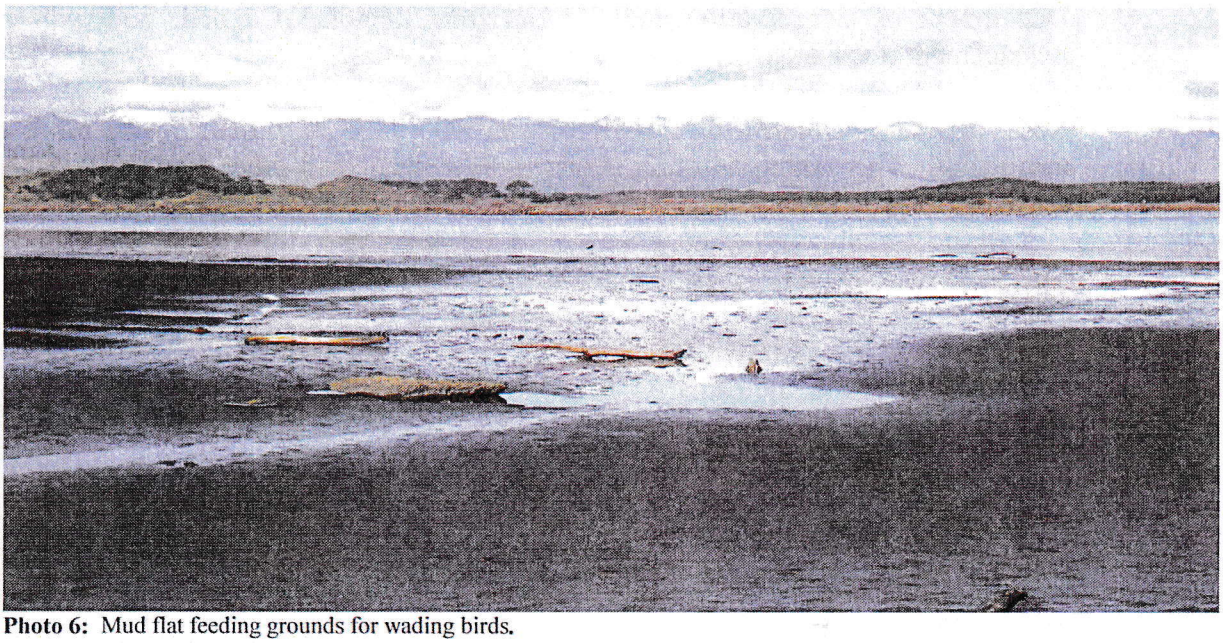

Photo 6: Mud flat feeding grounds for wading birds.

4.4.9 Social and Cultural

Objective **Public have access to the estuary without endangering special features.**

Currently there is legal public access to much of the proposed management area. The usual and easiest access is from Foxton Beach township, where access by foot, car or boat (via a boat ramp at the wharf) is possible. Boat access is also possible from Foxton via the Foxton Loop or from a boat ramp just upstream of the Whirokino cut. Access is also theoretically possible to the south end of the river mouth along the beach from Waitarere, though this is tide dependent and mostly impractical. Otherwise, access from the south is via the privately controlled Waitarere Forest. This requires permission, which is usually given for management reasons rather than recreation access.

Access to the northeast corner of the estuary is over privately owned land. The owners do allow some access for shooting, bird watching or other specific activities but this is not a public access. Even if the private land becomes a part of a legally protected area within the estuary, it is unlikely the owners would change this situation as it could affect their farming operation.

Foot access to the estuary is mostly limited to the river mouth area for fishing or walking as accessible parts of the estuary are otherwise muddy and unpleasant. Some people do venture further, for bird-watching or photography. Currently, there is vehicle access from the ocean beach and from roads in Foxton Beach. This is effectively controlled by the Horowhenua District Council.

While, in theory, there may be a clash between the perceived right to access the estuary and the need to limit bird disturbance, the physical difficulty of access to much of the estuary means this is rarely an issue. Mud flats are all but impossible to walk over, while access to the large saltmarshes is over privately owned or leased land, which, in itself, is not easy to get to. Therefore, many concerns over access are self-regulating anyway. Even where there are plantings or other sensitive issues, there are few parts of the estuary, other than the dune area, where public access is likely to cause problems. In the rare event that it is important to restrict public access to specific areas for specific periods, this could well be done with signs and local advertising.

However, it is important that birds are not disturbed excessively. It is possible that uncontrolled dogs accompanying members of the public could further disturb or even attack birds. Monitoring may show particularly vulnerable areas.

Actions:

1. Legal access to be maintained to the estuary. **Group responsible**: Horowhenua District Council
2. Areas which are identified as sensitive, either long term or temporarily, are protected passively through education and voluntary restrictions (such as dog-free zones). **Group responsible:** Horowhenua District Council; Department of Conservation; Manawatu Estuary Trust.

Objective **Fishing and whitebaiting continue in a sustainable fashion.**

A tradition of fishing within the Manawatu Estuary, for food or recreation, goes back hundreds of years (R.F.B.P.S. 2004). Currently, there are three main fishing activities within the estuary.

Line fishing is a popular pursuit and is mostly confined to the north bank of the river mouth, though other locations are sometimes chosen. It is less commonly done from boats. Netting for flounder is undertaken by a few people. Fish and Game and Ministry of Fisheries administer the fishing of these and other marine species. Whitebaiting, which is netting for juveniles of galaxiid fishes, is a popular recreational activity in the spring. This is administered by the Department of Conservation.

There is no real monitoring of fish take or the ecological effect of fishing within the estuary, though the Department of Conservation occasionally surveys for galaxiid spawning. Many fish species are transient within the estuary though they may be ecologically significant at certain times. There is no record that this has ever been studied.

There is already legislation in place in New Zealand to protect fish stocks (including whitebait), though this legislation obviously needs to be enforced. The only issue within the estuary which may need specific management relates to whitebait spawning. Spawning sites may need protection during the spawning season to ensure maximum hatching.

There is no current conflict with traditional Maori fishing interests but management should allow for any claim of traditional rights.

Actions:

1. Fishing and whitebaiting legislation is enforced. **Groups responsible:** Ministry of Fisheries; Department of Conservation; Fish and Game Council
2. Whitebait spawning sites are identified and protected (if necessary) **Group responsible:** Department of Conservation

Objective **Gamebird shooting is permitted in suitable locations.**

Duck shooting season is in May and June. The main target species is the introduced mallard duck (Anas platyrynchos) though other exotic species and some indigenous species, such as pukeko (Porphyrio porphyrio) and grey teal (Anas gibberfrons) are also shot. This shooting is strictly controlled by the Wellington Fish and Game Society under the Wildlife Act, 1953. Mostly, duck-shooting is done away from the township area, either on private land, on the south bank of the river or near the Whirokino Cut or Foxton loop.

Hunting limits the impact of these species on indigenous species and their habitat. A possible downside of this is that hunting activities may disturb indigenous species. However, due to physical access difficulties, this disturbance is considered to be

minimal. Any issues will be picked up by monitoring and management can be adjusted accordingly.

No conflicts with other activities have been identified, though some people object to the practice of duck-shooting on ethical grounds (for example one submission noted in R.F.B.P.S. 2004).

Provided current regulations are enforced, no difficulties are perceived relating to gamebird shooting in the Manawatu Estuary.

Actions:

1. Continue to enforce gamebird shooting regulations. **Group responsible:** Fish and Game Council

Objective Boating activities are safe and non-destructive.

The Manawatu Estuary offers one of very few sheltered, open and accessible stretches of water in the region and is ideally suited for certain types of boating. Much of this, however, is centered on the part of the estuary which is upstream of the proposed management area, though there is still some boating activity within the proposed Ramsar site. There are regular, organised events such as power boat racing. It is conceivable that tour boats may one day operate within the estuary and further upstream. The use of boats for access would be a normal part of management of the area. Jet skis have been of particular concern, while R.F.B.P.S. (2004) noted that some people were concerned about water skiing.

There are several issues associated with this boating. One is to recognise that there are few comparable areas for those who like to pursue this hobby. Another is that uncontrolled use of motorised boats may disturb roosting or feeding birds. There is a strong perception among some people that powered boats, particularly jet-skis or boats used for water skiing, do disturb birds. This disturbance could be directly through physical proximity to feeding or roosting birds or more remotely due to the wash boats produce. Noise may also be an issue in certain instances, though this is already handled by the harbour master. Finally, there are safety issues, though these are already dealt with by the Harbour Master and the Manawatu River Users Advisory group.

Generally speaking, however, boating in the Manawatu Estuary has a low impact and is well managed. The Manawatu Marine Boating Club is an active, well run club and the Harbour Master is able to enforce local regulations.

Continuation of the current management of boating activities is considered appropriate to protect special values of the estuary. However, if monitoring reveals any specific issues, it is anticipated that these could be controlled in cooperation with the Manawatu Marine Boating Club and the Harbour Master using voluntary restrictions.

Actions:

1. Continue to manage boating under the current regime. 2. Respond to any specific issues highlighted through monitoring through voluntary restrictions **Groups responsible:** Manawatu Marine Boating Club; Harbour Master
3. Analyse results of general plant and bird monitoring programmes to discern any deleterious effects of these activities. **Groups responsible:** Department of Conservation

Objective Use of recreational, land based vehicles is safe and non-destructive

Perhaps the most controversial issue affecting the proposed management area, and the one which gets the most attention at public meetings or through submissions (e.g. R.F.B.P.S 2004) is the use of recreational off-road vehicles in the dunes at the mouth of the estuary and on nearby sand and mudflats.

This vehicle use has already been through a major public consultation process and is currently managed by the Horowhenua District Council through its Foxton Beach Coastal Reserve Management Plan (Wiffen and Smith 2000) which is currently under review. This plan excludes or strictly controls vehicle use over much of the sand dune country in the vicinity of Foxton Beach. It allows open use of registered and warranted vehicles over part of the dune area within the proposed Manawatu Estuary management area but not on the mudflats. This is one of very few areas on the lower west coast of the North Island where vehicles are allowed in a dune area and is seen as an important resource by recreational off-roaders. This pressure on the dune area has increased as other parts of the coastline have been closed to vehicles.

There is a perception that vehicles create excessive sand movement and that this sand will eventually cover mudflats, which are vital feeding areas for birds. This is only partly true. In the absence of marram, indigenous sand-binding plants regulate, but do not prevent, sand movement. The process of natural sand stabilisation usually occurs over a space extending several hundred metres inland and involves a successional series of small shrubs and eventually trees (Ravine 1992). Historically, sand would inevitable have blown over the mudflat area anyway, as can be seen at the Rangitikei and Turakina Estuaries to the North.

Marram, planted for dune stabilisation (see above), traps more of the vast quantities of sand deposited on this coast than would otherwise have been the case. On much of the coast, exotic species such as tree lupin (Lupinus arboreus) and macrocarpa (Cupressus macrocarpa) have been planted to accelerate the stabilisation process (Hobday and Forbes 1984). Natural processes have been stopped by conversion of dunes to exotic pine (Pinus radiata) forest or farmland.

The dunes at the mouth of the estuary are mostly free of pines, lupins and macrocarpa. Somewhat ironically, the historic use of recreational vehicles has also discouraged establishment of marram grass and the dune area still contains populations of indigenous sand-binding species and shrubs, which are now rare on this coast (Ravine 1992). Inevitably, some sand does blow out of this area and across neighbouring

mudflats. Whether this is at a natural rate or at a temporarily high rate caused by disturbance of larger, semi-artificially induced marram dunes is impossible to determine without long-term monitoring.

Because this issue has been so controversial and polarised opinion so strongly, it would seem to be of vital importance to collect information so that management can be done on the basis of known facts. However, a decrease in vehicle activity (see below) suggests this may not be necessary. In the event that problems with vehicles persist, a scientifically conducted experiment comparing sand movement in vehicle exclosures with that in open areas is the only way to obtain the information needed for effective management.

A more obvious deleterious effect of vehicle abuse of the area is seen when people drive across mudflats, in direct breach of regulations set out in the Foxton Beach Coastal Reserve Management Plan. This disturbs roosting or feeding birds and may damage a proportion of their food supply.

Vehicles are also used for access to the river mouth and beach. In general, this is perceived as a right and only a few people object to this, provided vehicles do not venture onto mudflats. It is also necessary to use vehicles from time to time for management reasons.

Noise issues and safety issues are also of concern. Through late 2005 and early 2006, following serious injuries incurred through use of recreational vehicles in the dune area, enforcement of regulations has been much stricter. An updated Coastal Reserve Management is due for publication at about the same time as this plan and will control vehicle use to a greater extent. The Police and beach wardens have made a commitment to enforce these regulations. This increased enforcement has already considerably reduced use of recreational vehicles within the estuary. Because of these factors, the estuary management team will now support the Horowhenua District Council and the Police, rather than seeking to impose further regulations. There will, however, be an ongoing need to monitor the effects of vehicles in sensitive areas. It will also be highly beneficial to educate the public about the effects of recreational vehicles on the estuarine environment.

Actions:

1. Clearly identify areas where vehicle use is allowed. **Group responsible:** Horowhenua District Council
2. Enforce vehicle law and regulations. **Groups responsible:** Horowhenua District Council; Police
3. Establish a public education programme. **Groups responsible:** Horowhenua District Council; Manawatu Estuary Trust
4. Directly monitor effect of recreational land-based vehicles. **Groups responsible:** Department of Conservation; Ornithological Society of New Zealand

5. Analyse results of general plant and bird monitoring programmes to discern any deleterious effects of these activities. **Groups responsible:** Department of Conservation

Objective **Cultural and historical values are recognised and protected.**

The earliest people to settle in the lower North Island recognised the importance of the Manawatu River and Estuary as a source of food and other resources and as an access point inland and these are outlined in submissions recorded in R.F.B.P.S. 2004. Sites of significance dating back to those days remain within and around the estuary. Some of these have been documented, while others are part of an oral history. It is not always desirable or sensitive to specifically identify and record all of these. However, in consultation with local hapu, these resources should be considered in the case of any management practices which have potential to adversely affect particular sites. An ideal management structure would allow this to happen as a matter of course.

Foxton was settled by Europeans many years before the larger towns of Palmerston North and Feilding. The estuary was an important area to them, too. Due to the highly dynamic nature of an estuarine environment, particularly with the river being prone to flooding and the shifting sands of the river mouth, few physical clues remain from this time, though certain sites, such as the wharf, are significant.

In many cases, there are no physical historic features remaining to protect, just a location where something happened. It may also be that some historic resources are of private significance to traditional owners, who may not wish to share the locations of these resources with others. This needs to be respected. However, it may equally be that there are resources under threat which will need protection. This will require communication and coordination between all parties involved in managing the estuary. It also requires an inventory to be made of historic resources, which in turn may require some level of research.

Managers need to be sensitive to the potential of sites and structures to be of historic significance and consult with the local community from time to time.

Actions:

1. Identify and protect sensitive cultural sites. **Groups responsible:** Hapu; Department of Conservation; Horowhenua District Council; Manawatu Estuary Trust, Foxton Historical Society
2. Produce an inventory of historic sites and protect as required. **Groups responsible:** Hapu; Department of Conservation; Horowhenua District Council; Manawatu Estuary Trust. Foxton Historical Society
3. Record oral history both Maori and Pakeha. **Groups responsible:** Manawatu Estuary Trust

Objective **The estuary and its wise use is actively promoted**

At the time of writing, the Manawatu Estuary is not generally considered a tourist destination. Visitors do come from other parts of New Zealand to Foxton Beach as a summer holiday destination. Associated activities include fishing and boating, though these activities are not tourist activities as such. Tourist boat trips from further up the Manawatu River may operate in the future.

The Ramsar listing of the Estuary will raise its profile internationally and is likely to encourage small numbers of overseas visitors with a specific interest in wetlands or ornithology. This may have some ramifications for local businesses but any effect on the estuary itself is expected to be the same as that of recreational users. It is not considered likely that any special considerations will need to be made by estuary managers to accommodate these people, unless their numbers rise unexpectedly.

On the positive side, increased awareness of the values of the Estuary and its international significance already means that there is increased interest and activity in and around the Estuary. This could be advantageous both from a conservation perspective – for example through increased scientific and educational interest and study focused on the Estuary – as well as potentially for increased business opportunities compatible with the site.

Actions:

1. Develop publicity material eg brochures, presentations, signs interpreting the Ramsar Site and advising wise use for the site.

Groups responsible: Horowhenua District Council; Manawatu Estuary Trust

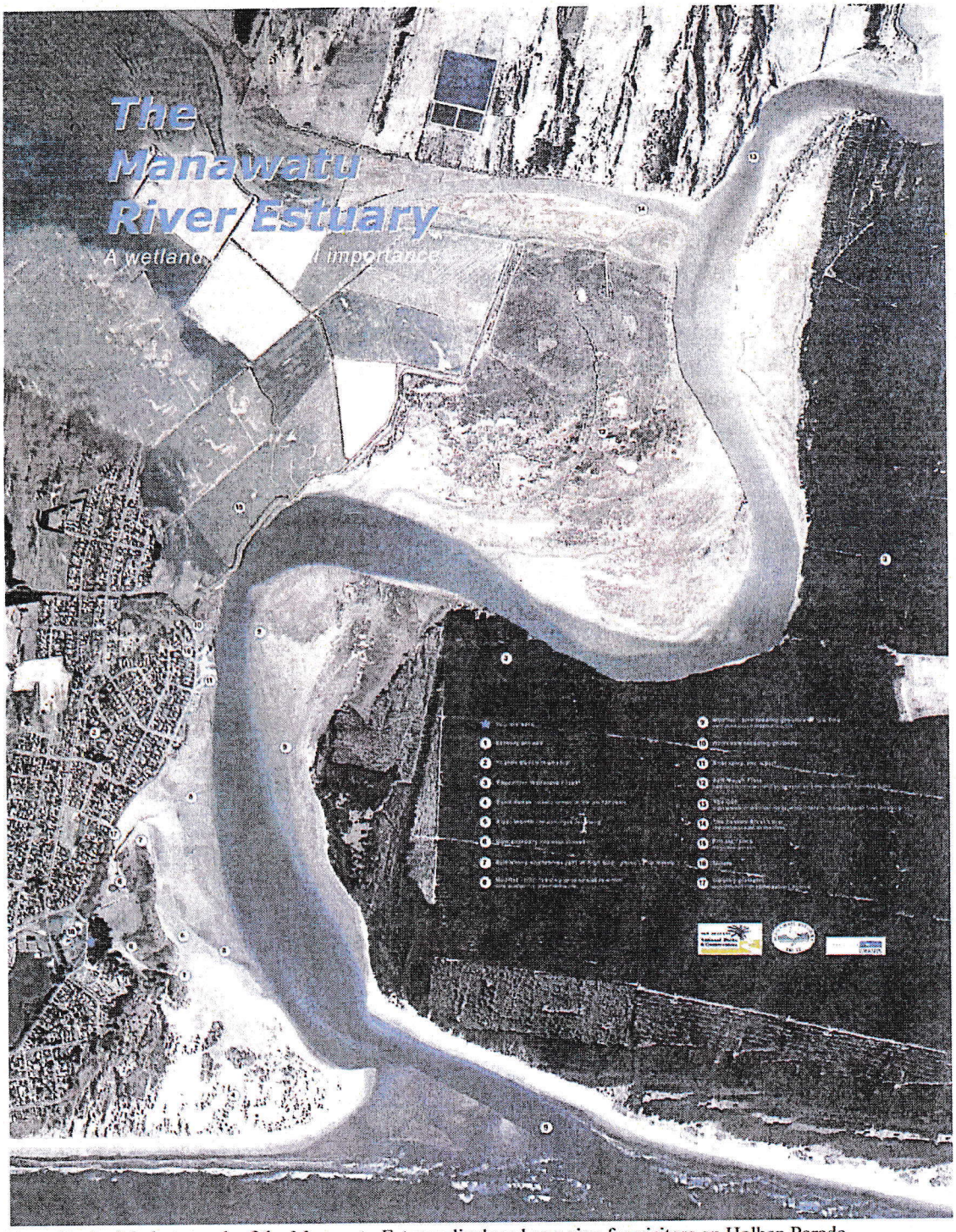

Photo 7: Aerial photograph of the Manawatu Estuary displayed as a sign for visitors on Holben Parade.

4.5 Research/Education Issues

Objective Research is encouraged and coordinated.

The Manawatu Estuary is a significant location for internationally migrating birds, which makes it important for research on these species. Some research has already been undertaken through local universities. This research, and that on other bird species, is likely to be a continuing process and needs to be allowed for by managers. Ideally, it would be coordinated, with some research directed to solving issues within the estuary.

Research on diadromous fish species is important because of the whitebait fishery and because of concerns about native fish stocks upstream. The estuary could be an ideal place for some of this research.

Other opportunities for research include weed control techniques, particularly for cordgrass and giant spike rush, dune plant succession and sand dynamics.

With the presence of two universities and several research organisations within two hours drive and having a range of biological features in a dynamic setting, the Manawatu Estuary is an attractive location for undertaking biological, ecological or geomorphological research. It is expected that most of this research would provide information of use to managers and that this would benefit the values for which the estuary has been protected. In fact, a system of actively encouraging suitable research would have potential impacts well beyond the estuary itself, even internationally. This would start with simple communication between those involved.

Actions:

1. Contact local research institutions to establish appropriate lines of communication. **Groups responsible:** Manawatu Estuary Trust; Department of Conservation; Horizons Regional Council; Horowhenua District Council
2. Evaluate all research proposals. **Groups responsible:** Management team

Objective Educational activities are encouraged.

The Manawatu Estuary is of high value as an educational resource, being easily accessible and containing a range of ecosystems and a diverse biota. The Manawatu Estuary Trust is already involved in such activities for schools and the public. For example, it holds open days and produces educational resources. Other organisations with an interest in the estuary could be encouraged to assist with or expand this as increased public knowledge of specific issues would only help protection of important features of the estuary.

As with research, use of this resource is mostly likely to be a good thing which could be encouraged but, again, some activities have potential to cause negative effects, such as scaring birds or disturbing restorative plantings. Ideally, there would be an evaluation system for large-scale activities to ensure disturbance is minimal.

Therefore, any new educational activities should be evaluated by estuary managers.

Actions:

1. Contact schools and other educational institutions and provide them with basic information. **Groups responsible:** Manawatu Estuary Trust
2. Evaluate proposals for educational activities. **Groups responsible:** Management team

Photo 8: Roger Slack shows school children a close look at Arctic waders.

4.6 Future Needs

Objective A visitor centre is established.

Plans are underway to construct a visitor centre, adjacent to the proposed management area, on a site administered by the Horowhenua District Council. Following initial public consultation, there was support for a purpose built visitor centre for the Manawatu Estuary. More recent public consultation has shown considerable opposition for this, with suggestions for providing facilities at an existing, though more distant location. Clearly, this issue needs further investigation, with input from the public and affected organisations.

Some details need to be established and accepted, not only who will pay for construction but also who would own it, who would staff it, who would cover ongoing costs and whether or not it should be included within the protected area. Staff may only be required on a part-time basis. Volunteer staff may be considered for times of peak

demand. Security could be a potentially serious issue then, particularly if the site is not manned full-time. In any case, clear responsibilities will need to be drawn up. Demand for the centre could increase in time so it would be prudent to allow for expansion.

Who will be responsible for staffing and financing this centre will depend largely on what protected status the estuary gets. Alternatively, various parties may agree to contribute on a proportional basis. This will need a legal agreement and long-term commitment.

Quite possibly, resistance is only because people have a perception that they will have to pay for this. Therefore, more public consultation will be needed.

If there is sufficient support for a visitor centre, fund-raising and planning will need to continue in response to this.

Actions:

1. Investigate the ongoing requirements for the operation of the visitor centre. 2. Continue with fund-raising and planning and establish a timeline for completion of the facility. **Group responsible:** Manawatu Estuary Trust

Objective Future Protection Options are evaluated

The largest piece of private land within the Manawatu Estuary contains valuable fernbird habitat within a large saltmarsh. While the owners are sympathetic to managing this area in line with the rest of the estuary, a preferred alternative would be if the area in question passes into public ownership. The landowners have indicated they will consider this.

At the time writing various options are being investigated including gazettal as a Wildlife Management Reserve. Another option may be to investigate the formation of a regional park based on the Manawatu Estuary. This would not change the underlying status of the land but would ensure the estuary has an identifiable status and receives cohesive management.

This issue needs to be discussed by the parties involved and an agreement reached before this management plan can be fully implemented.

Actions:

1. Negotiate for transfer of private land into public ownership. **Groups responsible:** Department of Conservation; Koputara Holdings; assistance from the Manawatu Estuary Trust.
2. Investigate possibility of declaring the area a regional park. **Groups responsible:** Horizons Regional Council; others to assist.

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APPENDICES

APPENDIX I - Plants of the Manawatu Estuary

(Taken from R.F.B.P.S. 2004; Appendix A. Data taken from unpublished plant lists recorded by Don Ravine, David Havell and Colin Ogle.)
*signifies adventive species.

Rushes	
*Juncus acutus	sharp rush
Juncus caespiticius	
Juncus maritimus var. australiensis	sea rush
Leptocarpus similis	oi oi; jointed wire rush
Sedges	
Bolboschoenus caldwelli	
Bolboschoenus fluviatilis	
Carex litorosa	
Isolepis nodosa	
Isolepis cernua	slender clubrush
*Isolepis setacea	
Schoenus nitens	
Schoenoplectus pungens	three square
Grasses	
*Agrostis stolonifera	creeping bent
*Cynodon dactylon	Indian doab
*Deyeuxia billardieri	sand wind grass
*Festuca arenaria	tall fescue
*Glyceria maxima	
Lachnagrostis filiformis	wind grass
*Parapholis incurva	sickle grass
*Puccinellia fasciculata	
*Polypogon monspeliensis	beard grass
*Spartina anglica	cord grass
Herbaceous Dicots	
*Apium nodiflorum	water celery
Apium prostratum	tutae-koau, native celery
*Aster subulatus	
Atriplex sp	
Calystegia soldanella	
*Carpobrotus edulus	South African
Chenopodium ambiguum	
Cotula coronopifolia	bachelor's buttons
*Egeria densa	
Leptinella dioica	
Lobelia anceps	punakuru, shore lobelia
Mimulus repens	
*Plantago coronopus	buck's horn plantain

*Rumex obtusifolius	broadleaf DOCk
*Ranunculus sp	
Ruppia polycarpa	horse's mane weed
Samolus repens	maakoako, sea primrose
Selliera radicans (may be rotundifolia)	remuremu
Sarcocornia quinqueflora	glasswort
Triglochin striata	arrow-grass
Dicot Trees and shrubs	
Coprosma propinqua	mingimingi
Coprosma repens	taupata
Leptospermum scoparium	manuka
Olearia solandri	
Plagianthus divaricatus	saltmarsh ribbonwood
Monocot Trees and shrubs	
Cortaderia toetoe	toetoe
Phormium tenax	harakeke, flax
Typha orientalis	raupo

APPENDIX II - Birds Recorded at the Manawatu Estuary

(Taken from R.F.B.P.S. 2004) Records are held by the Manawatu Branch of the Ornithological Society of New Zealand Inc. whose members regularly monitor the bird species at the estuary.

Birds Endemic to New Zealand

Spotted Shag	Strictocarbo punctatus
Paradise Shelduck	Tadorna variegata
New Zealand Scaup	Aythya novaeseelandiae
Pied Oystercatcher	Haemantopus ostralegus
Variable Oystercatcher	Haemantopus unicolor
New Zealand Dotterel	Charadrius obscurus
Banded Dotterel	Charadrius bicinctus
NZ Shore Plover	Thinornis novaeseelandiae
Wrybill	Anarhynchus frontalis
Black-billed Gull	Larus bulleri
Black-fronted Tern	Sterna albostriata
North Island Fernbird	Bowdleria punctata vealeae

Birds found in New Zealand and Australia

Australasian Gannet	Morus serrator
Pied Shag	Phalacrocorax varius
Little Shag	Phalacrocorax melanoleucos
Black Shag	Phalacrocorax carbo
Little Black Shag	Phalacrocorax sulcirostris
White-faced Heron	Ardea novaehollandiae
Australasian Bittern	Botaurus poiciloptilus
Royal Spoonbill	Platelea regia
Australian White Ibis	Threskiornis molucca
Chestnut-breasted Shelduck	Tadorna tadornoides
Chestnut Teal	Anas castanea
Grey Teal	Anas gibberfrons
Australasian Shoveler	Anas rhynchotis
Australasian Harrier	Circus approximans
Spotless Crake	Porzana tabuensis
Pied Stilt	Himantopus leucocephalus
Black-fronted Dotterel	Charadrius melanops
Red-kneed Dotterel	Erythrogonys cinctus
Spur-winged Plover	Vanellus miles
White-fronted Tern	Sterna striata
Fairy Tern	Sterna nereis
Crested Tern	Sterna bergii

Migratory Birds

Large Sand Dotterel	Charadrius leschenaultii
Pacific Golden Plover	Pluvialis fulva
Grey Plover	Pluvialis squatarola
Turnstone	Arenaria interpres
Japanese Snipe	Gallinago hardwickii
Red Knot	Calidris canutus

Great Knot	Calidris tenuirostris
Sanderling	Calidris alba
Curlew Sandpiper	Calidris ferruginea
Sharp-tailed Sandpiper	Calidris acuminata
Pectoral Sandpiper	Calidris melanotos
Baird's Sandpiper	Calidris bairdii
Red-necked Stint	Calidris ruficollis
Broad-billed Sandpiper	Limicola falcinellus
Eastern Curlew	Numenius madagascariensis
Whimbrel	Numenius phaeopus
Little Whimbrel	Numenius minutus
Bar-tailed Godwit	Limosa lapponica
Black-tailed Godwit	Limosa limosa
Hudsonian Godwit	Limosa haemastica
Grey-tailed Tattler	Tringa brevipes
Greenshank	Tringa nebularia
Terek Sandpiper	Tringa terek
Wilson's Phalarope	Phalaropus tricolor
Arctic Skua	Stercorarius parasiticus
Pomarine Skua	Stercorarius pomarinus

Birds found in widespread regions throughout the world

White Heron	Egretta alba
Intermediate Egret	Egretta intermedia
Little Egret	Egretta garzetta
Cattle Egret	Bubulcus ibis
Glossy Ibis	Plegadis falcinellus
Grey Duck	Anas superciliosa
Pukeko	Porphyrio porphyrio
Southern Black-backed Gull	Larus dominicanus
Red-billed Gull	Larus novaehollandiae
Gull-billed Tern	Gelochelidon nilotica
White-winged Black Tern	Chlidonias leucopterus
Caspian Tern	Sterna caspia
Little Tern	Sterna albifrons
Arctic Tern	Sterna paradisea
Common Tern	Sterna hirundo
Sacred Kingfisher	Halcyon sancta

Game birds introduced into New Zealand

Black Swan	Cygnus atratus
Canada Goose	Branta canadensis
Mallard	Anas platyrhynchos

Small introduced birds

Goldfinch	Carduelis carduelis
Greenfinch	Carduelis chloris
Yellowhammer	Emberiza citrinella
Chaffinch	Fringilla coelebs
Blackbird	Turdus merula
Song Thrush	Turdus philomelos
Dunnock	Prunella modularis

Skylark	Aluada arvensis
Australian magpie	Gymnorhina tibicen
House sparrow	Passer domesticus
Starling	Sturnus vulgaris
Small indigenous birds	
Grey Warbler	Gerygone igata
Fantail	Rhipidura fuliginosa
New Zealand Pipit	Anthus novaeseelandiae
Silvereye	Zosterops lateralis
Welcome Swallow	Hirundo tahitica

APPENDIX III - Fishes of the Manawatu Estuary

(Taken from R.F.B.P.S. 2004: Appendix C - List of freshwater fish species found in the Manawatu River Catchment. From New Freshwater Fish Database and unpublished data (M.K. Joy), includes species moving through, or possibly resident in the estuary. Some pelagic species not listed here may also be found at the river mouth on an incoming tide.)

Common name	Scientific name	Stages migrating through estuary
Marine Wanderers		
Grey mullet	Mugil cephalus.	juvenile/adult/resident
Yellow eyed mullet	Aldrichetta forsteri	juvenile/adult/resident
Kahawai	Arripis trutta	adult
Introduced		
Carp	Carassius auratus	non-migratory
Perch	Perca fluviatilis	non-migratory
Brown Trout	Salmo trutta	adult/Juvenile
New Zealand and Australian		
Shortfin eel	Anguilla australis	juvenile, adult
Koaro	Galaxias brevipinis	juvenile
Lamprey	Geotria australis	juvenile/adult
Endemic to New Zealand		
Longfin eel	Anguilla dieffenbachii	juvenile, adult
Torrentfish	Cheimarrichthyx fosteri	juvenile
Giant kokopu	Galaxias argenteus	juvenile/resident
Dwarf galaxiid	Galaxias divergens	non-migratory
Banded kokopu	Galaxias fasciatus	juvenile
Inanga	Galaxias maculatus	juvenile/adult/resident
Shortjawed kokopu	Galaxias postvectis	juvenile
Cran's bully	Gobiomorphus basalis	non-migratory
Common bully	Gobiomorphus cotidianus	juvenile
Giant bully	Gobiomorphus gobioides	resident
Redfin bully	Gobiomorphus huttoni	juvenile
Upland bully	Gobiomorphus breviceps	non-migratory
Brown mudfish*	Neochanna apoda	non-migratory
Common smelt	Retropinna retropinna	adult/juvenile
Black flounder	Rhomboslea retiaria	juvenile/adult/resident

* unlikely to be present within protected area.

APPENDIX IV - Invertebrates

The following list is taken from Maddison (2004), with additions from Stringer et. al. (1992) and Asher and Stark (1988).

Phylum:	**PORIFERA**	
Class:	DEMOSPONGIAE	
Order:	HAPLOSCLERIDA	
Family:	CALLYSPONGIIDAE	Callyspongia ramosa – tube sponge
Phylum:	**COELENTERATA**	
Class:	HYDROZOA	
Order:	CONICA	
Family:	SERTULARIIDAE	Amphisbetia operculata
Phylum:	**ANNELIDA**	
Class:	OLIGOCHAETA	
Family,Gen. et spp. indet. -		includes earthworms
Class:	POLYCHAETA	
Family:	NEREIDAE	Gen. et spp. indet.
Family:	SPIONIDAE	Gen. et spp. indet.
Family,Gen. et spp. indet. -		the major group of marine worms
Phylum:	**ARTHROPODA**	
Class:	ARACHNIDA	
Order:	ACARI	
Family:	ANYSTIDAE	Anystis baccarum - A predatory mite
Family:	CROTONIIDAE	Crotonia sp.
Family:	ERYTHRAEIDAE	Gen. et spp. indet.
Suborder:	**MESOSTIGMATA**	
Family,Gen. et spp. indet.		
Superfamily:	ORIBATOIDEA	
Family,Gen. et spp. indet.		
Family:	PHTHIRACARIDAE	Gen. et sp. indet.
Family, Gen. et spp. indet. – mites		
Order:	**ARANEAE**	
Family:	AGELENIDAE	Gen. et spp. indet.
Family:	ARANEIDAE	Eriophora pustulosa – garden orbweb spider
		Gen. et spp. indet.
Family:	CLUBIONIDAE	Gen. et spp. indet. – hopping spiders
Family:	LYCOSIDAE	Gen. et spp. indet. – wolf spiders
Family:	PISAURIDAE	Dolomedes minor – nurseryweb spider
Family:	SALTICIDAE	Trite spp.
		Gen. et spp. indet. – jumping spiders
Family:	THERIDIIDAE	Achaearanea veruculata – New Zealand cobweb spider
		Achaearanea sp.
		Argyrodes sp.

		Episinus sp.
		Moneta sp.
		Steatoda capensis – false katipo
Family:	THOMISIDAE	Diaea spp. – crab spiders
		Sidymella sp. – crab spider

Family, Gen. et spp. indet. – spiders

Order: PSEUDOSCORPIONES
Family, Gen. et spp. indet.

Class: CHILOPODA
Family, Gen. et sp. indet.

Class: CRUSTACEA
Order: AMPHIPODA

Family:	Not given	Transorchestia, sp. undescribed
Family:	Not given	Paracarophium sp.
Family:	Not given	Melita awa

Family, Gen. et spp. indet.

Order: CIRRIPEDIA

Family:	ARCHAEOBALANIDAE	Elminius modestus

Order: DECAPODA

Family:	HELICIDAE	Gen. et sp. indet.?
Family:	GRAPSIDAE	Helice crassa - burrowing mud crab
Family:	PORTUNIDAE	Ovalipes catharus - paddling crab

Family, Gen. et sp. indet. - crabs

Order: ISOPODA
Family, Gen. et sp. indet.

Class: DIPLOPODA

Family:	POLYXENIDAE	Gen. et sp. indet

Class: INSECTA
Order: COLYOPTERA

Family:	ANTHICIDAE	Lagrioida brouni
		Sapintus aucklandensis
Family:	BRENTIDAE	Exapion ulicis - gorse seed weevil
Family:	CERAMBYCIDAE	Psilocnaeia sp.
		Xylotoles sp.
		Gen. et sp. indet. - long-horned beetles
Family:	CERYLIDAE	Gen. et sp. indet.
Family:	COCCINELLIDAE	Rodolia cardinalis - cardinal ladybird
Family:	CORYLOPHIDAE	Gen. et sp. indet.
Family:	CURCULIONIDAE	Cecyropa sp.
Sub family:	COSSONINAE	Gen. et sp. indet
		Didymus sp.
		?Hiiracalles sp.
		Macrorhyncolus littoralis
		?Microcyptorynchus sp.

		Praolepra sp.
		Sericotrogus subaenescens
		Gen. et sp. indet
Family:	ELATERIDAE	Gen. et sp. indet.
Family :	HYDROPHILIDAE	Gen. et sp. indet. - water scavenger beetle
Family:	LATRIDAE	?Melanophthalma sp.
		Gen. et sp. indet.
Family:	OEDEMERIDAE	Thelyphassa diaphana
Family:	PHYCOSECIDAE	Phycosecis limbata
Family:	PSELAPHIDAE	Gen. et sp. indet.
Family:	SALPINGIDAE	Salpingus sp.
Family:	SCARABAEIDAE	Gen. et sp. indet.
Family:	STAPHYLINIDAE	Gen. et sp. indet. - rove beetles
Family:	TENEBRIONIDAE	Actizeta albata
		Actizeta fusca
		Chaerodes trachyscelides

Family, Gen. et sp. indet. - beetles

Order:	**COLLEMBOLA**	
Family:	ENTOMOBRYIDAE	Gen. et sp. indet.
Family:	PODURIDAE	Gen. et sp. indet.

Family, Gen. et sp. indet.

Order: DERMAPTERA

Family, Gen. et sp. indet.

Order:	**DIPTERA**	
Family:	CALLIPHORIDAE	Gen. et sp. indet. - blowfly
Family:	CHIRONOMIDAE	Gen. et sp. indet. - midges
Family:	DOLICHOPODIDAE	Gen. et sp. indet.
Family:	EPHYDRIDAE	Gen. et sp. indet.

Suborder: NEMATOCERA

Family, Gen. et sp. indet.

Family:	SARCOPHAGIDAE	Gen. et sp. indet.
Family:	SIMULIIDAE	Austrosimulium sp. - blackfly

Family, Gen. et sp. indet. - flies

Order:	**HETEROPTERA**	
Family:	ANTHOCORIDAE	Gen. et sp. indet.
Family:	CANTACADERIDAE	Cyperobia carectorum
Family:	LYGAEIDAE	Gen. et sp. indet.
Family:	MIRIDAE	Gen. et sp. indet.
Family:	VELIIDAE	Microvelia macgregori - common pond skater

Order:	**HOMOPTERA**	
Family:	APHIDIDAE	Gen. et sp. indet.
Family:	CICADIDAE	Gen. et sp. indet.
Family:	CICADELLIDAE	Paracephaleus sp.
		Gen. et spp. indet. (three species)
Superfamily:	COCCOIDEA	Family, Gen. et sp. indet.

Family: DELPHACIDAE Gen. et sp. indet.
Family: FLATIDAE Anzora unicolor - grey planthopper
Siphanta acuta - green planthopper
Family: PSEUDOCOCCIDAE Gen. et sp. indet. - mealy bugs

Order: HYMENOPTERA
Superfamily: CHALCIDOIDEA Family, Gen. et sp. indet.
Family: FORMICIDAE Huberia sp.
Pchycondyla castanea
Gen. et spp. indet. - ants

Suborder: PARASITICA
Family, Gen. et spp. indet. (two species)

Order: LEPIDOPTERA
Family: CRAMBIDAE Uresiphita polygonalis maorialis - kowhai moth
Gen. et sp. indet.
Family: GEOMETRIDAE Gen. et sp. indet.
Family: PIERIDAE Pieris rapae - white butterfly
Family: TORTRICIDAE Gen. et sp. indet.
Family, Gen. et spp. indet. - moths and butterflies

Order: MANTODEA
Family: MANTIDAE Orthodera novaezeelandiae - New Zealand praying mantis

Order: NEUROPTERA
Family: HEMEROBIIDAE Gen. et spp. indet. - brown lacewings

Order: ORTHOPTERA
Family:GRYLLIDAE Gen. et sp. indet. - cricket

Order: PSOCOPTERA
Family, Gen. et spp. indet. - booklice, barklice

Order: THYSANOPTERA
Family, Gen. et spp. indet. - thrips

Phylum: MOLLUSCA
Class: BIVALVIA
Family: MACTRIDAE Mactra discors - large trough shell
Mactra ovata?
Spisula aequilatera - triangle shell
Family: MESODESMATIDAE Paphies subtriangulata - tuatua
Family: PINNIDAE Atrina pectinata zelandica - horse mussel

Family: VENERIDAE Dosinia anus - ringed venus shell; coarse biscuit shell

Class: CEPHALAPODA
Family:SPIRULIDAE dead specimens

Class: GASTROPODA

Family:	AMPHIBOLIDAE	Amphibola crenata
Family:	HYDROBIIDAE	Gen. et sp. indet.
Family:	OLIVIDAE	Gen. et sp. indet.
Family:	TURRITELLIDAE	Gen. et sp. indet.
Family not given:		Potamopyrgus estuarinus
		Potomopyrgus sp.

Phylum:	CHORDATA
Class:	OSTEICHTHYES
Family:	DIODONTIDAE