AUCKLAND CONSERVANCY

Whangapoua Wetlands (6)

Location: 36°09'S, 175°25'E. On the northeast side of Great Barrier Island in the Hauraki Gulf, North Island.
Area: c.340 ha.
Altitude: Sea level.
Overview: The Whangapoua wetlands include Whangapoua Estuary, an associated sandspit and an adjoining area of freshwater wetland. Also included in the wetland area is the Mabey Farm stream which was formerly part of the Whangapoua wetland before Mabeys Road was formed. The estuary shows little sign of modification, and it is partly for this reason that it has been classified as having outstanding values as a wildlife habitat. The importance of this estuary is based on the whole ecosystem rather than individual species, although it is home to some threatened species. The wildlife in the Whangapoua wetlands is the most diverse on the island, with some 36 species of native and introduced birds, one of the most important being the Brown Teal *Anas aucklandica chlorotis*, which is one of New Zealand's most endangered waterfowl species.
Physical features: Inland are volcanic rocks of andesitic and rhyolitic composition. The land to the north of Whangapoua is a basement of greywacke and argillite; around the estuary and the Okiwi Basin are alluvial deposits of Quaternary age, and the shore is derived from sediments from the local catchments. The sandspit and the beach are made up of sands accumulated in the last 6000 years after the last glaciation. Water quality in the estuary is high, and there is a low level of turbidity. This is related to the low density of development in the catchment, the relatively intact nature of the swamp and its margins, and the high level of tidal flushing; the estuary almost completely empties each tidal cycle. The average tidal range is estimated at 3 m.
Climatic data are not readily available, the nearest weather station being at Leigh, on the North Island. Predominant winds are from the southwest and northeast, with little from the southeast. The average annual rainfall is estimated to be in the range 1,600 mm to 2,400 mm, peaking in winter. The mean annual temperature at Port Fitzroy is 15.6°C.
Ecological features: The Whangapoua wetlands are representative of northeastern New Zealand estuarine vegetation, with unbroken sequences of different vegetation types and species present along a salt and substrate gradient. There is a natural buffer of plant communities. The site contains the largest area of mangroves *Avicennia marina* var. *resinifera* on Great Barrier Island.
The Whangapoua wetlands are an area of high diversity, with 136 plant species, 57% of which are native. The exotic cordgrass *Spartina* sp. is absent from the area. The estuary is composed of mudflats (with a presence of *Zostera* sp.), sandflats (40%), saltmarshes (15%), mangrove swamps (20%) and shrubland. The upper reaches of the estuary are brackish to freshwater in composition and are dominated by Jointed Wire Rush *Leptocarpus similis*, with some Manuka *Leptospermum scoparium*, Raupo *Typha orientalis* and *Cyperus ustulatus*. The sandspit vegetation is made up of Lupin (50%), *Spinifex sericeus*, Pingao *Desmoschoenus spiralis*, Pohuehue *Muehlenbeckia complexa* and some *Pinus radiata* (a species commonly used in exotic forestry in New Zealand). The mangroves and bordering shrubland include species such as Oioi or Jointed Wire Rush *Leptocarpus similis* backing onto Sea Rush *Juncus maritimus* var. *australiensis*, and saltmarshes dominated by Glasswort *Sarcocornia quinqueflora*. *Baumea juncea* is also present. Behind this community is one of regenerating Kowhai *Sophora*

microphylla, and mature coastal forest including Kahikatea *Dacrycarpus dacrydioides*, Puriri *Vitex lucens*, Totara *Podocarpus totara* and Pohutukawa *Metrosideros excelsa*.

Land tenure: The wetlands are Crown land (harbour bed). Most of the surrounding land is now Crown land held as conservation area. A small area in the northern catchment is private land.

Conservation measures taken: With the recent acquisition of Okiwi Station which adjoins the Whangapoua Estuary on three sides, all of the wetland is now Crown land, either harbour bed or land held as conservation area and administered and managed by the Department of Conservation. A small area of coastal forest adjoining the southern margin of the estuary is a City Council Reserve which has been managed to conserve a significant population of Brown Teal *Anas aucklandica*.

Conservation measures proposed: It is proposed to allow part of the pastoral land of Okiwi Station to revert to shrubland to act as a buffer for the adjoining wetland. The wetland will be protected from occasional browsing by livestock through complete fencing. Although some of the pasture on surrounding land will be retained, the use of fertilizers will be restricted to prevent nutrient enrichment of the wetland from run-off. Some broken pasture areas at the northern end of the freshwater wetland will be encouraged to revert to rush and reed-beds, while still providing feeding areas for *Anas aucklandica* and other waterfowl. In general, Okiwi Station will be managed to promote the conservation and enhancement of the adjoining Whangapoua wetland habitat.

There is a proposal to create a Marine Reserve along the adjoining seaward boundary of the estuary and extending out to Rakitu Island.

Land use: The land immediately surrounding the estuary on Okiwi Station and Mabey Farm is used for pastoral farming. All the remaining conservation area is managed for protection and recreation. The conservation area is almost completely covered with indigenous forest with a number of small streams running into the Whangapoua wetlands. The wetland is used for conservation of plants and animals, swimming, fishing, and shellfish gathering.

Okiwi Station has one of only two commercial airstrips on Great Barrier Island, and this is close to the estuary on the southern side. The frequency of flights (by light aircraft) is at a low level, with an average of only 14 flights a week. There is a peak over the Christmas period, and possible closures during the winter months due to bad weather conditions.

Possible changes in land use: With the recent purchase of Okiwi Station by the Department of Conservation, some land presently in pasture will be retired to create buffer areas of shrubland immediately beside the wetland. In addition, other poor quality pasture above Mabeys Road will also be retired from grazing to allow native forest to regenerate. Development of some recreational activities and facilities, as well as protection of the wetland areas, is anticipated.

Disturbances and threats: One of the main threats to the Whangapoua wetlands in the past has been the draining of neighbouring swamps, and the clearing of swamp margins. The estuary is buffered to some extent by the natural plant communities existing on the margins. The introduction of invasive exotic plant species and the presence of stock on the estuary and sandspit have also threatened habitat values. Grazing by cattle in the past has led to a decrease in diversity, soil compaction and some localized erosion. During the summer months, over-fishing of shellfish stocks by campers occurs, as does use of an illegal campground leading to some pollution of the area. There are no possums on Great Barrier Island; however, they are considered a serious potential threat to the ecosystems, particularly forest ecosystems.

Hydrological and biophysical values: The wetland plays a significant role in maintenance of water quality, and is of importance in supporting aquatic and terrestrial food chains. It plays a general role in flood control, sediment trapping and the recharge and discharge of groundwater.

The high levels of flushing in the estuary together with unpolluted streams contribute to the high water quality.

Social and cultural values: Whangapoua is a significant site for shellfish gathering, and Pingao, which is abundant on the dunes, is valued by the local Maori for weaving. Archaeological surveys have found evidence of a battle on the Whangapoua spit in the form of human remains at the site. Middens are also found in the area. The estuary is valued for its aesthetic, scenic and recreational qualities.

Noteworthy fauna: The wetlands have been identified as a "Site of Special Wildlife Interest" (SSWI) and ranked as "outstanding" by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. Whangapoua has the highest bird diversity of any area on the island, including both coastal freshwater wetland species and forest and shrubland species. The most notable species present is the globally threatened Brown Teal *Anas aucklandica chlorotis*. An estimated 30% of the total population of this species are found in the area. Birds present in the upper reaches of the estuary include Australasian Bittern *Botaurus poiciloptilus*, *Anas aucklandica*, Banded Rail *Rallus philippensis assimilis*, Spotless Crake *Porzana tabuensis plumbea* and North Island Fernbird *Bowdleria punctata vealeae*. The sandspit provides a high tide roost and breeding area that is close to an estuarine food source, and is used by both international and internal migratory shorebirds. Both Variable Oystercatcher *Haematopus unicolor* and New Zealand Dotterel *Charadrius obscurus* breed on the spit, and this is also a major wintering are for the dotterel. Other species utilising this area include Pacific Golden Plover *Pluvialis fulva*, Banded Dotterel *Charadrius bicinctus*, Wrybill *Anarhynchus frontalis*, Bar-tailed Godwit *Limosa lapponica* and Caspian Tern *Sterna caspia*, as welews No. 61 December 1991; Waitangi Tribunal (1985).

Reasons for inclusion:

1a Manukau Harbour is a good representative example of an estuarine harbour.

2a The harbour supports substantial numbers of two globally threatened species of birds, *Charadrius obscurus* and *Anarhynchus frontalis*.

2b The harbour supports a rich and diverse estuarine flora and fauna including a number of threatened species and species which are scarce or local elsewhere in New Zealand.

2c The harbour is an important nursery area for fish and a major wintering area for migratory shorebirds.

2d The harbour is of special value for its endemic plant and animal species, including the mangrove *Avicennia marina* var. *resinifera* and the Jointed Wire Rush *Leptocarpus simplex*, and at least six bird species, *Haematopus unicolor*, *H. finschi*, *Himantopus novaezelandiae*, *Charadrius obscurus*, *Anarhynchus frontalis* and *Bowdleria punctata*.

3a The harbour regularly supports well over 20,000 waterfowl.

3c The wetland regularly supports over 1% of the regional population of several species of waterfowl, notably *Haematopus finschi* (68%) and *Himantopus leucocephalus* (56%)

Source: Ngaire Dutton.

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Kaitoke Swamp (7)

Location: 36¡14'S, 175¡26'E. On the eastern side of Great Barrier Island, North Island.
Area: c.300 ha. Altitude: Sea level.
Overview: Kaitoke Swamp is the most significant and largest freshwater wetland on Great Barrier Island. Its value is based on the high degree of naturalness, the high species diversity and the relatively unmodified environment. The swamp contains a range of habitats, and supports a number of rare or unique species and communities. It is also an important site for breeding and roosting waterbirds.
Physical features: The swamp is an infilled harbour on the eastern side of Great Barrier Island. The land is flat to undulating and surrounded by rolling hills. Soils in the swamp are of a peaty loam composition, with sand also being present (from old beach depositions and alluvial deposits). Climatic data are not collected on the eastern side of the island, but are based on measurements taken at some of New Zealand's offshore islands, and Port Fitzroy on the western side of the island. The mean annual temperatures are in the range 13.8¡C to 15¡C, and frosts are rare. The average annual rainfall is estimated at 1,270-1,780 mm, peaking in the winter; hot dry summers are not uncommon.
Ecological features: Kaitoke Swamp contains a zonation of habitats from hot springs and freshwater swamp to saltmarsh and tidal mangroves. Within these zonations, rare and unique species and communities are present. The swamp margins are vegetated by Manuka *Leptospermum scoparium*, with a dense understorey of *Gahnia xanthocarpa* and *Scirpus fluviatilis*. The endemic Kahikatea *Dacrycarpus dacrydioides* and Cabbage Tree *Cordyline australis* are also present. The lower tidal reaches include species such as sedges, rushes and the endemic mangrove *Avicennia marina var. resinifera*, as well as Saltmarsh Ribbonwood *Plagianthus divaricatus*, Raupo *Typha orientalis*, New Zealand Flax *Phormium tenax*, Sea Rush *Baumea juncea* and sedge tussock. Also present are the endemic Jointed Wire Rush *Leptocarpus similis*, Marsh Club Rush *Bolboschoenus fluviatilis* and Bamboo Spike-Sedge *Eleocharis sphacelata*. Most waterways are densely vegetated, and there are only small areas of open water. For the most part, the area is ungrazed.
Land tenure: Part of the wetland is Crown land (harbour bed and land held as Conservation Area) and part is private land. Most of the catchment land to the north and west is Crown land held as reserve. Catchment land to the south is mostly private land with some Crown land.
Conservation measures taken: Part of the wetland is Crown land held as Conservation Area, administered and managed by the Department of Conservation. This has provided indirect protection for the remaining area of wetland. The construction of board-walks in an area of the swamp allows access to the wetland with minimal damage.
Conservation measures proposed: Old District Schemes and the new draft District Plan for the island have all recognised the importance of the wetland and its value as a wildlife area. Changes in legislation (Resource Management Act 1991) have meant that new authorities are managing the area. Negotiations are under way between the Department of Conservation and the owners of the portion of the wetland in private ownership.
Land use: Conservation of plants and animals, recreation and education on the Conservation Area; farming activities (mostly pastoral) and land development on private land. Some reclamation has also occurred in the past. The surrounding land is largely made up of reserve areas covered in forest and shrubland, and used for conservation of plants and animals, and recreation. Possible changes in land use: Few changes in land use are anticipated. Some subdivision of the private land may be possible.
Disturbances and threats: The biggest threats to Kaitoke Swamp are the clearing of drains on neighbouring land and the drainage of wetland areas. Drain clearance causes siltation and

possible pollution problems, and subsequently results in a reduction in the water table and water quality. The grazing of margins by cattle and introduced herbivores damages the wetland margins. Coastal subdivision may also be a threat in the future. Careless use or over-use of the wetland for recreational purposes is another threat.

Hydrological and biophysical values: The wetland plays a general role in sediment trapping, the recharge and discharge of groundwater, the maintenance of water quality and the support of food chains. The water quality is high due to the forested water catchment. The Kaitoke area also has unique and unusual landforms.

Social and cultural values: Kaitoke Swamp has aesthetic, educational and landscape values. There is evidence of Maori occupation ("pa" sites).

Noteworthy fauna: Kaitoke Swamp is an important feeding, breeding and roosting site for a number of bird species. It is particularly noteworthy for the presence of the globally threatened Brown Teal *Anas aucklandica chlorotis*, one of New Zealand's rarest waterfowl. There are two main roosts in the area. Other species known to occur in the swamp include Australasian Bittern *Botaurus poiciloptilus*, Banded Rail *Rallus philippensis assimilis*, Spotless Crake *Porzana tabuensis plumbea* and New Zealand Dotterel *Charadrius obscurus*. Some of the largest populations of the North Island Fernbird *Bowdleria punctata vealeae* are found in the swamp margins and upper reaches.

Noteworthy flora: A rare wetland orchid *Spiranthes sinensis* is found in Kaitoke Swamp, as are a number of other orchid species.

Scientific research and facilities: There are no research facilities at the wetland. While Kaitoke Swamp has high scientific and wildlife values, there are very few reports that deal specifically with the area. The few that have been written on the Kaitoke area are mainly archaeological surveys.

Conservation education: No specific conservation education is undertaken.

Recreation and tourism: Recreational activity in the Kaitoke area is relatively high because of its proximity to walking tracks. Activities include walking, picnicking and bird-watching. There is also some swimming in the hot springs.

Management authority: The Department of Conservation (Auckland Conservancy) has responsibility for the management of conservation area and wildlife. The Auckland Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. Jurisdiction: Functional: Department of Conservation and Auckland/Waikato Fish and Game Council. Territorial: Auckland Regional Council.

References: Bell (1986a); Department of Lands and Survey (1983a); Given, Sykes *et al.* (1987); Marjoribanks (1976); Ogle (1980).

Reasons for inclusion:

1d Kaitoke Swamp is an example of an unusual wetland type containing a zonation from hot springs and freshwater swamp to saltmarsh and tidal mangroves. The swamp still retains a high degree of naturalness.

2a The wetland supports populations of three globally threatened species of birds, *Botaurus poiciloptilus, Anas aucklandica* and *Charadrius obscurus*. The rare wetland orchid *Spiranthes sinensis* is also present.

2c The wetland is an important breeding area for birds such as *Botauruspoiciloptilus, Anas aucklandica, Rallus philippensis* and *Bowdleria punctata*.

2d The wetland is of special value for its endemic plant and animal species, notably the plants *Dacrycarpus dacrydioides, Avicennia marina var. resinifera* and *Leptocarpus similis*, and the birds *Anas aucklandica, Charadrius obscurus* and *Bowdleria punctata*.

Source: Ngaire Dutton.

Kaipara Harbour (8)

Location: 36¡24'S, 174¡14'E. In Kaipara Ecological District, northwest of Auckland City, Auckland Region, North Island.
Area: c.94,700 ha. Altitude: Sea level.
Overview: With over 800 km of coastline, Kaipara Harbour is New Zealand's largest enclosed harbour and estuarine system. It is a highly productive ecosystem with a high diversity of habitats and good sequence of ecotones including sand-field vegetation, freshwater swamps, saline wetlands, coastal scrub and coastal forests. The harbour is an important habitat for large numbers of migratory waterfowl, including several threatened species, and is a major breeding area and roosting site for some species. The Waionui wetlands are an extensive area of sand dunes, soaks and wetlands which are regionally rare. This area contains a number of threatened species and a sequence of diverse ecotones.
Physical features: Kaipara Harbour is an estuarine environment of marine origins, dominated by tides. The coastline is deeply indented with sheltered rocky shores and low cliffs. Sand and mudflats are extensive at low tide. The harbour has a number of small islands around its margins; these are connected to the mainland by mudflats at low tide. There is little specific information on water quality other than factors relating to the direct discharge of treated sewage. In general, however, water quality is high. There are freshwater inputs from many small streams and three medium-sized rivers, the Wairoa, Hoteo and Kaipara. The sandy soils around the harbour are prone to erosion.
The average annual rainfall in the area is in the range of 1,200-1,400 mm, with the peak occurring in the winter months. The summers are warm and humid, while the winters are cool and wet. Water deficits are not uncommon in the South Kaipara area from December to April.
Ecological features: Kaipara Harbour has a range of ecotonal sequences and environments, including inter-tidal mudflats, mangrove forests (with *Avicennia marina var. resinifera*), swamps, salt-rush and reed swamps (with *Schoenus* spp.), sandflats, tidal reaches, saltmeadows and maritime rushes. The harbour has large areas of mangrove forest, particularly at Waionui Inlet near the harbour entrance and at Tauhoa Scientific Reserve, but also in many secluded inlets where streams and rivers enter the harbour. Saltmarsh and saltmeadow areas are also associated with the larger mangrove areas. The harbour provides high quality habitats for a large number marine species including soft bottom fish, especially flounders *Rhombosolea* spp., and a high diversity of estuarine invertebrates. The extensive mudflats represent a rich food source for up to 50,000 waterfowl, including large numbers of migratory shorebirds from the northern hemisphere. Some waterfowl breed on the more remote parts of the harbour edge, particularly at Papakanui Spit and Tapora sand islands, and on low-lying farmland towards the southern end of the harbour.
Land tenure: The majority of the harbour bed is Crown land up to Mean High Water Mark. However, there are a number of privately owned properties which include inter-tidal areas in excess of 100 ha. Parts of the harbour and a number of marginal strips of land are Crown land held as Scientific Reserves and Scenic Reserves. Most of the surrounding catchment is private land, although there are some large areas on the harbour edge which are Crown land administered by the Department of Conservation. These include six reserves covering an area of 1,320 ha on or adjoining the Okahukura Peninsula in the middle of the harbour, and a total of 71 Coastal Reserves in the Auckland Conservancy, mostly smaller areas and marginal strips on the harbour coastline.
Conservation measures taken: The Tauhoa Scientific Reserve (301 ha of Crown land) contains 75% of the mangroves in Kaipara Harbour. Most of the reserve is vegetated by dense mangroves with associated saltmarsh and saltmeadows. Other Crown land associated

with the wetland includes several large blocks of land adjoining the harbour, among them Atuanui Conservation Area (607 ha), which is the largest area of indigenous forest left adjoining the harbour, and Papakanui Conservation Area (1,113.5 ha). In addition, there are six reserves covering an area of 1,320 ha on or adjoining the Okahukura Peninsula in the middle of the harbour, and a total of 71 Coastal Reserves in the Auckland Conservancy, mostly smaller areas and marginal strips on the harbour coastline. Commercial fishing restrictions apply in the harbour mouth.

Conservation measures proposed: At present, a Regional Coastal Plan is being prepared by the Auckland Regional Council as part of the requirements under the Resource Management Act 1991. Under the same Act, the Department of Conservation has prepared a draft Coastal Policy Statement to aid the protection of valuable coastal areas such as Kaipara Harbour. The Department of Conservation is presently considering a proposal to improve protection of the significant vegetation associations in Waionui Inlet by reserving the area. The Department is also active in advocating the protection of intertidal habitat that is in private ownership. The Resource Management Act 1991 now makes development of the valuable wildlife habitat areas less likely.

Land use: Conservation of plants and animals in the Conservation Areas, Coastal Reserves and Scientific Reserves (although scientific purposes predominate here). Commercial and recreational uses include fishing, shellfish collection, oyster farming, water extraction and boating. Recreational fishing is popular from Papakanui Spit. Offshore extraction of sand occurs in the harbour near Pouto, and there is land-fill and illegal dumping of refuse in some wetland areas. Land use in the catchment is largely rural, with dairy and sheep farming, pastoral development and exotic forestry being the main activities. Small settlements are scattered throughout the region, but population densities tend to be of low.

Possible changes in land use: The felling of pine forests in the area could result in increased sedimentation in the future. There is some pressure for intensification of land use with consequent subdivision on the southern harbour edge around Parakai and Kaukapakapa. However, overall the current rural land uses are not expected to change in the foreseeable future.

Disturbances and threats: Kaipara Harbour is threatened by a wide range of activities. The invasive exotic cordgrass *Spartina* spp. covers a large area of mudflats near Oyster Point at the southern edge of the harbour, and is spreading. This grass was deliberately planted to assist reclamation of land for farming. It out-competes native species and reduces the diversity of the wetland environment; it is considered to be an exotic weed species by the Department of Conservation. Exotic forestry species such as *Pinus radiata* are contributing to the degradation of dune lakes by lowering groundwater, and thus the lake levels are lowered. This has lead to many lakes on the South Kaipara Head eventually drying out. Illegal land-fill and the dumping of refuse on the shore have led to pollution of parts of the wetland and a reduction in scenic and aesthetic qualities. Run-off from farms has caused nutrient enrichment, while soil erosion in parts of the catchment has led to increased siltation and risk of flooding. In many areas of Kaipara Harbour, cattle are allowed to graze on inter-tidal vegetation including mangrove and saltmarsh vegetation. Recreational activities involving off-road use of fourwheel drive vehicles and motorbikes have damaged the natural vegetation. The area adjacent to the Waionui Inlet and Papakanui Spit is popular with fourwheel drive clubs, and is also used by the airforce for bombing practice. These activities reduce the numbers of birds able to breed in the Papakanui Spit Wildlife Refuge.

Hydrological and biophysical values: The wetland plays a significant role in sediment trapping and the maintenance of water quality, and is of great importance in supporting food

chains by providing a breeding, nursery, and feeding area for many organisms from marine invertebrates to birds.

Social and cultural values: The recent increase in awareness of the high productivity of estuarine environments has placed higher values on Kaipara Harbour. It is used for marine farming and commercial and recreational fishing. Shellfish gathering is important to the people of the Kaipara area. The harbour has educational, historic and scenic values, and is also of great significance to the Maori, being important for food and other resources, and of cultural and spiritual significance.

Noteworthy fauna: Kaipara Harbour is extremely important for waterfowl, supporting breeding populations of several uncommon species and serving as a major wintering area for migratory shorebirds. In June/July 1989, approximately 24,500 waterfowl were recorded in the harbour (Ornithological Society of New Zealand National Wader Count Project). The harbour has the largest breeding colony of Caspian Tern *Sterna caspia* in New Zealand, with 500 pairs breeding on an island opposite Shelly Beach. It is also one of only two estuarine areas where the globally threatened Fairy Tern *Sterna nereis davisae* breeds on the mainland of New Zealand. This subspecies of the Fairy Tern is known to breed only on the coasts of Northland. Very large numbers of migratory shorebirds from the northern hemisphere utilize the harbour, mostly Bar-tailed Godwit *Limosa lapponica* and Red Knot *Calidris canutus*, but also some Pacific Golden Plover *Pluvialis fulva*, Grey Plover *P. squatarola*, Ruddy Turnstone *Arenaria interpres* and Red-necked Stint *Calidris ruficollis*. The harbour also supports high numbers of Banded Rail *Rallus philippensis assimilis*, South Island Pied Oystercatcher *Haematopus finschi*, Variable Oystercatcher *H. unicolor*, New Zealand Dotterel *Charadrius obscurus*, Banded Dotterel *C. bicinctus* and Wrybill *Anarhynchus frontalis*. The critically endangered Black Stilt *imantopus novaezelandiae* is an occasional visitor to southern areas of the harbour.

Other wetland birds using the margins of the Waionui Inlet include Australasian Bittern *Botaurus poiciloptilus*, crake species *Porzana* spp. and North Island Fernbird *Bowdleria punctata vealeae.*

Noteworthy flora: Two vulnerable, indigenous species, the fern *Cyclosorus interruptus* and Dwarf Mazus *Mazus pumilio*, are present in the harbour.

Scientific research and facilities: The Tauhoa Scientific Reserve contains an area of high quality mangroves and estuarine systems. A large number of surveys and scientific investigations have been carried out in this area in the past. Otherwise, Kaipara Harbour is in many ways a forgotten harbour. Little information is available, except from the Tauhoa Reserve, and most deals with the wildlife values of the estuary.

Conservation education: Little use has been made of Kaipara Harbour for conservation education, and there are few aids dealing specifically with the harbour. However, the harbour has considerable potential for conservation education, as the inter-tidal areas are relatively undisturbed compared to those of other harbours near Auckland.

Recreation and tourism: Bird-watching is a major form of recreation in the harbour. Other activities include fishing, shellfish gathering, swimming and walking. On the South Kaipara Heads, recreation with four-wheel drive vehicles is popular. Recreational activity is currently limited in most areas of the harbour.

Management authority: The Department of Conservation (Auckland Conservancy and Northland Conservancy) has responsibility for the management of conservation area and wildlife. The Auckland Regional Council and Northland Regional Council have statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The Auckland/Waikato Fish and Game Council and the Northland Fish and Game Council are responsible for the management of sport fishing (trout

and salmon) and game-bird hunting. The boundaries of two regional councils, conservancies and fish and game councils run through the middle of the harbour.

Jurisdiction: Functional: Department of Conservation, Auckland/Waikato Fish and Game Council and Northland Fish and Game Council. Territorial: Auckland and Northland Regional Councils.

References: Auckland Regional Authority (1987d); Chapman (1976); Hobson County Council (1986); Ogle (1982); Otamatea County Council (1987); XXXX OSNZ News No. 57 December 1990.

Reasons for inclusion:

1a Kaipara harbour is a particularly good representative example of an enclosed harbour and estuarine system characteristic of northern New Zealand, containing saltmarsh, saltmeadow and mangrove forest communities which are representative of the Auckland and Northland regions.

2a The harbour supports populations of at least three globally threatened species of birds, *Botaurus poiciloptilus, Charadrius obscurus* and *Anarhynchus frontalis*.

2b The harbour supports a rich and diverse estuarine flora and fauna including a number of threatened species and species which are scarce or local elsewhere in New Zealand. It has good sequences of habitats including mudflats, sandflats, saltmarshes, and mangrove forests.

2c The harbour is an important nursery area for various fish species and marine life generally; it supports breeding colonies of two vulnerable Sterna species, and is a major wintering area for international and internal migratory shorebirds.

2d The harbour is of special value for at least six endemic bird species, *Haematopus finschi, H. unicolor, Himantopus novaezelandiae, Charadrius obscurus, Anarhynchus frontalis* and *Bowdleria punctata.*

3a Kaipara Harbour regularly supports over 20,000 waterfowl.

3c The wetland regularly supports over 1% of the regional population of several species of waterfowl, notably *sterna caspia* (50%) and *S. nereis davisae* .

Source: Ngaire Dutton.

Manukau Harbour (9)

Location: 37¡02'S, 174¡42'E. To the south and west of Auckland City; also bounded by Manukau City, Waitakere City and Franklin District, all within Auckland Region, North Island.

Area: c.34,000 ha. Altitude: Sea level.

Overview: Manukau Harbour is the second largest harbour in New Zealand. The harbour is made up of extensive inter-tidal mudflats consisting of sand flats, shellfish beds, silts and muds. Mangroves *Avicennia marina var. resinifera* with some associated saltmarshes dominate the upper reaches, creating diverse ecosystems ranging from saltmarshes to deepwater channels. Most of the harbour catchment is highly modified, containing a mixture of urban, industrial and rural areas, which have had detrimental effects on water quality. The harbour retains important natural values despite these influences, and is especially important for international and internal migratory shorebirds.

Physical features: Manukau Harbour is a shallow harbour covering an area of 340 sq.km, formed in a drowned river valley. At low tide, approximately 145 sq.km of the harbour bed is exposed, revealing a range of inter-tidal habitats. At the harbour mouth, the Manukau is

2.2 km wide and the channel 30 m deep. The harbour contains a mixture of habitats created by the range of substrates. In some areas, hard substrates of basaltic lava provide a rocky shoreline habitat, while in others, the inter-tidal area is dominated by sedimentary reefs, silt, sand or shell banks. On the shore, the Wiri lava cave is of national importance. The estuarine harbour environment is strongly influenced by the tides, which range from 1.9 m (neap) to 3.8 m (spring). There are considerable exchanges between the harbour and the ocean, but the flushing process is slow and may take up to a month in sheltered areas. The flow in Manukau Harbour is predominately tidal with some freshwater inputs from the surrounding catchment. The tidal flows are mainly along channels which were once part of the old river system before a change in sea level. Sediment is derived from erosion on the Awhitu Peninsula, shoreline erosion and from a bar in the harbour mouth.

The average annual rainfall in the area ranges from 1,200 mm to 1,400 mm, peaking during the winter months. The mean daily temperature is 22.5-24.0¡C during the summer months and 13.5-15.0¡C during the winter.

With a land catchment area of 870 sq.km (most of which is highly modified), the water quality is subject to high levels of pollution from treated sewage, heavy metals, sediment and other sources. Pollution comes both from urban areas, where storm water carries many pollutants to the harbour, and from rural areas, from fertilizers and sediments associated with farming activities.

Ecological features: Manukau Harbour is a highly productive marine environment, supporting a high diversity of marine life including a wide range of fish species, and providing feeding habitat for large numbers of *Anatidae* and shorebirds. Saltmarshes and mangrove communities can be found in the eastern and southern regions of the harbour. Important saltmarsh species include the endemic Jointed Wire Rush *Leptocarpus simplex*, Sea Rush *Juncus maritimus var. australiensis*, Knobby Club Rush *Scirpus nodosus* and Glasswort *Salicornia quinqueflora*. Large beds of eelgrass *Zostera* sp. provide feeding areas for birds and fish, and the seaweed *Gracilaria secundata* is important for its role in nutrient stripping and trapping fine sediments. Large numbers of marine invertebrates are found in the mudflats, and these attract up to 50,000 waterfowl, at least half of-which are international migrants from the northern hemisphere. Northern hemisphere species spend the northern winter here, arriving in October and November and departing in March and April. Similarly, large numbers of New Zealand species overwinter in the harbour before flying to the South Island to breed during the New Zealand summer. The numbers of birds seems to be limited by the availability of roosting sites rather than food. The harbour has six important roosts: Ambury Park Roost, Puhinui Roost, Seagrove Roost, Waipipi Roost, Pollok Spit Roost and Karaka Roost (with the largest number of birds). An artificial roost has been created at Wiroa Island to encourage the birds to stay away from Auckland International Airport which encroaches into the harbour.

Land Tenure: The harbour bed is Crown land up to Mean High Water Springs. Ownership of surrounding land is mixed, with large areas in private ownership, some small areas of Maori land, land administered by the Auckland Regional Authority, and Crown land held as reserve and administered by the Department of Conservation and City Councils.

Conservation Measures taken: The Puhinui Wildlife Refuge covers 116 ha of inter-tidal land at the mouth of the Puhinui Creek. The Department of Conservation administers a total of 22 small coastal reserves, mostly 20 metre wide marginal strips on the harbour coastline. Auckland Regional Authority administers the Centennial Memorial Park and associated indigenous forests in the Waitakere Ranges which cover over 7,000 ha in the northwestern catchment of the harbour. Some 4,500 ha of this area are used as a water catchment area to supply water to metropolitan Auckland. The Council also administer Albury Regional Park, covering 135 ha on the northeastern shore of the harbour, and the Awhitu Regional Park,

covering 113 ha. The latter is one of the few large areas of protected coastal land on the Awhitu Peninsula. In addition, there are many small coastal reserves administered by city councils on the northern and eastern perimeters of the harbour. However, there are few such reserves on the southern and eastern coastline, other than Awhiti Regional Park.

The harbour itself has been divided into a number of conservation and habitat protection zones by the proposed Manukau Harbour Maritime Planning Scheme. While the scheme is not yet operative, the managing authority, Auckland Regional Council, must have regard to the proposals. The Auckland Regional Council has also embarked on a programme to improve the quality of stormwater run-off entering the harbour by minimising the entry of contaminants at source, particularly in rural areas. The Regional Council is also actively improving the collection and treatment of leachate from several land-fill sites closed down in the past, particularly at Pikes Point.

Commercial fishing is now restricted by a quota system for the harbour. Trawling, Danish seining and drag-netting are prohibited. Anchorage and fishing are prohibited near the international airport. Planting programmes have been undertaken in some areas.

Conservation measures proposed: At present, a Regional Coastal Plan is being prepared by the Auckland Regional Council as part of the requirements under the Resource Management Act 1991. Under the same Act, the Department of Conservation has prepared a draft Coastal Policy statement to aid the protection of valuable coastal areas such as Manukau Harbour. In addition, protection of several large areas of land adjoining the harbour is being actively pursued by the Department of Conservation and several local conservation groups. These areas are known to be high-tide roosting sites for large numbers of waterfowl, and are in danger of being subdivided.

Land use: Harbour uses include protection of wildlife in the Wildlife Refuge, navigation, low level port activities, marine farming, fishing (both commercial and recreational) and various forms of outdoor recreation. In addition, a large area of harbour bed east of Puketutu Island has been enclosed for sewage purification prior to discharge into the harbour.

Land use in the surrounding catchment is a mixture of industrial and public utility (5%), water supply catchments and reserves (10%), residential (10%) and rural (75%). Some low impact recreation is undertaken in the indigenous forests in the Waitakere Ranges to the north of the harbour. A part of these Ranges is used for water catchment to supply metropolitan Auckland, and is closed to the public. To the southeast, there is an area which is used extensively for market gardening, and to the south, there are horticultural and dairy farming areas. Also in the south is New Zealand's largest steel mill at Glenbrook.

Possible changes in land use: Changes in the collection, treatment and disposal of waste water, especially sewage and storm water, may lead to a substantial improvement in water quality. The planned expansion of Auckland International Airport and increased urbanisation and industrial development as Auckland continues to grow potentially increase the likelihood of pollution and disturbance of the harbour. Rural land-use changes from pastoral farming to more intensive horticulture and market gardening are also likely.

Disturbances and threats: The principal threats include siltation, pollution from a number of sources such as leachate from land-fills (both operational and closed), storm water and farm run-off, grazing on coastal plants on the southern margins of the harbour, illegal dumping of refuse, and the introduction of invasive plants, particularly Spartina spp. along the southern margins. Subdivision is a continuing threat to some shorebird roosting sites. There is evidence that commercial fish species, including Grey Mullet *Mugil cephalus*, Rig *Mustelus lenticulatus* and Snapper *Chrysophrys auratus*, declined in numbers during the 1980s (MAFFish, 1989). The continued operation and expansion of the international airport poses a threat to the high numbers of waterfowl flying over the harbour. In some areas, vehicles pose a threat, especially the use of motorbikes on mudflats.

Hydrological and biophysical values: The wetland plays a general role in sediment trapping and the maintenance of water quality; it is also of great importance in supporting aquatic and terrestrial food chains. The harbour is an important nursery area for a diversity of fish species, and is a site where whitebait *Galaxias* spp. breed. Economically important fish species harvested from Manukau Harbour in order of importance are Grey Mullet *Mugil cephalus*, flounders *Rhombosolea* spp., *Kahawai Arripis trutta*, Rig *Mustelus lenticulatus* and Yellow-eyed Mullet *Aldrichetta forsteri*.

Social and cultural values: Manukau Harbour is of great significance to local Maori, as outlined in the Report of the Waitangi Tribunal on the Manukau Claim (WAI-8). "Basically the claim is about the despoliation of the Manukau Harbour and the loss of certain surrounding lands of the Manukau tribes. More potently underlying this claim is an enormous sense of grievance, injustice and outrage that continues to haunt the Manukau Maori and bedevil the prospect of harmony in greater Auckland" (Waitangi Tribunal, 1985). Maori history in the area can be found in a number of archaeological sites located at Albury Park, Puketutu Island Pa, Crater Hill, Pukaki Creek Pa and Puhinui Creek Pa. Findings include living sites, burial areas, gardens and terraces. The harbour also has considerable educational, landscape, scenic and historical values.

Noteworthy fauna: Manukau Harbour is extremely important for waterfowl, occasionally holding up to 50,000 birds. It is particularly important as a wintering area for migratory shorebirds, supporting very large numbers of South Island Pied Oystercatcher *Haematopus finschi*, Pied Stilt *Himantopus leucocephalus*, Bar-tailed Godwit *Limosa lapponica* and Red Knot *Calidris canutus.* Other common shorebirds from the northern hemisphere include Pacific Golden Plover *Pluvialis fulva* and Ruddy Turnstone *Arenaria interpres*; unusual species have included Far Eastern Curlew *Numenius madagascariensis*, Greytailed Tattler *Tringa brevipes*, Sharp-tailed Sandpiper *Calidris acuminata*, Curlew Sandpiper *C. ferruginea* and Red-necked Stint *C. ruficollis*. Other notable species occurring in significant numbers include Banded Rail *Rallus philippensis*, Variable Oystercatcher *Haematopus unicolor*, New Zealand Dotterel *Charadrius obscurus*, Banded Dotterel *C. bicinctus*, Wrybill *Anarhynchus frontalis*, Caspian Tern *Sterna caspia* and North Island Fernbird *Bowdleria punctata vealeae*. The critically endangered Black Stilt *Himantopus novaezelandiae* is an occasional visitor to the harbour. Counts of shorebirds in the harbour in June/July 1991 and November/December 1991 gave totals of 41,500 and 42,000, respectively (Ornithological Society of New Zealand National Wader Count Project).

The small weevil *Peristoreus australis* has been found in the Huia saltmarsh; this species was previously known only from South Island.

Noteworthy flora: The harbour has extensive beds of eelgrass *Zostera* sp. and important saltmarsh and mangrove communities. On the northern shore, there are many native coastal plant species.

Scientific research and facilities: Extensive scientific investigation has already been carried out in the fields of marine biology, water quality and fisheries. There is considerable potential for further monitoring of land use. Research into harbour ecology is encouraged.

Conservation education: Various educational aids and leaflets have been produced in the Auckland Region for wetland areas, especially mangroves. The 1992 theme for "Conservation Week" was Wetlands. Other aids such as posters are also based around the water theme, and are important in raising public awareness of conservation issues. News releases in local newspapers and in the more widespread publications, e.g. "The New Zealand Herald", also help in public education. For a variety of occasions, displays are set up, often with an emphasis on Manukau Harbour and general environmental health issues.

Resource kits are also available for schools and other educational organisations. There is a Conservation Corps project in the Manukau region, and the Manukau Harbour Protection Society is actively promoting conservation of the harbour through education.

Recreation and tourism: The harbour supports a wide range of recreational activities such as fossicking, power-boating, yachting, rowing, bathing, fishing and shellfish gathering. The harbour is also enjoyed for its scenic values, seen best in the Cornwallis and Titirangi areas. The international airport is sited on the harbour, and is important for tourism as an estimated 75% of all international visitors arrive at this location.

Management authority: The Department of Conservation (Auckland Conservancy) has responsibility for the management of conservation area and wildlife. The Auckland Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The Auckland/Waikato Fish and Game Council is responsible for the management of sport fishing (trout and salmon) and game-bird hunting.

Jurisdiction: Functional: Department of Conservation and Auckland/Waikato Fish and Game Council. Territorial: Auckland Regional Council.

References: Auckland Regional Authority (1987c); Auckland Regional Water Board (1990); Bell (1986a); Bioresearches Ltd. (1985); Brown (1985); Given (1981); IUCN (1981); MAFFish (1989); Manukau Harbour Maritime Planning Authority (1989); XXXX OSNZ News No. 61 December 1991; Waitangi Tribunal (1985).

Reasons for inclusion:

1a Manukau Harbour is a good representative example of an estuarine harbour.

2a The harbour supports substantial numbers of two globally threatened species of birds, *Charadrius obscurus* and *Anarhynchus frontalis.*

2b The harbour supports a rich and diverse estuarine flora and fauna including a number of threatened species and species which are scarce or local elsewhere in New Zealand.

2c The harbour is an important nursery area for fish and a major wintering area for migratory shorebirds.

2d The harbour is of special value for its endemic plant and animal species, including the mangrove *Avicennia marina var. resinifera* and the Jointed Wire Rush *Leptocarpus simplex,* and at least six bird species, *Haematopus unicolor, H. finschi, Himantopus novaezelandiae, Charadrius obscurus, Anarhynchus frontalis* and *Bowdleria punctata*.

3a The harbour regularly supports well over 20,000 waterfowl.

3c The wetland regularly supports over 1% of the regional population of several species of waterfowl, notably *Haematopus finschi* (68%) and *Himantopus leucocephalus* (56%)

Source: Ngaire Dutton.

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