

AUCKLAND PROTECTION STRATEGY

A report to the Nature Heritage Fund Committee

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Definitions

Indigenous ecosystems - are defined as those that were present prior to human settlement, including the natural changes that have subsequently occurred to those ecosystems. It is not possible from the broad scope of the available information to be certain that any given location is indeed intact indigenous vegetation. Field surveys would be required to verify this.

Auckland Conservancy - is defined as the area from the Kaipara Harbour entrance and Mangawhai in the north to the Waikato River and Miranda in the south. It includes islands in the Hauraki Gulf from the Mokohinau Islands to The Firth of Thames, including Little Barrier Island and Great Barrier Island, and extends a further 1000 kilometres northeast to include the Kermadec Islands. The Kermadec Islands are not included in this report because of their remoteness and because they are already fully protected as the Kermadec Islands Nature Reserve.

Priorities – are evaluated for the protection of ecological and biodiversity values currently on private land.

Threatened species - are as determined by de Lange et al. (2008) four highest threat classifications for vascular plants, Miskelly et al. (2008) for birds and the five highest threat classifications from Hitchmough et al (2005) for all other species listed. Mosses, liverworts, fungi and microalgae are not included. The data on threatened species has been assembled using information that is currently available. The presence or absence of data does not mean that there definitely are or are not species present at a particular site as an area may or may not have been recently surveyed. Lists of threatened species are regularly revised and threat classifications changed. The 'acutely' and 'chronically' threatened categories referred to in Priority 4 of the national priorities (DOC and MfE 2007) have been replaced by the 'threatened' and 'declining' categories following the revision in 2008. The most recent list should always be used in applying this report.

Recently recorded - The data is based on threatened species that have been recorded in the catchment post 1970 for plants, lizards and invertebrates, and between 1999 and 2004 for birds.

Originally rare ecosystems – are as determined by Williams et al. (2006). The data only indicates that these ecosystems may be present in an area as no surveys for these have been carried out. (See Appendix II for more details on how potential sites of these ecosystems were identified).

Protected Areas (dated 2004) - are defined as follows:

1. Land under DOC, ARC, district or city council management
2. Land covenanted by the QEII Trust
3. Land protected under District Plan provisions

There are many protection mechanisms in place for the preservation of natural values including crown land, public conservation land, land under local government management, covenants, and provisions in district plans. The reserve definition is comprised of digital land information for land in public ownership whose status affords it some vegetation clearance protection and also private land protected by covenant or District Plan restrictions.

The GIS layer from which the information on the level of protection was compiled includes some Crown land, public conservation land administered by DOC, ARC parks, district council parks and reserves and QEII covenants. However for some EDs it also includes areas protected under local government district plans. Further judgement is required to assess the effective level of protection afforded to any ecosystem with protected status in this definition as changes to district plan provisions can affect the level of protection. The layer also excludes local government, Resource Management Act (RMA) covenants and bush bonds, as most are not available in digital form.

Abbreviations used in this report

ACC	Auckland City Council
ARC	Auckland Regional Council
ASCV	Area of Significant Conservation Value
CMS	Conservation Management Strategy
DOC	Department of Conservation
ED	Ecological District
ER	Ecological region
EW	Environment Waikato
FDC	Franklin District Council
GIS	Geographical Information System
LENZ	Land Environments of New Zealand
MCC	Manukau City Council
MfE	Ministry for the Environment
NHF	Nature Heritage Fund
NIWA	National Institute of Water & Atmospheric Research
NSCC	North Shore City Council
NZMS	New Zealand Map Series
OSNZ	Ornithological Society of New Zealand
PDC	Papakura District Council
PNAP	Protected Natural Area Programme
QE II Trust	Queen Elizabeth II National Trust
RDC	Rodney District Council
RMA	Resource Management Act
WCC	Waitakere City Council

1. INTRODUCTION

The primary purpose of this report is to assist the Nature Heritage Fund in assessing priorities for legal protection or restoration of indigenous ecosystems in the Auckland Conservancy which are currently on private land.

A secondary purpose is to provide information to DOC staff and other organisations to assist them in making decisions about values and priorities for protecting biodiversity in the Auckland Conservancy. It is noted however that this is a report based on analysis of very broad scale vegetation classes across the conservancy and the best available data at the time of collation. The results of more detailed ecological field surveys and assessment must be used to identify the value of specific sites.

An important result of the work undertaken to produce this report has been the development of a comprehensive GIS system combining ecological survey data from DOC, ARC and district and city councils. The underlying data and GIS Layers will be valuable in providing information which can be used by government agencies, regional and district councils and organisations such as the QE II Trust to develop a co-ordinated approach to biodiversity management and to establish a representative and sustainable protected natural areas system in the Auckland region. To assist this process the aim is to have the data available via a web mapping service from an updateable database. The information can then be kept transparent, current, secure and easily accessible to relevant users.

The Nature Heritage Fund (NHF) is a contestable Ministerial fund with a purpose to protect indigenous ecosystems that represent the full range of natural diversity originally present in the New Zealand landscape by providing incentives for voluntary conservation. Since 1990 the fund has protected over 339,528 hectares of indigenous ecosystems by assistance with legal and physical protection for biodiversity values on private land through various means such as direct purchase, covenanting or fencing.

Assessment of ecological significance is a key part of protecting areas of significant indigenous vegetation and significant habitats for indigenous fauna. The NHF receives many applications for funding each year and information on biodiversity values is required by the fund managers to prioritise these proposals.

As Auckland is a rapidly growing region there is constant pressure for clearance of indigenous vegetation for urban subdivision and industrial expansion. Department of Conservation (DOC) planners are involved in large numbers of submissions on policy statements, regional and district plans and resource consent applications and require information to allow them to quickly identify if a particular site is of conservation value. As natural vegetation is severely fragmented within the metropolitan limits, there are many sites that have high value as scarce habitat for threatened species even though other values may be low.

This report assesses the original extent of terrestrial indigenous ecosystems in each Ecological District (ED) in the Auckland Conservancy, the present extent of those ecosystems, and the extent to which they are protected. It also lists the threatened species and naturally rare ecosystems which are present in each ED. The report also identifies criteria against which all proposals for protection on private land in the Auckland Conservancy can be compared and prioritised and sets out a scoring system with which proposals can be assessed against these criteria. It is however only intended to be a guide to the potential value of a site or to alert staff to potential opportunities. It is not intended to replace site inspections and expert knowledge.

The area covered by this report extends from the Kaipara Harbour entrance across to the south of the Mangawhai Spit in the north, down to the Waikato River and Miranda in the south, including offshore islands in the Hauraki Gulf, and includes all the major terrestrial and freshwater indigenous ecosystems. The information is presented by Ecological District, but as the boundaries of the EDs do not align with the boundaries of the Auckland Conservancy some of the information refers only to a portion of an ED.

The Auckland Conservancy protection priorities have been developed by DOC's Auckland Conservancy, with advice from the Auckland Regional Council (ARC), and with data and advice supplied by regional, district and city councils.

1.2 Scope of the report

The purpose of this report is to evaluate the ecological and biodiversity values of sites. The cultural, historic, recreational or amenity value of sites is not covered. A site that does not score high in the biodiversity criteria could still have significant cultural, historic, and amenity value and may be considered of priority for these other reasons. This report does not attempt to address these values.

2. CONTEXT

2.1 National context

The New Zealand Biodiversity Strategy (MfE 2000) was developed to fulfil some of the commitments made by New Zealand under the Convention on Biological Diversity, an international treaty adopted at the Earth Summit in Rio de Janeiro in 1992. One of the goals of this strategy is to:

“maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; and do what else is necessary to;

maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity”.

Many rare ecosystems in New Zealand are under-represented in land under conservation management and some unique habitats for endangered species remain only on private land.

The Statement of National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land was published in April 2007 by the Ministry for the Environment and the Department of Conservation. It provides a framework for local decision making about biodiversity on private land, particularly for regional and district councils who work directly with landowners in their areas. The national priorities in the statement identify the types of ecosystems and habitats in particular need of protection. However the threat classification system for species has recently been revised so national priority 4 now applies to the habitats of ‘threatened’ and ‘declining’ indigenous species instead of ‘acutely’ and ‘chronically’ threatened indigenous species.

2.2 Regional context

The Auckland region, although one of the smallest regions in the country, is home to 1.3 million people, which is almost a third of the population of New Zealand. It includes New Zealand’s largest urban area, Auckland City, and urban development is encroaching on many natural habitats and iconic landscapes.

Most of the remaining indigenous ecosystems in the Auckland region are heavily fragmented with the exception of the Waitakere and Hunua Ranges and some offshore islands. A great deal of work is being carried out by regional, district and city councils, DOC, community groups and private individuals to preserve remaining important ecosystems in the region. Many councils support landowners to preserve biodiversity on their land through covenants, funding and advice. These organisations also run extensive volunteer programmes in parks and reserves to encourage public education and participation in conservation activities. With this support and other support from organisations such as Landcare groups and QE II Trust, there are a large number of individuals and community groups working in the region to preserve areas of indigenous vegetation by activities such as revegetation, controlling plant and animal pests and fencing to prevent stock grazing.

2.3 DOC Auckland Conservancy context

The Auckland Conservancy Conservation Management Strategy (CMS) 1995 - 2005 is currently being reviewed and a revised CMS is expected to be in place by 2011. A significant component of new CMS’s is the identification of ‘places’ and the development of outcomes, objectives and policies for those places. The idea of ‘places’ and the need for their management becomes more obvious at locations where a number of values overlap or intersect. A ‘place’ may also be chosen to highlight a particularly important or iconic site of international or national significance (e.g. World Heritage or Ramsar sites). Opportunities to extend or buffer these ‘places’ could be considered a high priority for protection.

New strategic directions have been developed for the Auckland Conservancy, building on the earlier focus of 'precious places on our doorstep.' Three themes were identified: integrated conservation management of special places (focusing on the Hauraki Gulf Marine Park), marine protection and increasing awareness of and support for conservation.

Management of natural resources in the Auckland Conservancy is currently divided between DOC, two regional councils, three district councils and four city councils, but this will change following the review of Auckland's governance.

3. DESCRIPTION OF THE AUCKLAND CONSERVANCY

The area included in the DOC Auckland Conservancy extends from the Kaipara Harbour entrance across to the south of the Mangawhai Spit in the north, down to the Waikato River and Miranda in the south and includes offshore islands in the Hauraki Gulf and the remote Kermadec Islands. It incorporates all of the Auckland Ecological Region (ER) and parts of the Eastern Northland, Kaipara, Coromandel and Waikato Ecological Regions.

The Auckland Conservancy includes the rohe of the following iwi:

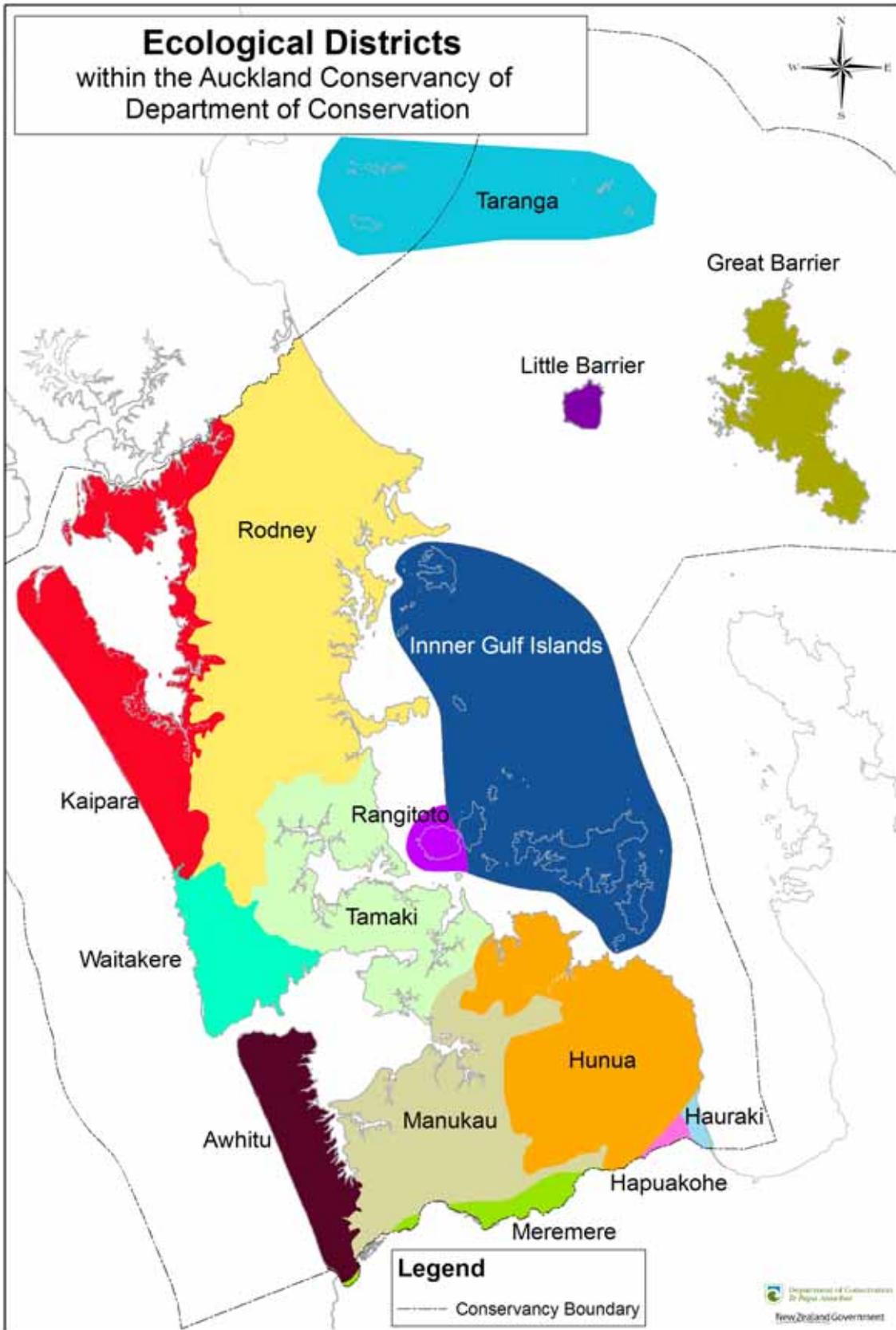
Ngati Whatua ki Orakei, Ngati Whatua ki Kaipara, Te Uri o Hau, Ngati Wai, Ngati Manuhiri, Ngati Rehua, Ngai Tai, Te Kawerau-a-Maki, Ngati Paoa, Ngati Whanaunga, Te Akitai, Ngati Tamaoho, Ngati te Ata, Ngati Maru and Hauraki.

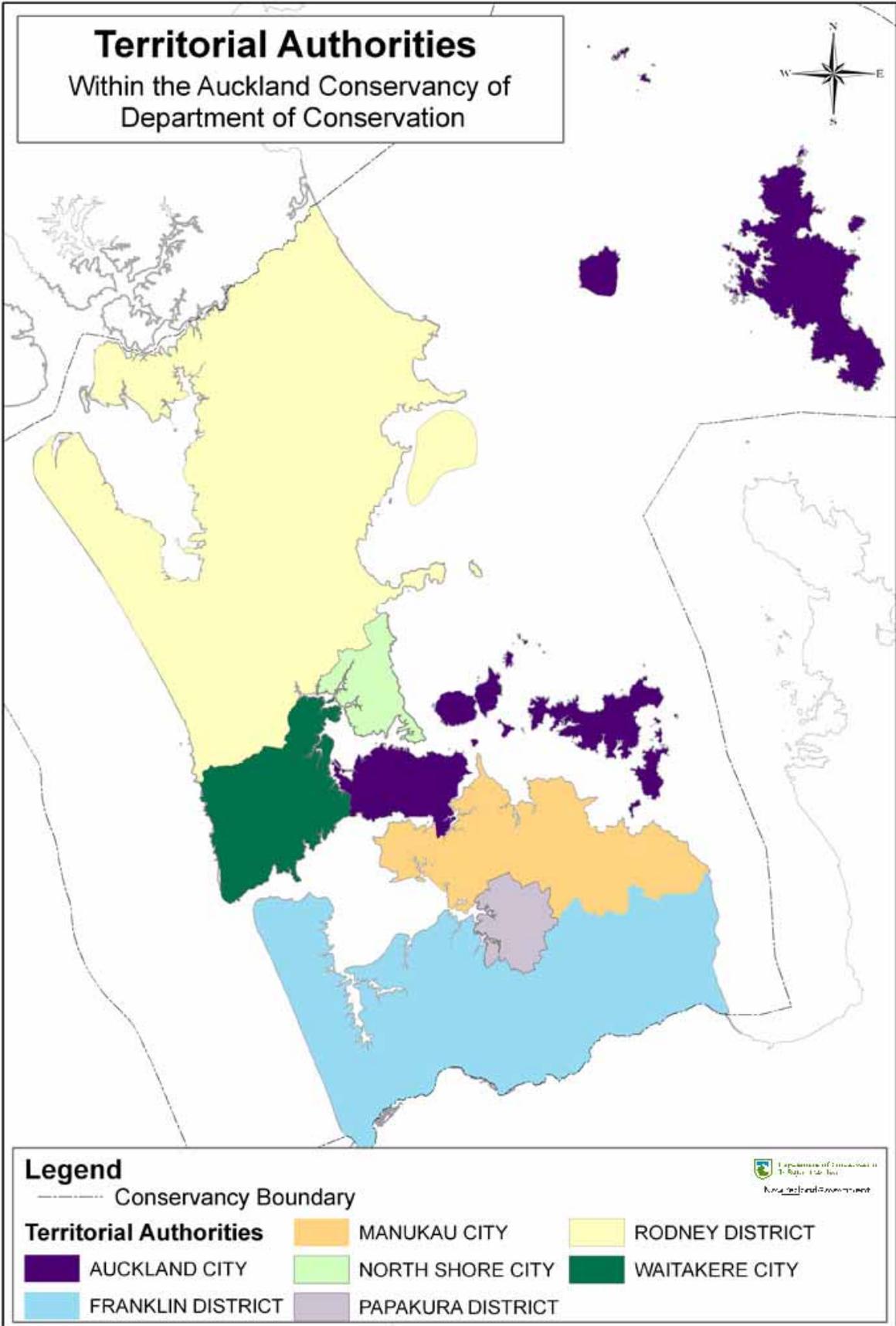
As well as the boundaries of the Auckland region, the Auckland Conservancy also encompasses part of the Waikato Region. It also includes the Rodney, Franklin and Papakura Districts, and the Waitakere, Auckland, North Shore and Manukau City boundaries.

Almost 17% of the land in the Auckland region is secured as public open space. The Department of Conservation administers about 36,400 hectares of public conservation land within the conservancy, with two thirds of this land being on offshore islands (DOC 1995). The ARC manages approximately 40,000 hectares as Regional Parks (ARC 2008).

The Auckland region includes a diverse range of ecosystem types including coastal lowlands, consolidated sands, uplifted and dissected hill country, volcanic hills, lowland hills and islands. The most extensive of the remaining native vegetation consists of modified forest and scrubland (Tyrell et al 1999). The most prominent characteristic of the region is its coastal setting. It encompasses an area of land that is very narrow with a very short distance between the west and the east coast and with deeply indented harbours. Catchments are therefore small and there are few large bodies of water. However a feature of the original Auckland isthmus was an abundance of swamps and lakes formed by the blockage of drainage patterns by lava flows from volcanic activity, most of which have now been drained. Lakes and swamps were also formed by shifting coastal sands and dune formation processes and there were extensive areas of tidal mudflats and mangroves in estuaries (Myers 2005).

The natural ecosystems of the region have been highly modified by human settlement through large scale clearance of forest and scrub, housing and road development, reclamation of bays, draining of wetlands, culverting of streams, quarrying of volcanic cones, and the introduction of alien plants. Kauri and coastal forests have been felled for timber, and estuarine habitats altered by siltation. Due to the extent of biodiversity loss, all remaining natural ecosystems in the Auckland Conservancy have value for protection or restoration. However, some ecosystems are more poorly represented than others and this report identifies these.





4. VEGETATION CLASSES IN THE AUCKLAND CONSERVANCY AND THEIR PROTECTION STATUS

It is estimated that of the original indigenous ecosystems in the Auckland Conservancy approximately 24% remains, most of these being represented by podocarp/broadleaf forest in the Waitakere and Hunua Ranges. Approximately half of these remaining indigenous ecosystems are in protected areas.

An estimate of the original extent of indigenous ecosystems in the Auckland Conservancy, their present extent and the proportion of their present extent that is protected is presented in the table below. These figures were generated from GIS analysis of current predicted original vegetation distribution maps and a protected land map prepared for this project. The methodology is explained further in Appendix I.

Auckland Conservancy Ecosystems

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	14093	N/A	2289	16
Coastal Forest	86956	3160	3	1356	42
Dune vegetation	16721	2577	15	1806	70
Freshwater wetland & wetland forest	83677	3731	4	1427	38
Kauri forest	+73449	6972	9	5119	73
Volcanic boulderfield	#5310	29	.5	5	17
Podocarp/broadleaf and kauri	273802	56030	20	31736	56
Shrubland	N/A	54096	N/A	20201	37
Unclassified	N/A	6362	N/A	732	11
Total	539924	*132957	24	66476	49

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

#excludes Rangitoto Island as it could not be compared with prehuman vegetation because it formed only 600 years ago, once humans were already present in NZ

+there are some anomalies in the data which overestimates the amount of kauri forest that would have originally been present in the Auckland Region. This affects the percentages between the remaining kauri forest and the remaining podocarp/broadleaf and kauri forest but does not affect the overall percentage of remaining ecosystems.

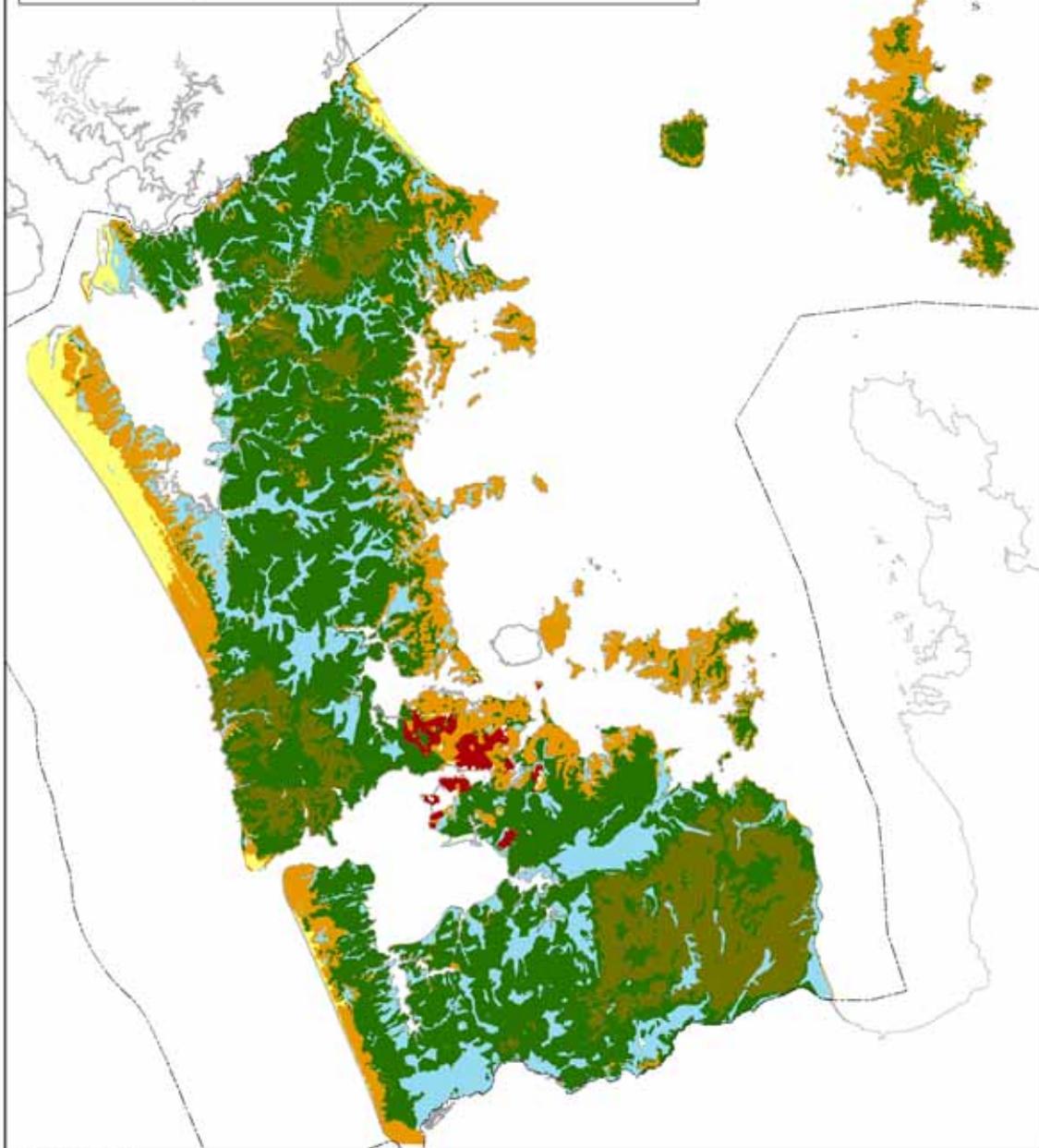
N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

These figures show that only 24% of the original natural ecosystems remain and 40% of that remaining vegetation is regenerating shrub cover which will take many years to return to its former vegetation associations, if ever.

All ecosystems in the Auckland Conservancy are severely depleted by human activity. The rarest ecosystems are volcanic boulderfields on the mainland, freshwater wetlands (including wetland forest) and coastal forest.

Dune vegetation is also scarce as only 15% of the original vegetation remains and although 70% of duneland in the region is currently in protected areas, the original dune vegetation is often highly modified. These dune ecosystems were rare in comparison to the extent of other ecosystems in the region and habitat for animal and plant species which exist in these environments are therefore limited.

Pre People Native Vegetation Cover
 within the Auckland Conservancy of
 Department of Conservation



Legend

----- Conservancy Boundary

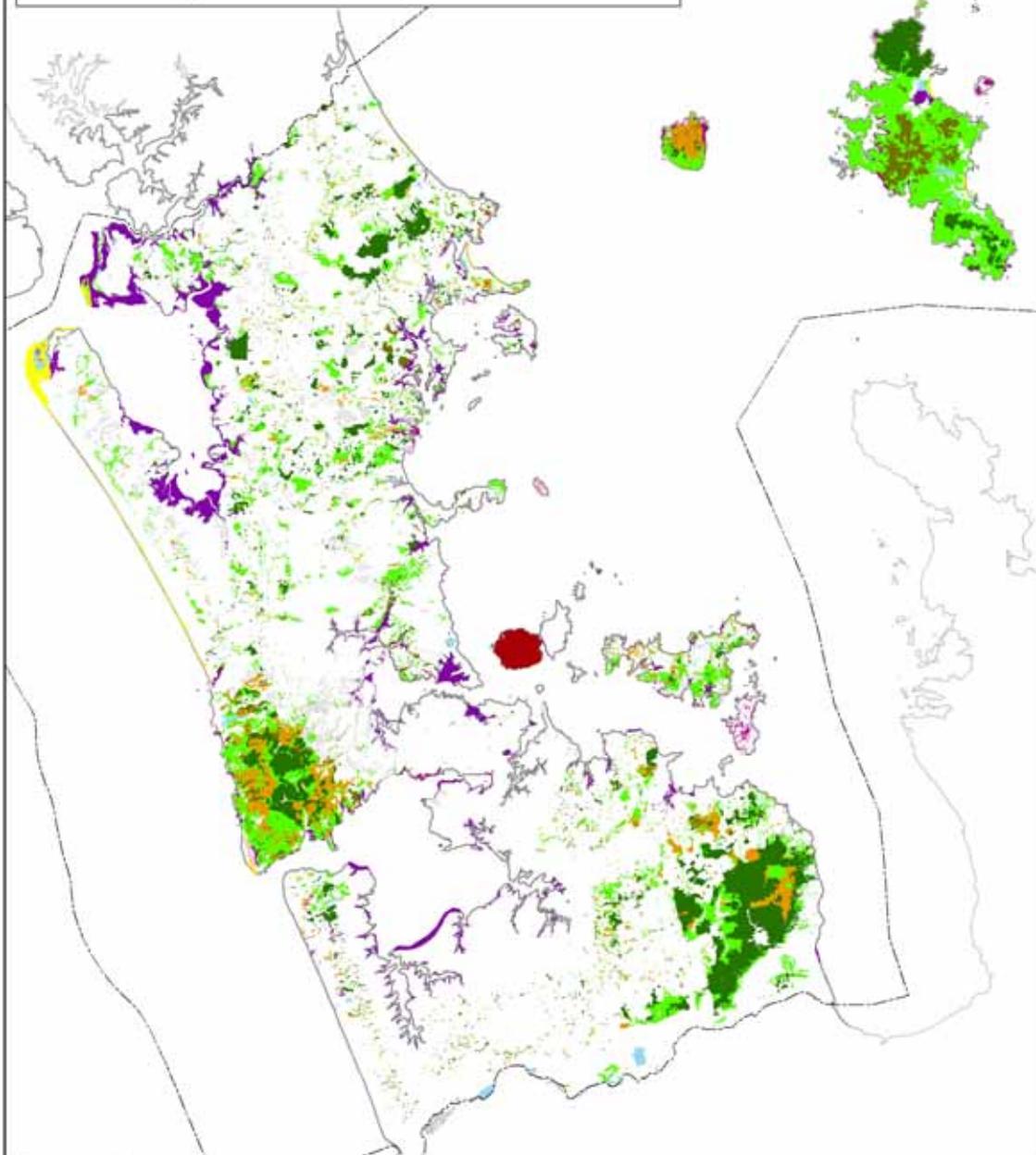
Predicted Pre People Native Vegetation

- | | |
|--|---|
|  Kauri |  Volcanic Boulderfield |
|  Podocarp/Broadleaf/Kauri |  Dune Complex |
|  Broadleaf and Coastal Forest |  Freshwater Wetland and Wetland Forest |



Native Vegetation Cover 2004

within the Auckland Conservancy of
Department of Conservation



Legend

—	Conservancy Boundary		Broadleaf		Dune Complex
Native Vegetation Class			Shrubland		Freshwater Wetland
	Kauri		Coastal Forest		Brackish Estuarine
	Podocarp/Broadleaf/Kauri		Coastal Shrubland		unclassified
	Podocarp		Volcanic Boulderfield		

Department of Conservation
100 Great North Road
New Zealand Government

5. PRIORITY CRITERIA FOR THE AUCKLAND CONSERVANCY

The priority criteria that are used in this report are based on the four priorities set out in the National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land published by the Ministry for the Environment and the Department of Conservation (2007), and the four criteria currently used by the Nature Heritage Fund in the funding application process. Further criteria have been added in recognition of the Auckland Conservancy's strategic direction, which identifies the marine environment as an important focus for the region and encourages community participation in conservation activities.

National priorities

1. Indigenous vegetation associated with land environments (defined by Land Environments of New Zealand (LENZ) at Level IV) that have 20% or less remaining in indigenous cover
2. Indigenous vegetation associated with sand dunes and wetlands
3. Indigenous vegetation associated with 'originally rare' terrestrial ecosystems not covered in priorities 1 or 2.
4. Habitats of threatened and declining indigenous species.

Nature Heritage Fund priorities

5. Representativeness – the extent to which the area is representative of the full range of vegetation variety that was originally present in the natural landscape
6. Sustainability – the extent to which the area is likely to continue to be viable and evolve in a natural way in the long term
7. Landscape integrity – the extent to which the area contributes to and maintains the original integrity of the landscape
8. Amenity/utility – the extent to which the area contributes to the physical and spiritual welfare of the local people.

Conservancy priorities

9. Impact on Marine Protected Areas – the extent to which the area contributes to the protection of natural coastal resources.
10. Potential for community involvement in restoration.

These criteria are intended to provide a process for identifying the values of individual sites proposed for protection as follows:

1. Less than 20% remaining

Land environments (defined by Threat Classification of LENZ at Level IV) that have 20% or less remaining in indigenous cover.

Determined by:

- whether or not the site has been identified as being in this category.

2. Dunes and wetlands

Indigenous vegetation associated with sand dunes and wetlands.

Determined by:

- ecosystems that have been identified as functioning dune or wetland ecosystems regardless of the current vegetation. This criterion recognises the importance of these sites as ecosystem types that have become uncommon due to human activity, the need to protect what remains of these ecosystems and where possible to restore them.

3. Originally rare ecosystems

Indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.

Determined by:

- whether or not the site has been identified as containing an originally rare ecosystem as defined by Williams et al (2006).

4. Threatened Species

Habitats of threatened and declining indigenous species

Determined by:

- recent records of naturally occurring threatened plant species in the catchment.
- recent records of threatened animal species in the catchment. This criterion recognises the importance of vegetation as wildlife habitat regardless of how well it represents the original ecosystems.

5. Representativeness

The extent to which the site is representative of the full range of vegetation variety that was originally present in the natural landscape.

Determined by:

- amount remaining of original vegetation type.
- modification - the extent to which the vegetation at the site is modified. (eg intact, logged or regenerating)
- protection - the amount of the original ecosystem protected in the ED. (based on percentage remaining)

6. Sustainability

The extent to which the area is likely to continue to be viable and evolve in a natural way in the long term.

Determined by:

- size - how well the size of the site protects the ecosystem from edge effects such as plant pest invasion or exposure to light and wind.
- shape – how well the shape of the site protects the ecosystem from edge effects such as plant pest invasion or exposure to light and wind.
- connectivity – how well the ecosystem links or buffers existing protected natural areas or contributes to wildlife corridors.
- resilience – what threats are posed to the ecosystem from introduced plants and animals.
- management – what are the opportunities for management of threats.

7. Landscape Integrity

The extent to which the area contributes to, and maintains, the original integrity of the landscape.

Determined by:

- how well the ecosystem contributes to the protection of the character and context of the landscape by protecting energy flows, nutrient cycles, hydrological regimes, linkages and uninterrupted ecological sequences.

8. Amenity/Utility

The extent to which the area contributes to the physical and spiritual welfare of the local people

Determined by:

- the extent of direct use made of, or values placed on the ecosystem by the local community including: soil and water conservation; water quality and yield; scenery protection; aesthetic coherence; recreation and tourism; scientific use and spiritual and cultural values.

9. Marine protection

Determined by:

- the extent to which the ecosystem contributes to the protection of marine life including impact on water quality and reduction of siltation.

10. Potential for restoration

Determined by:

- scarcity of the ecosystem – lack of remaining representative sites of ecosystems which would originally have been widespread in the district
- community support - the extent to which the community supports restoration efforts.

Other considerations

National importance

It is recognised that certain ecosystems in the Auckland Conservancy are of national importance for nature conservation in particular the Miranda chenier plain. This globally rare ecosystem is listed under the Ramsar Convention on Wetlands as of international importance as a wading bird habitat, and contains extensive saline wetlands, mangrove communities and salt meadows. Other ecosystems of national importance are the coastal breeding sites of the NZ fairy tern, New Zealand's rarest breeding bird. Two of the four known breeding sites of this species occur in the Auckland Conservancy.

Threats

Current threats to indigenous ecosystems in the Auckland Conservancy include vegetation clearance of land for housing development and lifestyle blocks particularly in coastal sites, road development and the use of the natural landscape for recreation (e.g. four wheel driving). It is expected that the current degree of threat to a particular ecosystem will be an important consideration for decision making.

Opportunities

It is expected that current opportunities will determine which areas are proposed for protection (e.g. when a property comes up for sale). However, there are opportunities for regional conservation agencies to be more proactive by working together to develop a long term integrated plan for a sustainable protected natural areas system for the Auckland region. The GIS project associated with this report provides the basis for further development of an integrated system of data collection and

analysis which would assist this process. There is scope to develop this dataset as a central resource so that it can be updated when new information becomes available, and for it to be made widely available to conservation management organisations.

6. PRIORITIES FOR PROTECTION IN THE AUCKLAND CONSERVANCY

All remaining areas of indigenous vegetation have value for protection and restoration because of the extent of biodiversity loss in the region (ARC 2004). Even small forest remnants in an urban environment can still provide a haven for indigenous species and play an important role in providing linkages between habitats and in establishing wildlife corridors. However, some ecosystems are particularly poorly represented and also have a crucial role in the survival of threatened species in the region. This places a higher priority on ensuring that further loss of these ecosystems is avoided and that where possible restoration of degraded sites is undertaken. Ecosystems that have been identified as the highest regional priorities are:

- Coastal ecosystems including estuarine, wetland, duneland, shrubland and forest
- Volcanic boulderfields
- Sites of nationally critical threatened species
- Sites of originally rare ecosystems

Modification of the landscape for urban development has resulted in depletion of coastal ecosystems leaving few intact representative sites remaining. Coastal, wetland and stream sites are crucial for the survival of most threatened species in the region, many of which use habitats along the shoreline or in wetlands. Even some coastal species which at present still exist in large numbers are listed as declining, e.g. little blue penguins (Miskelly et al. 2008). Many threatened species have been given safe haven on offshore islands because of the risk of predation or disturbance on the mainland. Protection of natural ecosystems in the coastal zone assists with providing corridors to allow some of these species to recolonise mainland sites naturally.

Coastal ecosystems also play an important role in ecosystem services by contributing to the enhancement of water quality and soil conservation and in mitigating impacts of land based activities on the marine environment. Inadequate storm water infrastructure is contributing to pollution of waterways and levels of heavy metals and sediment are increasing in streams and harbours threatening the health of marine ecosystems (ARC 2008). The extensive harbours and coastal fringe encourage the use of the marine environment for recreational purposes and the impact of people on coastal environments is substantial.

Activities such as quarrying and land clearance have resulted in the destruction of almost all of the volcanic boulderfields on the mainland which are unique to the region. Only approximately twenty nine hectares of this ecosystem type remain on the mainland and only five of these hectares are protected. The relatively recently formed Rangitoto Island is the only substantial remaining example of this unique ecosystem type.

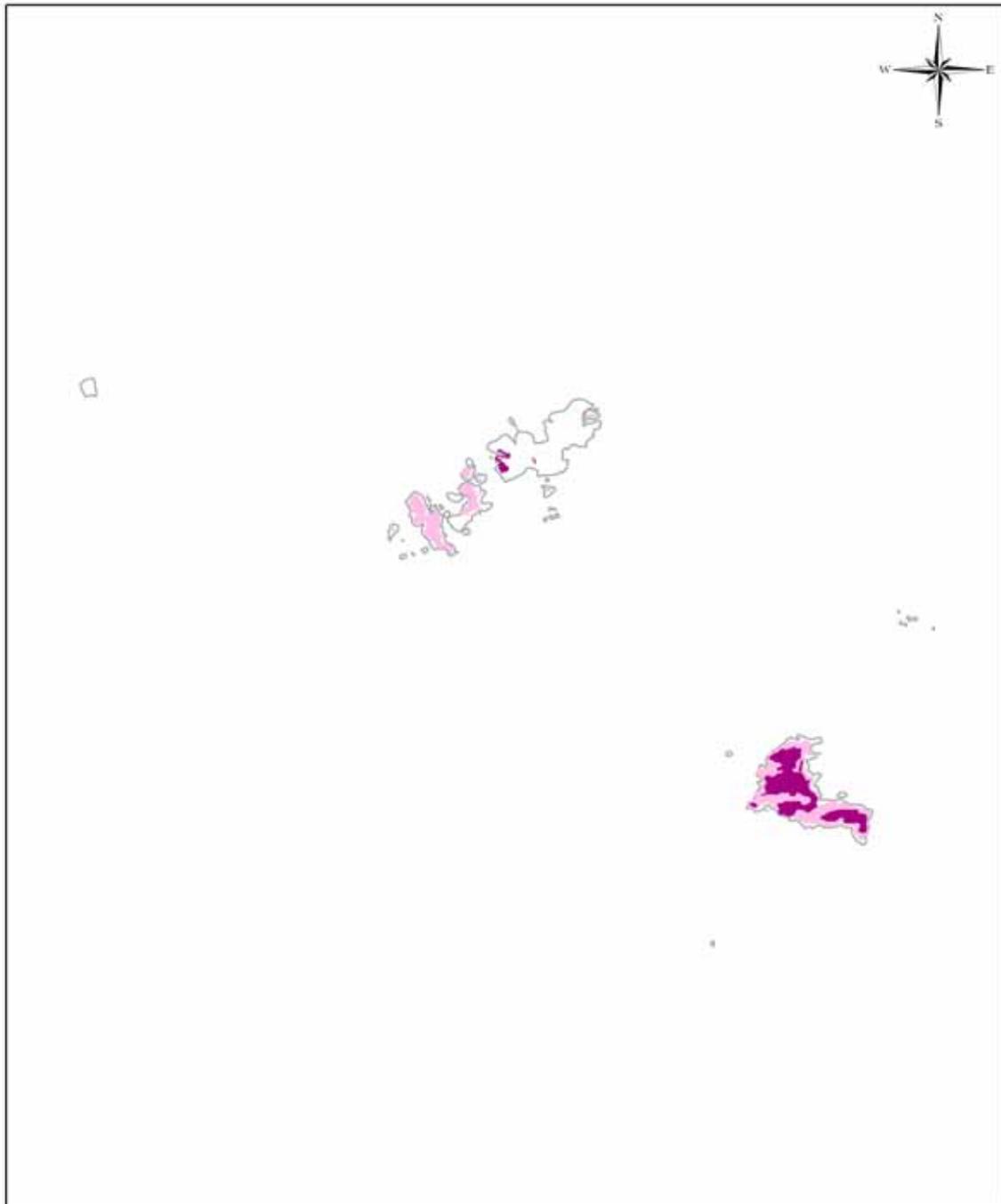
Many sites of threatened species in the Auckland Conservancy are currently on private land and are therefore vulnerable to further loss from urban development, logging and farming activities. The same applies to sites of originally rare ecosystems.

6.1 Summary of priorities for protection by ED

This table represents a summary of the priorities for protection that have been identified for each ED in the Auckland Conservancy.

Priorities for Protection	Ecological District											
	Kaipara	Rodney	Tamaki	Waitakere	Inner Gulf Islands	Hunua	Awhitu	Manukau	Great Barrier	Meremere	Hapuakohe	Hauraki
Coastal ecosystems (dunes, wetlands, shrubland and forest)	x	x	x	x		x	x	x	x	x		x
Kauri forest	x	x									x	
Volcanic boulderfield			x									
Freshwater wetlands					x	x	x			x		
Wetland forest						x						
Kahikatea swamp forest								x				
Podocarp/broadleaf forest											x	
Sites of <i>Centipeda minima</i> Sneezeweed	x	x	x		x				x			
Sites of <i>Clianthus puniceus</i> Kakabeak	x											
Sites of <i>Lobelia</i> aff. <i>angulata</i>	x											
Sites of <i>Pseudowintera inseperta</i>		x										
Sites of <i>Senecio scaberulus</i> Native fireweed	x	x			x	x			x			
Sites of <i>Ophioglossum petiolatum</i> Stalked adder's tongue fern		x		x		x			x			
Sites of <i>Fissidens berteroi</i>			x									
Sites of <i>Daucus glochidiatus</i> NZ carrot				x	x				x			
Sites of <i>Epilobium hirtigerum</i> Hairy willowherb			x									
Sites of <i>Lindbergia maritima</i>				x								
Sites of <i>Parahebe</i> aff. <i>spathulata</i>		x										
Sites of <i>Nematoceras</i> aff. <i>rivulare</i>				x								
Sites of <i>Calochilus</i> aff. <i>herbaceus</i>		x										
Breeding sites and habitat for <i>Sternula nereis davisae</i> NZ fairy tern	x	x										
Breeding sites and habitat for <i>Anas superciliosa superciliosa</i> Grey duck			x		x				x			
Linkages and buffers to existing reserves				x		x						x
Sites of plants endemic to Great Barrier Island									x			

Taranga Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp\Broadleaf\Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7. ECOLOGICAL DISTRICTS IN THE AUCKLAND REGION – EXISTING VALUES AND PROTECTION STATUS AND PRIORITIES FOR PROTECTION

The Auckland Conservancy contains fifteen EDs. For each ED the information below lists the ecosystem types which are present and their protection status, threatened species recorded and the originally rare ecosystems potentially present. Recommendations are included on priorities for protection for each ED. The ED descriptions are taken directly from descriptions in the Protected Natural Area Programme (PNAP) reports for each ED where these have been published, or from other ecological surveys for EDs for which PNAP reports have not been published

7.1 Eastern Northland Ecological Region

7.1.1 Taranga ED (part)

Location and Physical Description:

The Taranga ED encompasses the Mokohinau Islands and the Hen (Taranga) and Chickens (Marotere) group of islands. However the latter lie within the Northland Conservancy of DOC and therefore are not included in this report. The Mokohinau Islands are a small rugged group of volcanic islands approximately 100km northeast of Auckland, and 25km northwest of Great Barrier Island. Their rhyolitic base material and highly exposed location has resulted in the formation of high cliffs and stacks, guts and sea caves. The ecosystems descriptions are from DOC (1995).

Ecosystems Originally Present:

Coastal forest and vegetation associated with seabird communities, coastal cliffs, stacks, guts and sea caves.

Existing Ecosystems:

The vegetation of the nature reserve islands is predominately regenerating coastal forest dominated by pohutukawa. There are large areas of shrubland dominated by flax and hebe. Herbfield is present on areas of exposed coast. Burgess Island was formerly grazed and there are large areas of thick buffalo grass, bracken, muehlenbeckia and *Isolepis nodosa* covering most of the island. There are small areas of coastal forest where regeneration has been assisted by the eradication of kiore in 1990.

Protection Status:

The Mokohinau Islands are fully protected as the Burgess (Pokohinu) Island Scenic Reserve and the Mokohinau Islands Nature Reserve and are administered by DOC.

Threatened Species Recorded (categories 1 – 4)

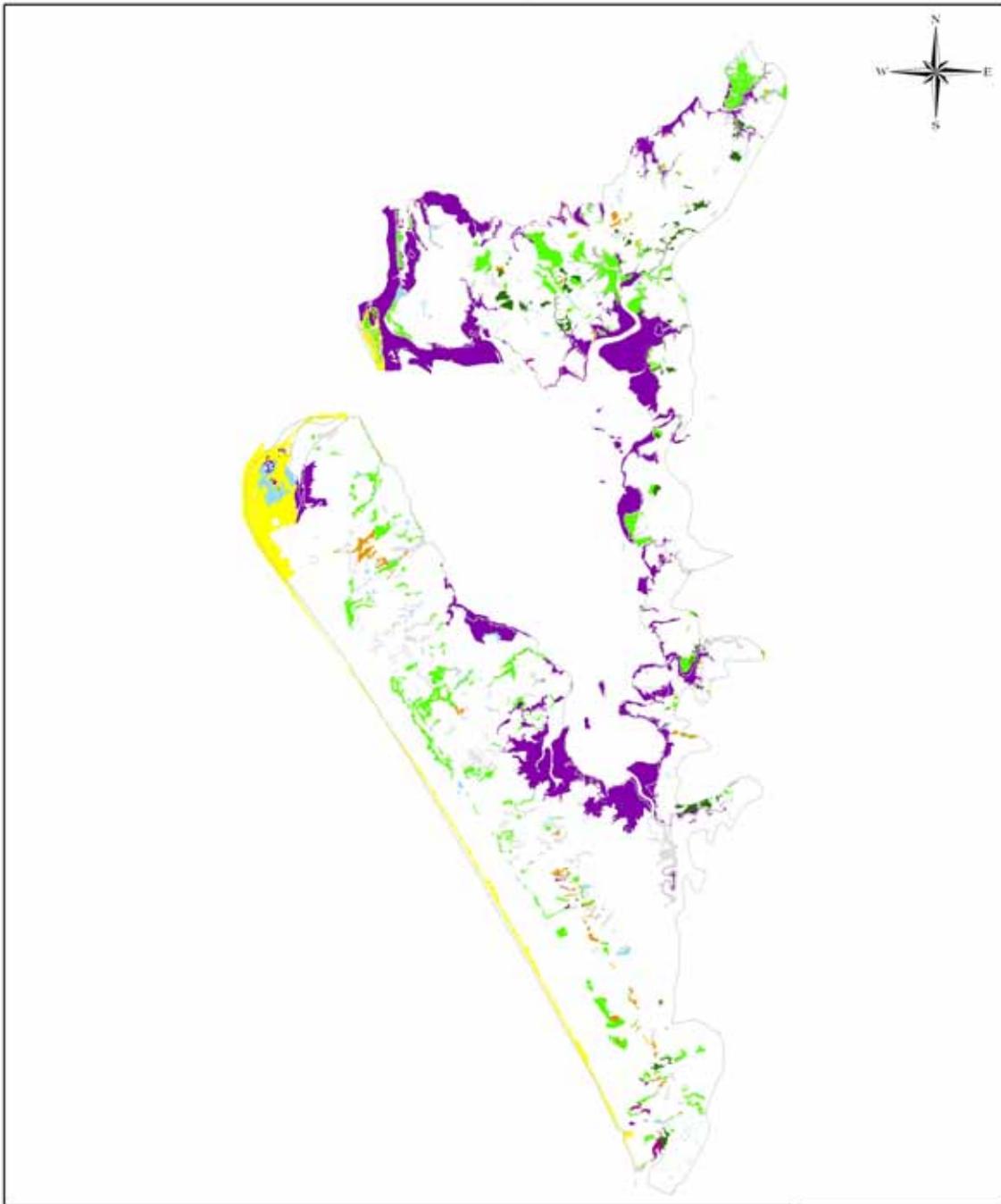
Flora

Nationally Critical	Nationally endangered	Nationally vulnerable	Declining
	<i>Picris burbridgeae</i> Native oxtongue	<i>Lepidium oleraceum</i> Cook's scurvy grass	<i>Tupeia antarctica</i> White mistletoe
		<i>Rorippa divaricata</i> NZ watercress	

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Geodorcus ithaginis</i> Mokohinau stag beetle			

Kaipara Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7.2 Kaipara Ecological Region

7.2.1. Kaipara – Otamatea ED (part)

Location and Physical Description:

This ED is centred on the Kaipara Harbour, New Zealand's largest harbour, and spans the Northland and Auckland Conservancies. The Poutu Peninsula and the northern reaches of the Kaipara Harbour are contained in the Northland Conservancy. The area of the ED which is part of the Auckland Conservancy consists of South Kaipara Head, Okahukura Peninsula and the eastern fringe of the Kaipara Harbour. In the south it abuts the Waitakere ED and to the east, the Rodney ED. The ecological descriptions of the Kaipara Ecological Region are from Davis (2002).

Ecosystems Originally Present:

The key features of the Kaipara-Otamatea ED are the Kaipara Harbour and the extensive duneland sequences dating back to the early Pleistocene. In the harbour, there were extensive areas of saline vegetation, although there may have been an increase in the area of mangroves following the deforestation of catchments. On the dunelands there were spinifex and pingao on the more mobile dunes, while the more stable backdunes were dominated by tauhinu and toetoe. On the older, more stable dunes, coastal broadleaf forest were present with a combination of puriri, kohekohe, pohutukawa, taraire, tawa, titoki and mangeao making up the canopy. On inland ridges, kauri-tanekaha forest was dominant with podocarp-broadleaf forest in the gullies.

Existing Ecosystems:

The vegetation in this ED has been severely altered initially by Maori burning of forest with more severe modification around occupied coastal areas. More recently settlement by Europeans resulted in more widespread burning and felling of forest. Harbour reclamation and the establishment of the Woodhill pine forest in the 1960s further altered the vegetation cover of the duneland with marram grass establishing on the more mobile dunes. Twelve different habitat types have been identified in the Auckland region part of the ED. Forest is the predominant habitat type although there is very little original forest left, most of the remaining forest is kanuka shrubland. Shrubland and rush/reed/sedgeland habitat is present on the dunelands and in freshwater wetlands. Despite reclamation of an estimated 30 – 40% of estuarine areas in the Kaipara Harbour, there are still extensive areas of mangroves, salt marshes and salt meadows.

Protection Status:

Approximately 31% of the natural ecosystems within the Auckland Conservancy part of the Kaipara ED are in protected areas. An estimate of the original extent of indigenous ecosystems, their present extent and the proportion of their present extent that is protected is presented below.

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	8606	N/A	1912	22
Coastal Forest	16287	133	1	17	12
Dune vegetation	13778	2151	16	1627	75
Freshwater wetland & wetland forest	13082	726	6	333	46
Kauri forest	164	11	7	.5	4
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	19896	1059	5	273	25
Shrubland	N/A	2935	N/A	807	27
Unclassified	N/A	1156	N/A	216	18
Total	63207	*16777	26	5185	31

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

All ecosystems in this ED are severely depleted, in particular podocarp and kauri forest, coastal forest and wetlands, and most of those that remain are fragmented, small in size and highly modified by logging and weed and animal pest invasion.

Threatened Species Recorded (categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed	<i>Hebe speciosa</i>	<i>Pimelea tomentosa</i>	<i>Carex litorosa</i> Sea sedge
<i>Clianthus puniceus</i> Kakabeak	<i>Lepidium oleraceum</i> Cook's scurvy grass		<i>Ptisana salicina</i> King fern
<i>Lobelia</i> aff. <i>angulata</i>	<i>Utricularia australis</i> Yellow bladderwort		<i>Mazus novaezeelandiae</i> Swamp musk
<i>Senecio scaberulus</i> Native fireweed			<i>Cyclosorus interruptus</i>
			<i>Thelypteris confluens</i> Swamp fern

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasian bittern	<i>Egretta sacra sacra</i> Reef heron	<i>Anguilla dieffenbachii</i> Longfin eel
<i>Ardea modesta</i> White heron	<i>Larus bulleri</i> Black-billed gull	<i>Anarhynchus frontalis</i> Wrybill	<i>Cyclodina ornata</i> Ornate skink
<i>Sternula nereis davisae</i> NZ Fairy tern		<i>Charadrius obscurus</i> <i>aquilonius</i> Northern NZ dotterel	<i>Eudyptula minor iredalei</i> Northern little blue penguin
		<i>Chalinolobus tuberculata</i> Long tailed bat (North Island)	<i>Glaxias argenteus</i> Giant kokupu
		<i>Hydroprogne caspia</i> Caspian tern	<i>Naultinus elegans elegans</i> Auckland green gecko
		<i>Larus novaehollandiae</i> <i>scopulinus</i> Red billed gull	<i>Puffinus carneipes</i> Flesh- footed shearwater
		<i>Nestor meridionalis</i> <i>septentrionalis</i> North Island kaka	<i>Puffinus griseus</i> Sooty shearwater
			<i>Sterna striata striata</i> White- fronted tern

Originally Rare Ecosystems

Active sand dunes
Calcareous cliffs, scarps and tors
Cliffs, scarps and tors of mafic rock
Coastal cliffs on calcareous rock
Coastal cliffs on mafic rocks
Coastal rock stacks
Dune slacks
Estuary
Gumland
Lake margins

Priorities for Protection

Coastal ecosystems including dunes, wetlands, shrublands and forest

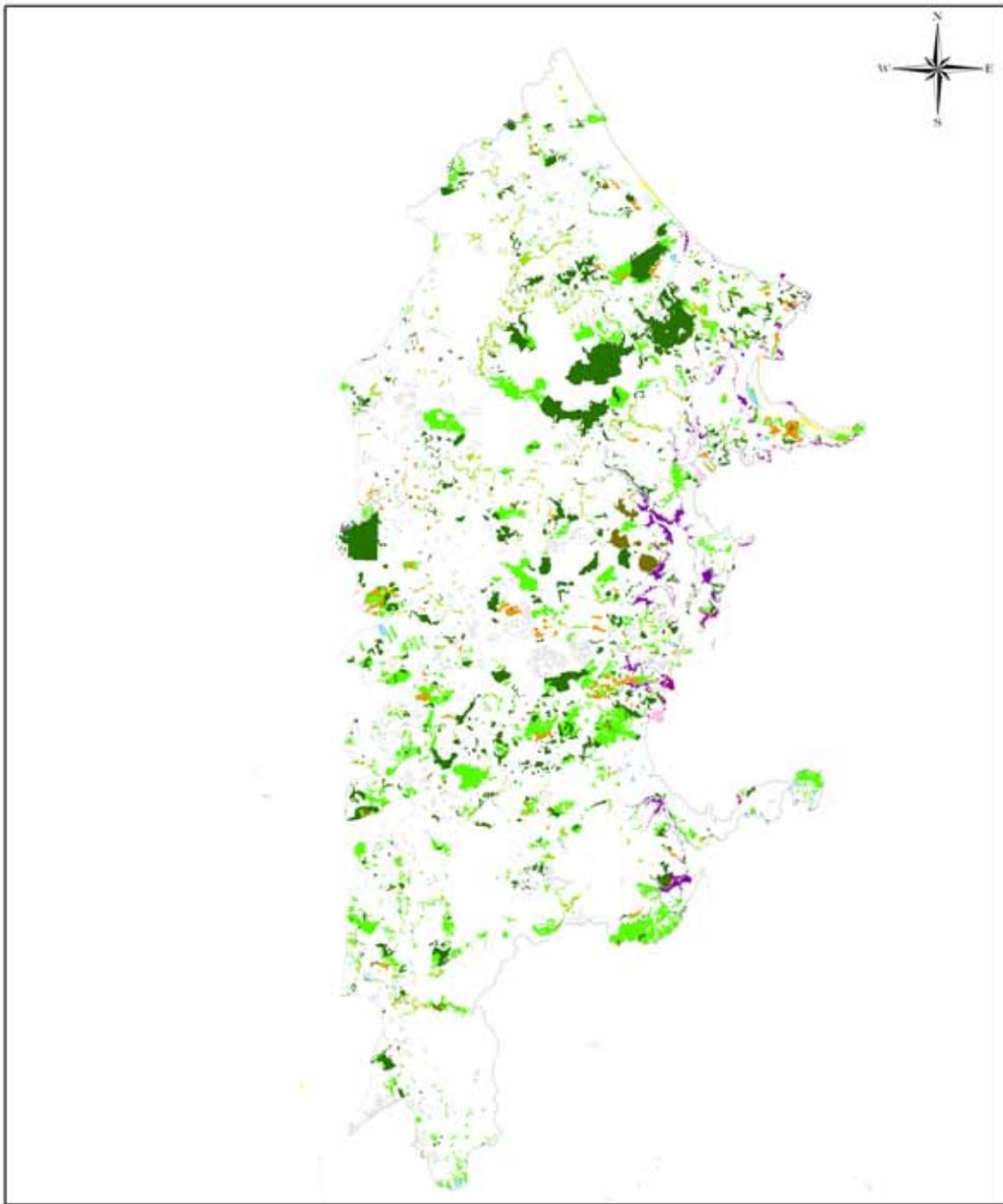
Kauri forest

Sites of *Centipeda minima*, *Clianthus puniceus*, *Lobelia* aff. *angulata* and *Senecio scaberulus*

Breeding sites and habitat for *Sternula nereis davisae*

Sites of originally rare ecosystems where these can be confirmed

Rodney Ecological District



Legend

Native Vegetation Class

Kauri

Podocarp/Broadleaf/Kauri

Podocarp

Broadleaf

Shrubland

Coastal Forest

Coastal Shrubland

Volcanic Boulderfield

Dune Complex

Freshwater Wetland

Brackish Estuarine

unclassified

7.3 Auckland Ecological Region

7.3.1 Rodney ED

Location and Physical Description:

This ED lies to the north of Auckland city between the Kaipara Harbour to the west and the Hauraki Gulf in the east. It borders the Eastern Northland and Islands ED to the north, Otamatea ED and Kaipara ED in the west, and the Tamaki and Waitakere EDs in the south. The ecological description of the Rodney ED is from Mitchell et al (1992).

The Rodney ED is an area of relatively subdued lowland hill country. The hills extend to the coast which forms the eastern boundary in an intricate pattern of dunes, headlands and peninsulas, broad harbours and deeply penetrating tidal inlets. The drowned valleys of the Kaipara Harbour extend to within a few kilometres of the east coast.

Ecosystems Originally Present:

This ED was originally extensively forested with a few areas of reedland (Beever, 1981). Towards the coast, forest would have given way to saltmarsh and mangrove forest in tidal inlets and pingao-spinifex communities on the mobile sand dunes. By the time of European arrival/settlement in the area, most of the primary forest had been destroyed and much of the district was covered in manuka/kanuka shrubland and areas of bracken. Over the last 150 years extensive areas of this shrubland have been cleared for pasture initially and, in later years, for production pine forests and urban development.

Existing Ecosystems:

Most of this ED is highly modified and the remaining native vegetation is fragmented. There are sizeable areas of regenerating forest in the ED, dominated by kanuka. There is very little of the original kauri forest left, except in a few small reserves such as Thompson's Scenic Reserve. Totara dominated remnants are a feature of the district, characteristically forming distinctive riverside forests. Kahikatea is common away from the coast (except for the swamp forest at Omaha) and is associated with waterlogged sites. Freshwater wetlands have been seriously depleted, there are now only small and scattered wetlands remaining in the district. The most notable wetland areas are the dune lakes and areas of raupo and other rush and sedge species near Tomarata. There are significant spinifex and pingao sand dune communities on the Mangawhai and Pakiri foredunes.

Protection Status:

Approximately 15% of the remaining native vegetation remnants in the Rodney ED are in protected areas. The largest blocks are Atuanui/Mt Auckland, Moirs Hill and Mt Tamahunga, all administered by DOC. The estimated original extent of ecosystems in the Rodney ED, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	1010	N/A	60	6
Coastal Forest	16773	505	12	221	43
Dune vegetation	1351	163	11	90	55
Freshwater wetland & wetland forest	24614	858	3	116	13
Kauri forest	12417	762	6	220	29
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	102757	13089	11	2545	19
Shrubland	N/A	10643	N/A	1056	9
Unclassified	N/A	2501	N/A	48	1
Total	157912	*29531	18	4356	15

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

All ecosystems in this ED are heavily depleted in particular freshwater wetlands and kauri forest, and dune vegetation is scarce.

Threatened Species Recorded (categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed	<i>Picris burbridgeae</i> Native oxtongue	<i>Pimelea tomentosa</i>	<i>Brachyglottis kirkii</i> var. <i>kirkii</i> Kirk's daisy
<i>Calochilus</i> aff. <i>herbaceus</i>	<i>Pomaderris phyllicifolia</i> Tauhinu		<i>Carex litorosa</i> Sea sedge
<i>Parahebe</i> aff. <i>spathulata</i>			<i>Coprosma acerosa</i> Sand coprosma
<i>Pseudowintera insperata</i> Northland horopito			<i>Kunzea ericoides</i> var. <i>linearis</i>
<i>Senecio scaberulus</i> Native fireweed			<i>Ptisania salicina</i> King fern
<i>Ophioglossum petiolatum</i> Stalked adder's tongue fern			<i>Austrofestuca littoralis</i> Sand tussock

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasian bittern	<i>Egretta sacra sacra</i> Reef Heron	<i>Anguilla dieffenbachii</i> Longfin eel
<i>Ardea modesta</i> White heron	<i>Larus bulleri</i> Black-billed gull	<i>Anarhynchus frontalis</i> Wrybill	<i>Cyclodina ornata</i> Ornate skink
<i>Sternula nereis davisae</i> NZ Fairy tern		<i>Charadrius bicinctus bicinctus</i> Banded dotterel	<i>Eudyptula minor iredalei</i> Northern little blue penguin
		<i>Charadrius obscurus</i> <i>aquilonius</i> Northern NZ dotterel	<i>Galaxias argenteus</i> Giant kokupu
		<i>Chalinolobus tuberculata</i> Long tailed bat (North Island)	<i>Hoplodactylus pacificus</i> Pacific gecko
		<i>Hydropogon caspia</i> Caspian tern	<i>Larus novaehollandiae</i> <i>scopulinus</i> Red billed gull
		<i>Nestor meridionalis</i> <i>septentrionalis</i> North Island kaka	<i>Naultinus elegans elegans</i> Auckland green gecko
			<i>Sterna striata striata</i> White- fronted tern

Originally Rare Ecosystems

Active sand dunes
Calcareous cliffs, scarps and tors
Cliffs, scarps and tors of mafic rock
Coastal cliffs on calcareous rocks
Coastal cliffs on mafic rocks
Coastal rock stacks
Debris flow or lahar

Estuary
Gumland
Lake margin
Seabird burrowed soils and/or guano deposits
Shell barrier beach

Priorities for protection

Coastal ecosystems including dunes, estuarine, wetlands, shrublands and forest

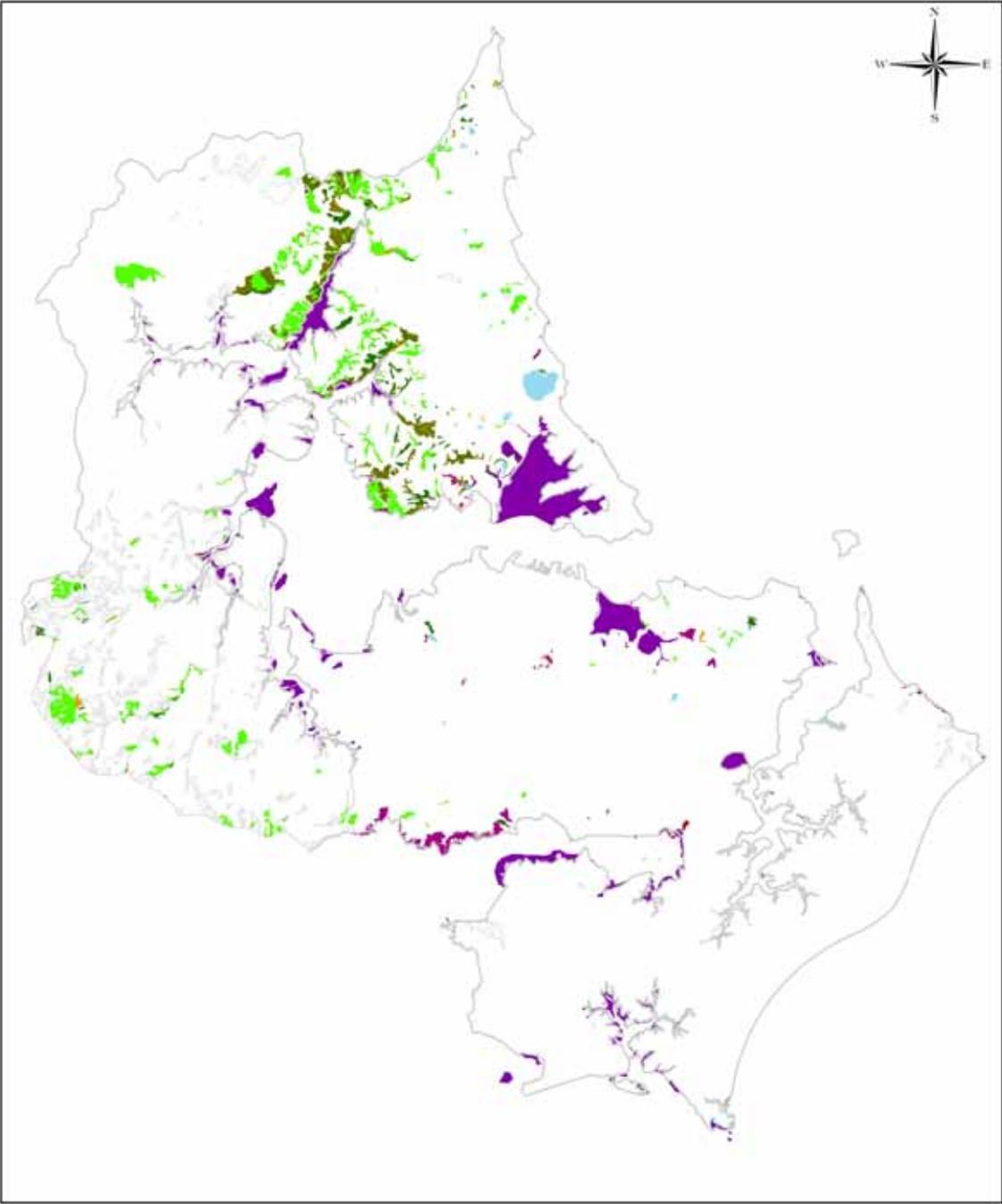
Kauri forest

Sites of *Centipeda minima*, *Calochilus* aff. *herbaceus*, *Pseudowintera insperata*, *Senecio scaberulus* and *Ophioglossum petiolatum*

Breeding sites and habitat for *Sternula nereis davisae* and *Anas superciliosa superciliosa*

Sites of originally rare ecosystems where these can be confirmed

Tamaki Ecological District



Legend

Native Vegetation Class	Shrubland	Freshwater Wetland
Kauri	Coastal Forest	Brackish Estuarine
Podocarp/Broadleaf/Kauri	Coastal Shrubland	unclassified
Podocarp	Volcanic Boulderfield	
Broadleaf	Dune Complex	

Department of Conservation
New Zealand Government

7.3.2. Tamaki ED

Location and Physical Description:

The Tamaki ED covers approximately 59,904 hectares and is occupied by New Zealand's largest urban centre, Auckland City. This includes the low lying hills, pumice and volcanic deposits of the North Shore, the Auckland isthmus and South Auckland. It also incorporates all the catchments that drain into the Waitemata Harbour. The ED extends to the foothills of the Waitakere Ranges to the west, and the Hunua Ranges to the east, and is bordered in the west by the Waitakere ED, the north/northwest by Rodney ED and to the south and east by the Manukau and Hunua EDs. The ecological descriptions of the Tamaki ED are from Julian (1995) and Myers (2005).

Ecosystems Originally Present:

The original forest is assumed to have been the characteristic northern North Island lowland forest type with kauri and abundant puriri and taraire and dominated by pohutukawa forest near the coast. The lowland hills and Waitakere foothills supported conifer-dominated stands with kauri and tanekaha being the major species. Broadleaf lava forest occupied boulderfields on volcanic cones and extensive areas of tidal flats and mangroves were also present around the coastline. There was also a network of freshwater wetlands and lakes formed by the blockage of drainage patterns by volcanic activity.

Existing Ecosystems:

Only 6.9% of the Tamaki ED remains in indigenous cover. The vegetation has been highly modified, initially by clearing from early Polynesian occupation and by subsequent urban development. Some kauri remnants with hard beech remain on the North Shore and very small patches of volcanic boulderfield remain on volcanic cones. In city parks there are remnants of lowland forest and fringes of pohutukawa are present on coastal cliffs. Mangroves have been reduced from their former extent but are still present in estuaries.

Protection Status:

Approximately 20% of the remaining native vegetation remnants in the Tamaki ED are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	2057	N/A	97	4
Coastal Forest	15556	309	2	190	61
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	7367	73	1	35	48
Kauri forest	1722	359	20	155	43
Volcanic boulderfield	#5133	29	.5	5	17
Podocarp/broadleaf and kauri	27715	362	1	140	38
Shrubland	N/A	1174	N/A	275	23
Unclassified	N/A	1980	N/A	385	19
Total	57493	*6343	11	1282	20

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

All ecosystems in this ED are severely depleted with less than 5% remaining of the original extent of all ecosystems except kauri. Volcanic boulderfield is particularly scarce being reduced to only 29 hectares in total, of which only five hectares are protected.

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed	<i>Picris burbridgeae</i> Native Oxtongue	<i>Anogramma leptophylla</i> Annual fern	<i>Brachyglottis kirkii</i> var. <i>kirkii</i> Kirk's daisy
<i>Epilobium hirtigerum</i> Hairy willow herb			<i>Carex litorosa</i> Sea sedge
<i>Fissidens berteroi</i>			<i>Kunzea ericoides</i> var. <i>linearis</i>
			<i>Ptisania salicina</i> King Fern
			<i>Drosera pygmaea</i> Pygmy sundew

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Larus bulleri</i> Black-billed gull	<i>Anarhynchus frontalis</i> Wrybill	<i>Anguilla dieffenbachii</i> Longfin eel
		<i>Charadrius bicinctus bicinctus</i> Banded dotterel	<i>Cyclodina ornata</i> Ornate skink
		<i>Charadrius obscurus</i> <i>aquilonius</i> Northern NZ dotterel	<i>Eudyptula minor iredalei</i> Northern little blue penguin
		<i>Chalinolobus tuberculata</i> Long tailed bat (North Island)	<i>Galaxias argenteus</i> Giant kokupu
		<i>Egretta sacra sacra</i> Reef Heron	<i>Larus novaehollandiae</i> <i>scopulinus</i> Red billed gull
		<i>Hydropogon caspia</i> Caspian tern	<i>Naultinus elegans elegans</i> Auckland green gecko
		<i>Nestor meridionalis</i> <i>septentrionalis</i> North Island kaka	<i>Sterna striata striata</i> White- fronted tern

Originally rare ecosystems

Coastal cliffs on mafic rock
Coastal rock stacks
Debris flow or lahar
Estuary
Gumland
Lake margin
Subterranean basalt fields
Volcanic boulderfields

Priorities for protection

Volcanic boulderfield

Coastal ecosystems including estuarine, wetlands, shrublands and forest

Sites of *Centipeda minima*, *Epilobium hirtigerum*, and *Fissidens berteroi*

Breeding sites and habitat for *Anas superciliosa superciliosa*

Sites of originally rare ecosystems where these can be confirmed

7.3.3. Waitakere ED

Location and Physical Description:

This district is 29,157 hectares in area and the altitude ranges from sea level to 474m. Much of the district is still covered in native vegetation, particularly the characteristic Waitakere Ranges. The district is bounded by the Tasman Sea and the Manukau Harbour to the west and south respectively. The Kaipara and Rodney districts lie to the north, which follows the boundary between the volcanic Manukau subgroup rocks and the Kaihu sands (Denyer *et al.*, 1993). To the east the Waitakere Ranges give way abruptly to the lowlands of the Auckland isthmus in the Tamaki ED. The ecological descriptions of the Waitakere ED are from Denyer *et al.* (1993).

Ecosystems Originally Present:

In pre-European times the vegetation of the Waitakere Ranges was dense podocarp-broadleaf forest with kauri forest on the eastern slopes and ridges. Māori occupation and thus modification of the vegetation was primarily around coastal sites, with the interior of the district being virtually untouched until the arrival of Europeans. Since then, timber milling, flaxmilling, gumdigging, mineral extraction, quarrying and farming has resulted in modification of these forest systems. Another activity which altered the district was the damming of catchments for Auckland's water supply. Initially this meant large scale clearance for reservoir and dam sites. However, the subsequent closing of water supply catchments to development has protected large areas of the ranges.

Existing Ecosystems:

This ED contains a high diversity of vegetation and wildlife in one of the two largest blocks of continuous vegetation in the Auckland region and includes internationally important wading bird habitats. The PNAP report describes eight broad and 43 subgroups of vegetation classes, including kauri forest, podocarp broadleaf forest, bluff and coastal edge vegetation and freshwater wetlands. Most of the natural ecosystems present are in the Waitakere Ranges, which has extensive continuous areas of regenerating forest.

Protection Status:

Approximately 75% of the remaining native vegetation remnants in the Waitakere ED are in protected areas. A large proportion of this protected land is incorporated in the ARC managed Waitakere Ranges Regional Park. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

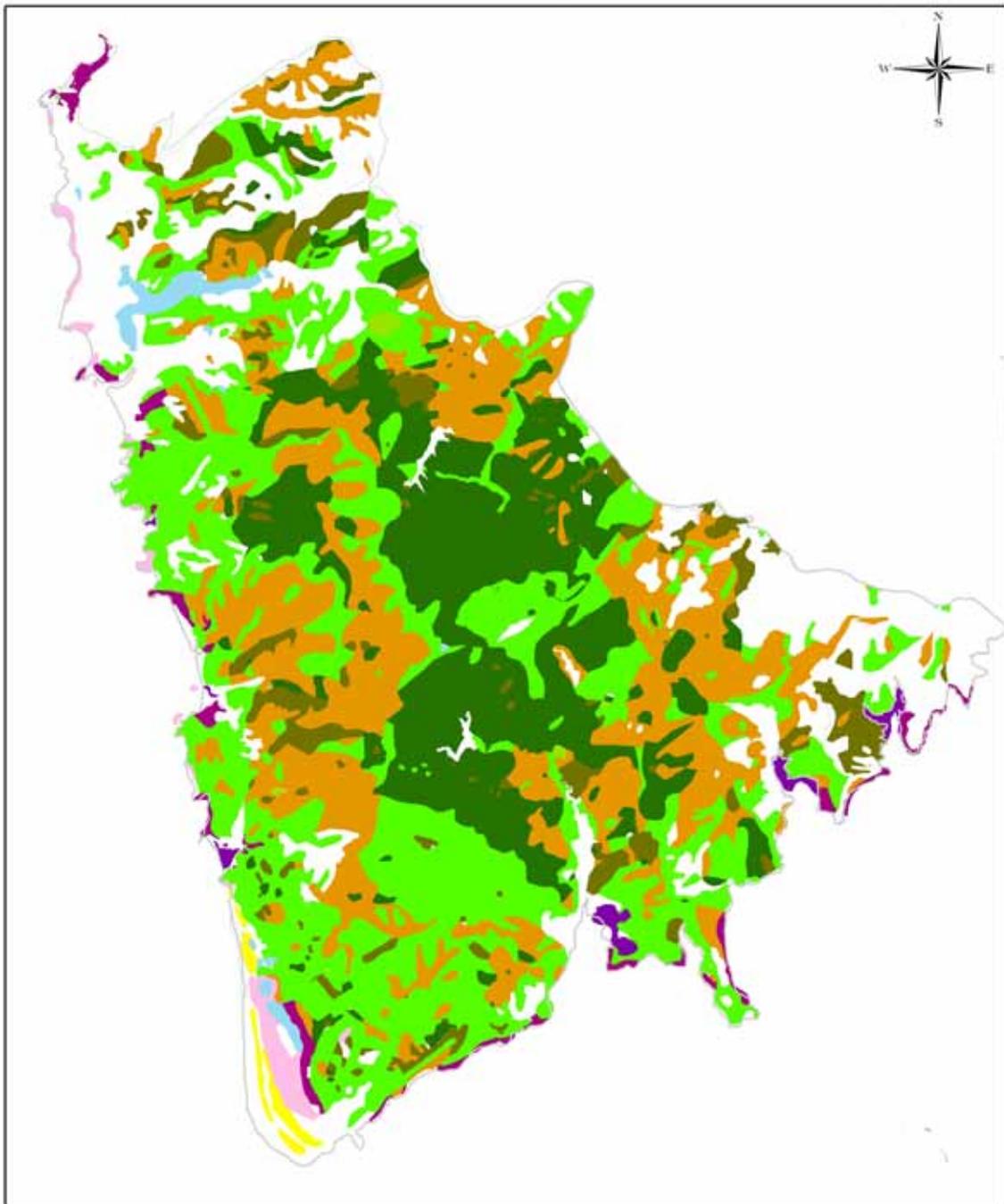
Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	145	N/A	25	17
Coastal Forest	864	421	48	225	53
Dune vegetation	338	122	36	1	1
Freshwater wetland & wetland forest	481	247	51	36	14
Kauri forest	11452	1675	14	973	58
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	13145	10670	73	8993	84
Shrubland	N/A	8258	N/A	6038	73
Unclassified	N/A	148	N/A	61	41
Total	26280	*21686	78	16352	75

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick *et al.*

The most intact ecosystems in the Auckland region are represented here although the once extensive kauri forest has been severely depleted by logging of the larger trees. Wetlands and duneland are however relatively scarce and, outside of the Waitakere Ranges, ecosystems are heavily fragmented.

Waitakere Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Daucus glochidiatus</i> NZ carrot	<i>Myosotis petiolata</i> var. <i>pansa</i>	<i>Hebe bishopiana</i>	<i>Brachyglottis kirkii</i> var. <i>kirkii</i> Kirk's daisy
<i>Lindbergia maritima</i>	<i>Utricularia australis</i> Yellow bladderwort	<i>Lepidium oleraceum</i> Cook's scurvy grass	<i>Carex litorosa</i> Sea sedge
<i>Nematoceras</i> aff. <i>rivulare</i> Spider orchid			<i>Eleocharis neozelandica</i> Sand spike sedge
<i>Ophioglossum petiolatum</i> Stalked adder's tongue fern			<i>Ptisania salicina</i> King fern
			<i>Pimelea tomentosa</i>
			<i>Pittosporum kirkii</i> Kirk's kohuhu
			<i>Myriophyllum robustum</i> Stout water milfoil
			<i>Paspalum orbiculare</i> Native paspalum
			<i>Peraxilla tetrapetala</i> Red mistletoe
			<i>Pimelea arenaria</i>
			<i>Thelypteris confluens</i>

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasian bittern	<i>Anarhynchus frontalis</i> Wrybil	<i>Eudyptula minor iredalei</i> Northern little blue penguin
	<i>Larus bulleri</i> Black-billed gull	<i>Chalinolobus tuberculata</i> Long tailed bat	<i>Hoplodactylus pacificus</i> Pacific gecko
	<i>Notiomystis cincta</i> Hihi (Stitchbird)	<i>Charadrius bicinctus bicinctus</i> Banded dotterel	<i>Larus novaehollandiae scopulinus</i> Red billed gull
		<i>Charadrius obscurus aquilonius</i> NZ dotterel	<i>Naultinus elegans elegans</i> Auckland green gecko
		<i>Egretta sacra sacra</i> Reef heron	<i>Paryphanta busbyi busbyi</i> Kauri snail
		<i>Hydropogone caspia</i> Caspian tern	<i>Puffinus carneipes</i> Flesh footed shearwater
		<i>Nestor meridionalis septentrionalis</i> North Island kaka	<i>Puffinus griseus</i> Sooty shearwater
			<i>Sterna striata aucklandornata</i> White fronted tern

Originally Rare Ecosystems

Active sand dunes
Cliffs, scarps and tors of mafic rock
Cliffs, scarps and tors of silicic rock
Cliffs, scarps and tors of silicic-intermediate rock
Coastal cliffs on mafic rocks
Coastal cliffs on silicic bedrock

Coastal rock stacks
Damp sand plains
Estuary
Gumland
Lake margin
Seabird burrowed soils and/or guano deposits

Priorities for Protection

Coastal ecosystems including dunes, estuarine, wetlands, shrublands and forest

Linkages and buffers to existing reserves.

Sites of *Daucus glochidiatus*, *Lindbergia maritima*, *Nematoceras* aff. *rivulare*, and *Ophioglossum petiolatum*,

Breeding sites and habitat for *Anas superciliosa superciliosa*

Sites of originally rare ecosystems where these can be confirmed

7.3.4 Rangitoto ED

Location and Physical Description:

The Rangitoto ED is made up entirely of the 2333 hectare Rangitoto Island Scenic Reserve. It is approximately 3km from the mainland at its nearest point and joins Motutapu Island via a causeway on its eastern side.

Ecosystems originally present

Rangitoto is Auckland's youngest volcano, formed around six hundred years ago and therefore the landform was not present in pre-human times.

Existing Ecosystems

Rangitoto is composed of gently sloping basaltic lava and ash base with a steeper central cinder cone and its geological features are of international significance. Rangitoto is unique for its colonising *Metrosideros* hybrid-dominated forest and shrubland associations growing on basaltic lava and scoria, which is recognised in its status as its own ED (DOC, 1995).

Protection Status

Fully protected as the Rangitoto Island Scenic Reserve, the Rangitoto ED is administered by the Department of Conservation.

Vegetation class	Hectares	Protected hectares	% protected
Brackish estuarine	6	6	100
Volcanic boulderfield	2309.06	2309.06	100

This island is a unique example of recent volcanic boulderfield and the only extensive example of this ecosystem type left in Auckland. No comparison can be made with prehuman vegetation as this island was formed from a volcanic eruption after human occupation of New Zealand.

Threatened Species Recorded (Categories 1 – 4)

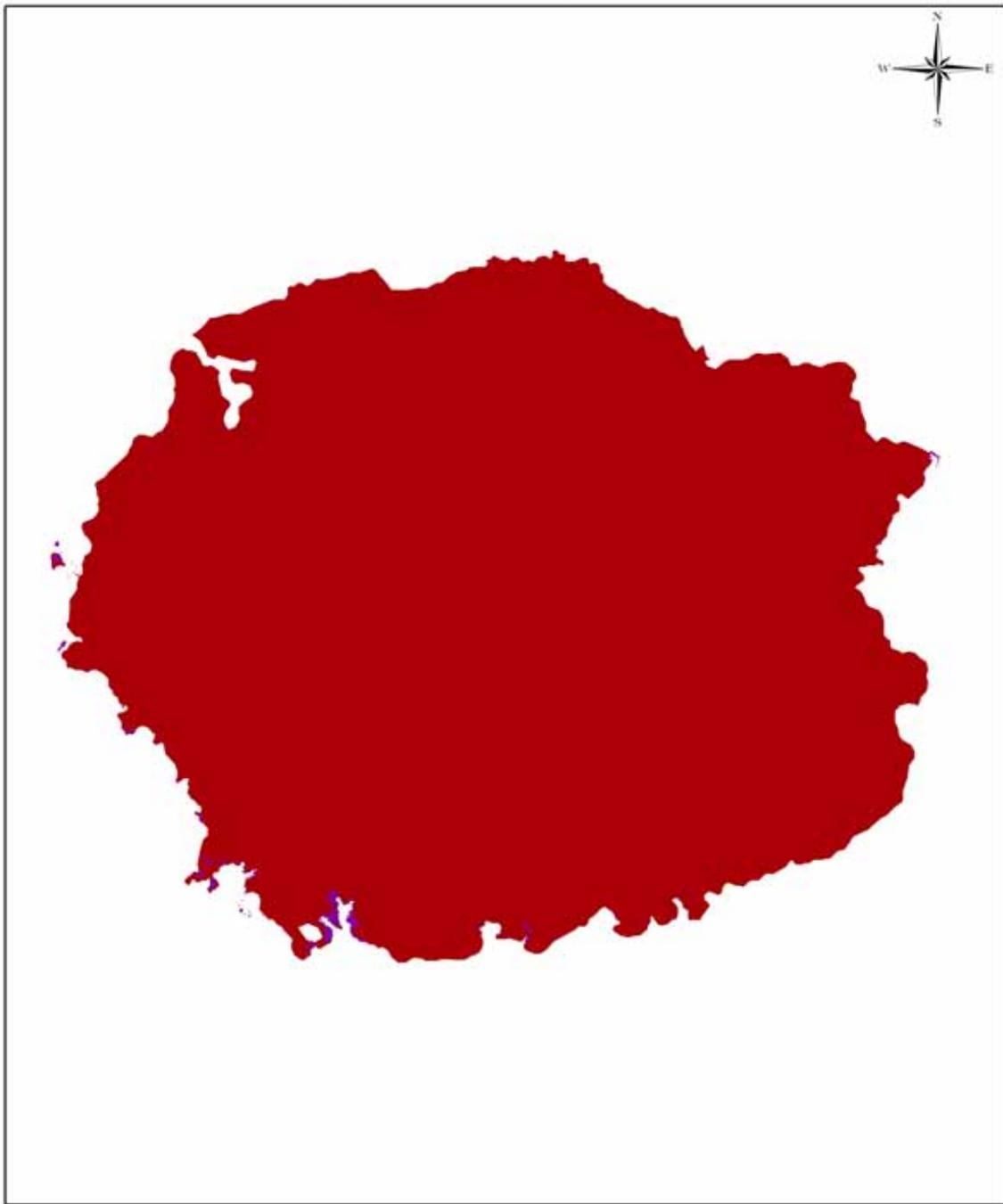
Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Daucus glochidiatus</i> NZ carrot	<i>Plumatochilos tasmanicum</i>		<i>Brachyglottis kirkii</i> var. <i>kirkii</i> Kirk's daisy

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
		<i>Hydropogne caspia</i> Caspian tern	<i>Eudyptula minor iredalei</i> Northern little blue penguin
			<i>Hemiphaga novaeseelandia</i> Kereru
			<i>Larus novaehollandiae scopulinus</i> Red billed gull
			<i>Sterna striata aucklandornata</i> White fronted tern
			<i>Cyclodina ornata</i> Ornate skink

Rangitoto Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7.3.5 Inner Gulf Islands ED

Location and Physical Description:

The Inner Gulf Islands ED is made up of several groups of mostly small inshore islands and islets in the Hauraki Gulf including Kawau, Motuora, Tiritiri Matangi, the Noises, Rakino, Motutapu, Waiheke, Ponui, Motuihe and Motukorea Islands. The largest islands in this district are Waiheke (9459 ha) and Ponui (1851 ha). The islands are mostly of low elevation but often with steep coastal cliffs.

Ecosystems Originally Present:

Most of the islands were covered with coastal forest, predominantly pohutukawa but with some kauri. On Waiheke kauri, hard beech, miro, rimu and tawa were common. Kawau had similar forest but hard beech and kauri were rare.

Existing Ecosystems:

All these island have been highly modified by human occupation and farming activities, many having been almost totally cleared of indigenous vegetation. Large areas of *Leptospermum* forest are present on Kawau, probably as a result of early Polynesian clearing. Motuora and Tiritiri Matangi were grazed for a long period but have more recently been extensively revegetated in order to re-establish indigenous forest and currently consist mostly of regenerating coastal shrubland and some remaining pasture. Motutapu and Motuihe have been partially revegetated, but along with Brown's Island (Motukorea) and Ponui still consist mostly of pasture with a coastal fringe of remnant indigenous vegetation often heavily infested with weed species. Waiheke, Rakino and Kawau have extensive areas of housing development.

Protection Status:

Approximately 17% of the remaining native vegetation remnants in the Inner Gulf Islands ED are in protected areas. This protection largely consists of land on islands administered by DOC as recreation, scenic or scientific reserves. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

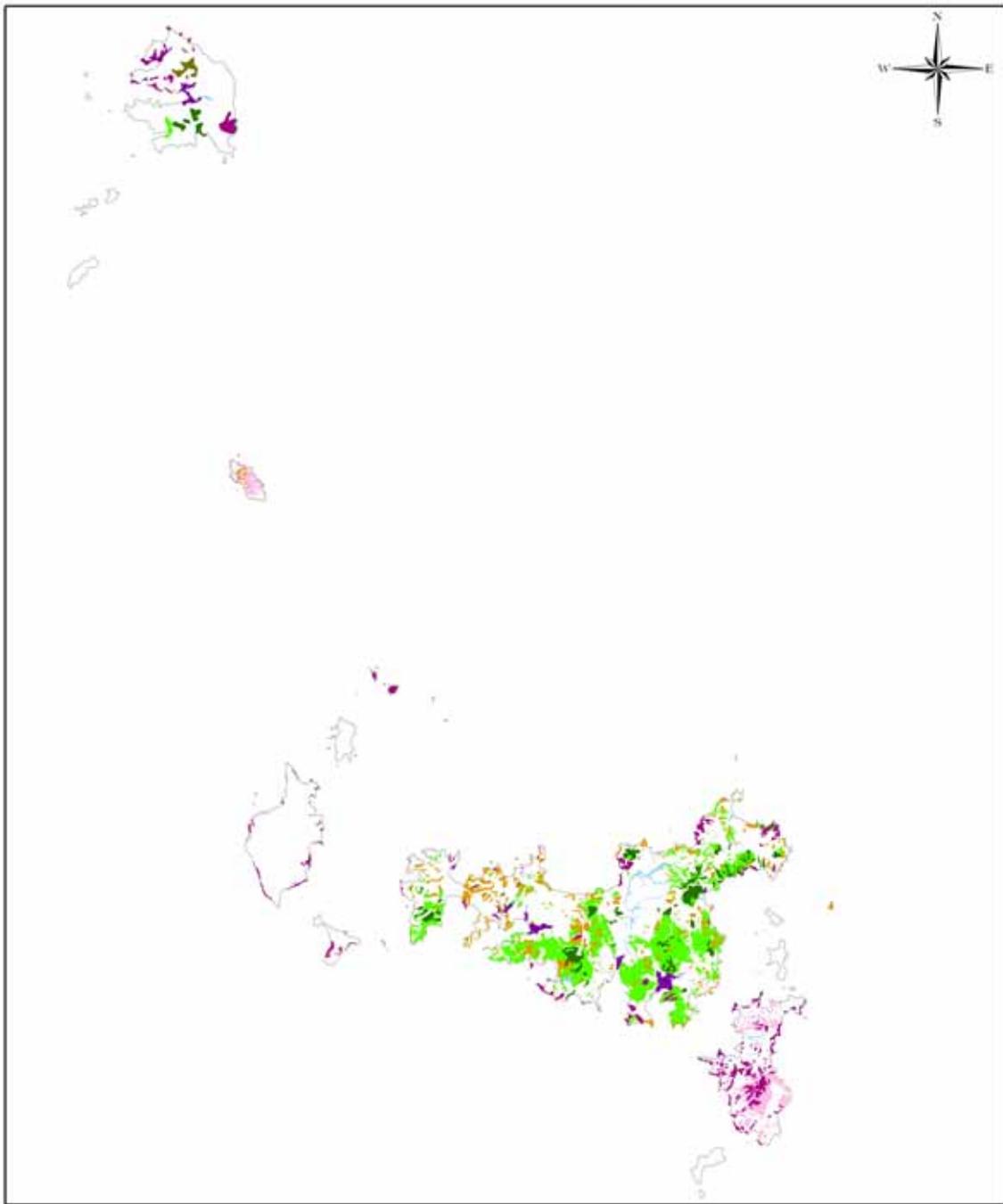
Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	203	N/A	4	2
Coastal Forest	11774	732	13	95	13
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	524	147	28	13	8
Kauri forest	0	56	0	0	0
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	3203	1365	19	217	16
Shrubland	N/A	2792	N/A	592	21
Unclassified	N/A	128	N/A	1	.7
Total	15501	*5423	34	922	17

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

Islands are particularly important for conservation because of the ability to keep them pest free. Many islands in this ED are being restored using coastal forest species to re-establish habitat that can be used as safe haven for threatened species. However, small islands have a limited number of habitats available and of those, freshwater wetlands are particularly scarce.

Inner Gulf Islands Ecological District



Legend

Native Vegetation Class

Kauri

Podocarp/Broadleaf/Kauri

Podocarp

Broadleaf

Shrubland

Coastal Forest

Coastal Shrubland

Volcanic Boulderfield

Dune Complex

Freshwater Wetland

Brackish Estuarine

unclassified

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed		<i>Pimelia tomentosa</i>	<i>Euphorbia glauca</i> Shore spurge
<i>Senecio scaberulus</i> Native fireweed			<i>Paspalum orbiculare</i> Native paspalum
<i>Daucus glochidiatus</i> NZ carrot			<i>Peraxilla tetrapetala</i> Red mistletoe
			<i>Ptisania salicina</i> King fern

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Porphyrio hochstetteri</i> Takahe	<i>Notiomystis cincta</i> Hihi (Stitchbird)	<i>Apteryx mantelli</i> NI Brown kiwi	<i>Charadrius obscurus aquilonius</i> NZ dotterel
		<i>Callaeas cinerea wilsonii</i> NI Kokako	<i>Egretta sacra sacra</i> Reef heron
		<i>Gallirallus australis greyi</i> North Island weka	<i>Eudyptula minor iredalei</i> Northern little blue penguin
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	<i>Hydropogon caspia</i> Caspian tern
		<i>Nestor meridionalis septentrionalis</i> NI Kaka	<i>Naultinus elegans elegans</i> Auckland green gecko
			<i>Puffinus carneipes</i> Flesh-footed shearwater
			<i>Puffinus griseus</i> Sooty shearwater
			<i>Sterna striata aucklandornis</i> White fronted tern

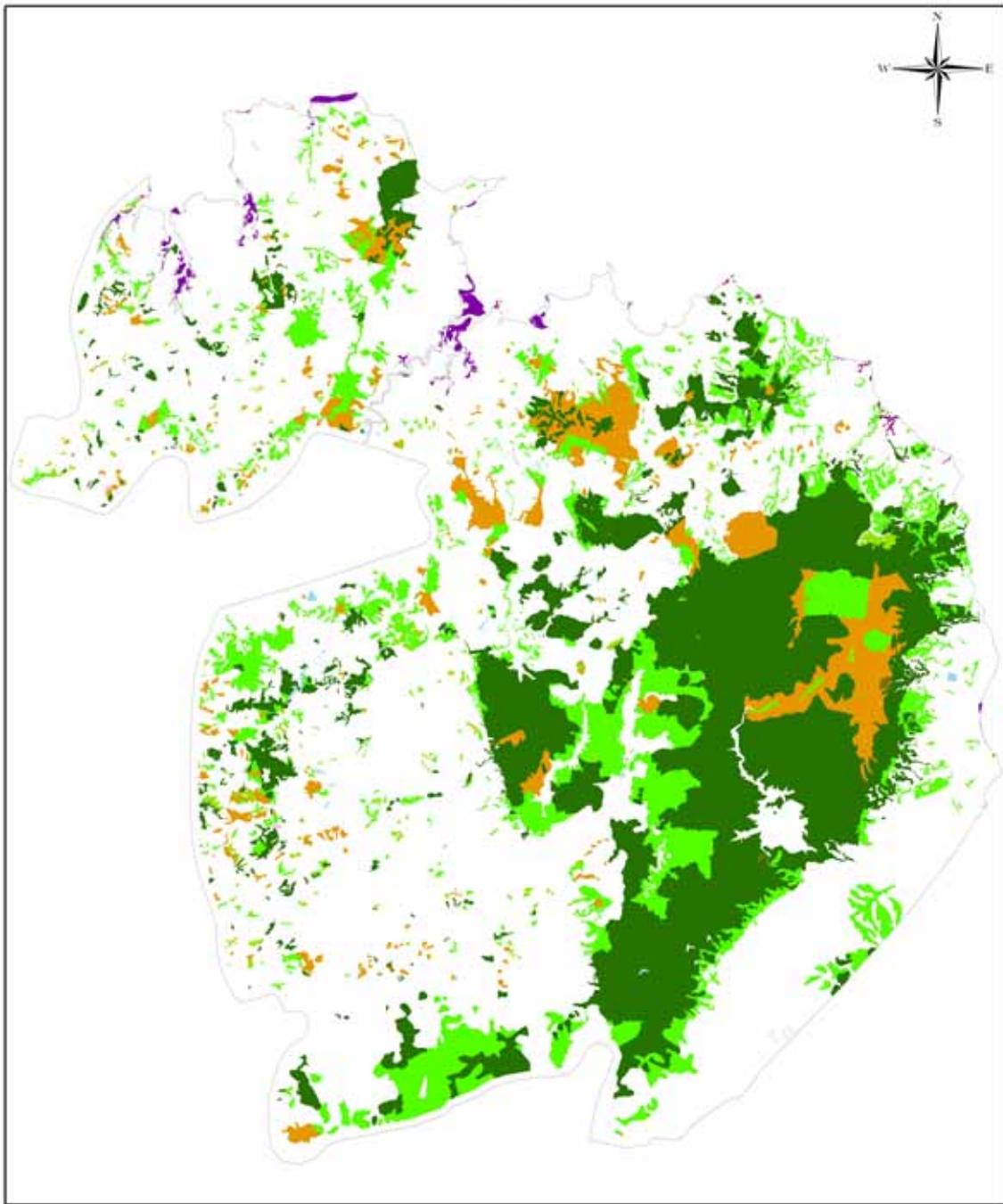
Originally rare ecosystems

Boulderfields of silicic-intermediate rock
Calcareous cliffs, scarps and tors
Coastal cliffs on calcareous rocks
Coastal rock stacks
Estuary
Lake margin
Recent lava flows
Seabird burrowed soils and/or guano deposits

Priorities for protection

Freshwater wetlands
 Coastal shrublands and forest
 Sites of *Centipeda minima*, *Senecio scaberulus* and *Daucus glochidiatus*
 Sites of originally rare ecosystems where these can be confirmed

Hunua Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7.3.6 Hunua ED

Location and Physical Description:

The Hunua ED covers 85,723 hectares in the southern part of the Auckland ER and ranges in altitude from sea level to 688m. To the east and north the ED is bounded by the coastlines of the Firth of Thames and Hauraki Gulf respectively. A series of faults separates it from the Manukau ED to the west and the Waikato ER to the south. The district is composed mostly of greywacke and argillite basement rock with some sedimentary rocks around Mangemangeroa Estuary in the north. The ecological descriptions of the Hunua ED are taken from the Hunua PNAP report (Tyrell *et al.* 1999).

Ecosystems Originally Present:

Pre-human vegetation cover in the ED consisted of tawa-podocarp and kauri-hard beech and northern rata-rimu-taraire, kauri-broadleaf and coastal forests on lowland and coastal hills. Most of the ED's vegetation was unmodified prior to European arrival with Maori settlement and influence being confined to the fringes of the hill country and on the coastal flats.

Existing Ecosystems:

Tawa, kauri-hard beech and taraire forest are the characteristic vegetation classes of the district. Few freshwater wetlands remain and saline wetlands are more extensive than freshwater wetlands. Coastal ecosystems are diverse but also highly fragmented, there is no intact sequence of vegetation from coastal saline vegetation through coastal forests to inland forests. However, the largest single block of continuous forest left in the Auckland region, the Hunua Ranges, is in this district. The Ranges consist of over 20,000ha of native forest, predominately tawa-podocarp, with kauri-hard beech at lower elevations. Above 600m there is also an area of submontane forest which is unique in the district. It is dominated by hutu in the canopy with tawheowheo, heketara and lancewood. Elsewhere in the ED the remaining native vegetation mostly consists of very small remnants (less than 10ha). However, there are a few substantial blocks of forest remaining. These include the forests of Maraitai, Mataikokako and Mataitai Hills, each contain several hundred hectares of native vegetation. Other forest classes described in the Hunua PNAP report include: the broadleaf forest types taraire, puriri, pukatea, swamp maire, and kahikatea forest; areas of secondary forest (mapou, kanuka, and treefern) totara forest on alluvial sediments; small scattered patches of pohutukawa forest; and small areas of kowhai forest (four sites, totalling 4 hectares) on gravel ridges or coastal sediments.

Protection Status:

Approximately 58% of the remaining native vegetation remnants in the Hunua ED are in protected areas. Approximately two thirds of this protected land is included in the Hunua Ranges Regional Park managed by the ARC. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	111	N/A	0	0
Coastal Forest	3076	52	1	23	44
Dune vegetation	98	0	0	0	0
Freshwater wetland & wetland forest	6336	87	1	15	17
Kauri forest	+41334	29	.5	20	68
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	31599	20956	66	14477	69
Shrubland	N/A	8912	N/A	3149	35
Unclassified	N/A	297	N/A	20	6
Total	82443	*30444	36	17704	58

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

+there are some anomalies in the data which in this case overestimates the amount of kauri forest that would have originally been present in the Hunua ED. This affects the percentages between the remaining kauri forest and the remaining podocarp/broadleaf and kauri forest but does not affect the overall percentage of remaining indigenous ecosystems.

Coastal forest and freshwater wetlands are severely depleted in this ED and previous areas of dune vegetation have been completely lost.

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	National endangered	Nationally vulnerable	Declining
<i>Senecio scaberulus</i> Native fireweed			<i>Brachyglottis kirkii</i> var. <i>kirkii</i> Kirk's daisy
<i>Ophioglossum petiolatum</i> Stalked adder's tongue fern			<i>Ptisania salicina</i> King fern
			<i>Pittosporum kirkii</i> Kirk's kohuhu

Fauna

Nationally critical	National endangered	Nationally vulnerable	Declining
<i>Ardea modesta</i> White heron	<i>Botaurus poiciloptilus</i> Australasia bittern	<i>Anarhynchus frontalis</i> Wrybill	<i>Naultinus elegans elegans</i> Auckland green gecko
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Callaeas cinerea wilsonii</i> NI Kokako	<i>Egretta sacra sacra</i> Reef heron	<i>Rhytida greenwoodi webbi</i> Snail
	<i>Larus bulleri</i> Black-billed gull	<i>Chalinolobus tuberculata</i> Long tailed bat	<i>Sterna striata striata</i> White-fronted tern
		<i>Charadrius bicinctus bicinctus</i> Banded dotterel	
		<i>Charadrius obscurus aquilonius</i> NZ dotterel	
		<i>Gallirallus australis greyi</i> North Island weka	
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	
		<i>Nestor meridionalis septentrionalis</i> NI Kaka	

Originally rare ecosystems

Calcareous cliffs, scarps and tors
Coastal rock stacks
Estuary
Gumland
Lake margin
Shell barrier beach
Stony beach ridges
Subterranean basalt fields

Priorities for protection

Freshwater wetland and wetland forest

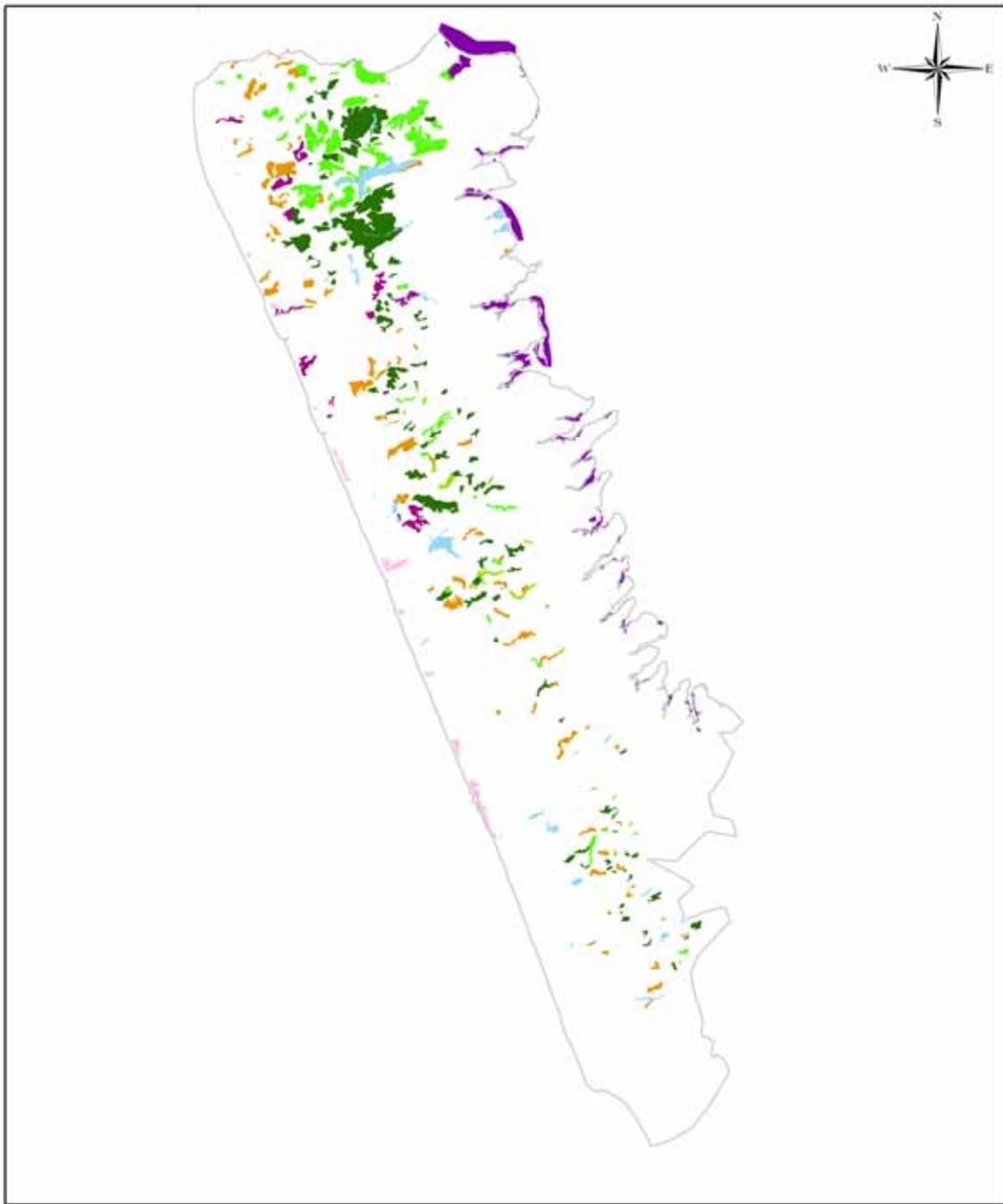
Coastal ecosystems including estuarine, wetlands, shrublands and forest

Sites of *Senecio scaberulus* and *Ophioglossum petiolatum*

Breeding sites and habitat for *Anas superciliosa superciliosa*

Sites of originally rare ecosystems where these can be confirmed

Awhitu Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7.3.7 Awhitu ED

Location and Physical Description:

The Awhitu ED lies in the south-western corner of the Auckland ER, stretching from the Manukau Harbour in the north to the mouth of the Waikato River in the south, covering approximately 29,400 hectares. The Tasman Sea forms the western boundary and the Waiuku River forms the eastern boundary. A change in topography occurs in the southern part of the ED between the steep consolidated sand hills and the low-lying Aka Aka Plains. The ecological descriptions of the Awhitu ED are taken from ARC (2004) and McEwan (1987).

Ecosystems Originally Present:

The original vegetation of the Awhitu Peninsula comprised coastal-lowland broadleaved forest with pohutukawa, taraire, puriri and kohekohe, with locally common podocarps such as rimu, kahikatea and totara. One of the greatest puriri forests in New Zealand is thought to have thrived on the peninsula, while large quantities of kauri were present in the northern part of the peninsula before it was milled.

Existing Ecosystems:

The original vegetation has been modified and fragmented by human activities but has approximately 3000 ha (10%) of remaining indigenous vegetation. This comprises scattered sites of forest, scrub and wetland, with most occurring on hill slopes and gullies in the central uplands of the Awhitu Peninsula. Awhitu ED also contains fourteen freshwater dune lakes covering nearly 56 hectares.

Protection Status:

Approximately 7% of the remaining native vegetation remnants in the Awhitu ED are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	491	N/A	16	3
Coastal Forest	7763	161	7	4	2
Dune vegetation	763	0	0	0	0
Freshwater wetland & wetland forest	3347	240	7	43	7
Kauri forest	124	0	0	0	0
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	16485	1401	5	138	14
Shrubland	N/A	715	N/A	14	1
Unclassified	N/A	0	N/A	0	0
Total	28482	*3008	10	215	7

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

All ecosystems are severely depleted in this ED with less than 10% of any vegetation class remaining.

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
		<i>Hebe speciosa</i>	<i>Austrofestuca littoralis</i> Sand tussock
			<i>Brachyglottis kirkii</i> Kirk's daisy
			<i>Myriophyllum robustum</i>

			Stout water milfoil
			<i>Ptisania salicina</i> King fern

Fauna

Nationally critical	National endangered	Nationally vulnerable	
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasia bittern	<i>Charadrius obscurus</i> <i>aquilonius</i> NZ dotterel	<i>Eudyptula minor iredalei</i> Northern little blue penguin
	<i>Larus bulleri</i> Black billed gull	<i>Egretta sacra sacra</i> Reef heron	<i>Sterna striata striata</i> White-fronted tern
		<i>Hydropogone caspia</i> Caspian tern	
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	

Originally Rare Ecosystems

Coastal rock stacks
Estuary
Lake margin
Subterranean basalt fields

Priorities for Protection

Freshwater wetlands
 Kahikatea swamp forest
 Coastal ecosystems including estuarine, wetlands, shrublands and forest
 Linkages and buffers to existing reserves
 Breeding sites and habitat for *Anas superciliosa superciliosa*
 Sites of originally rare ecosystems where these can be confirmed

7.3.8 Manukau ED

Location and Physical Description:

The Manukau ED is one of the southernmost districts in the Auckland ER and covers approximately 62,100 ha. Its northern boundary follows the Manukau Harbour from Clarks Beach in the west to Manurewa in the north-east. It adjoins the Tamaki ED along the northern boundary, before following the Hunua ED boundary as it skirts around the alluvial Ardmore lowlands and then heading almost due south along the base of a prominent scarp formed by the Drury faultline. This boundary continues almost to Pokeno, where it changes to a westerly direction until it reaches the Waikato River, which it follows until meeting the Awhitu ED south of Waiuku.

Ecosystems Originally Present:

The original forest of the Manukau ED included the most southerly common occurrence of characteristic northern North Island lowland forest types containing abundant taraire and puriri. Alluvial flats and terraces throughout the ED once supported extensive stands of kahikatea swamp forest, but these have largely been drained and converted to farmland.

Existing Ecosystems:

The Manukau ED is highly modified. It is primarily in pasture, with large areas of urban settlement. Small scattered remnants of modified or regenerating forests of conifer and broadleaved species, especially puriri and taraire, occur throughout, but the only large area of 'natural landscape' is the Manukau Harbour itself.

Protection Status:

Approximately 6% of the remaining native vegetation remnants in the Manukau ED are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

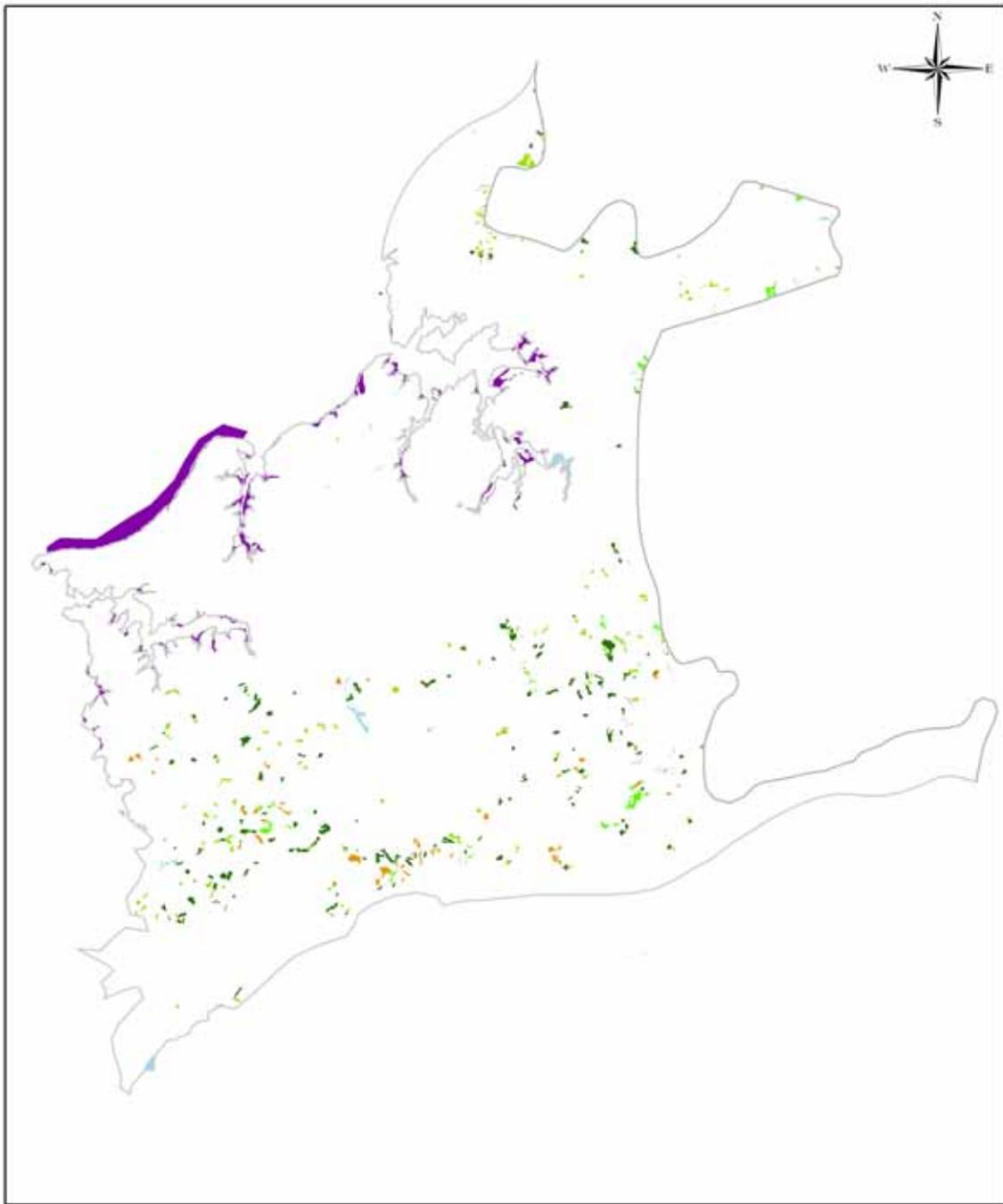
Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	1096	N/A	32	3
Coastal Forest	274	13	4	3	23
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	22244	105	.4	2	2
Kauri forest	1541	0	0	0	0
Volcanic boulderfield	178	0	0	0	0
Podocarp/broadleaf and kauri	42462	908	2	103	11
Shrubland	N/A	271	N/A	7	2
Unclassified	N/A	36	N/A	1	2
Total	66699	*2429	3	148	6

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

All ecosystems in this ED are severely depleted with only 3% remaining in total. Of this remaining three percent only 6% are protected. The district once contained extensive wetlands and wetland forest almost all of which have been lost.

Manukau Ecological District



Legend

Native Vegetation Class

 Kauri	 Coastal Forest	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Shrubland	 unclassified
 Podocarp	 Volcanic Boulderfield	
 Broadleaf	 Dune Complex	

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Ardea modesta</i> White heron			<i>Carex litorosa</i> Sea sedge
			<i>Brachyglottis kirkii</i> Kirk's daisy
			<i>Ptisania salicina</i> King fern

Fauna

Nationally critical	National endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasia bittern	<i>Anarhynchus frontalis</i> Wrybill	
		<i>Charadrius obscurus aquilonius</i> NZ dotterel	
		<i>Egretta sacra sacra</i> Reef heron	
		<i>Hydropogone caspia</i> Caspian tern	
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	

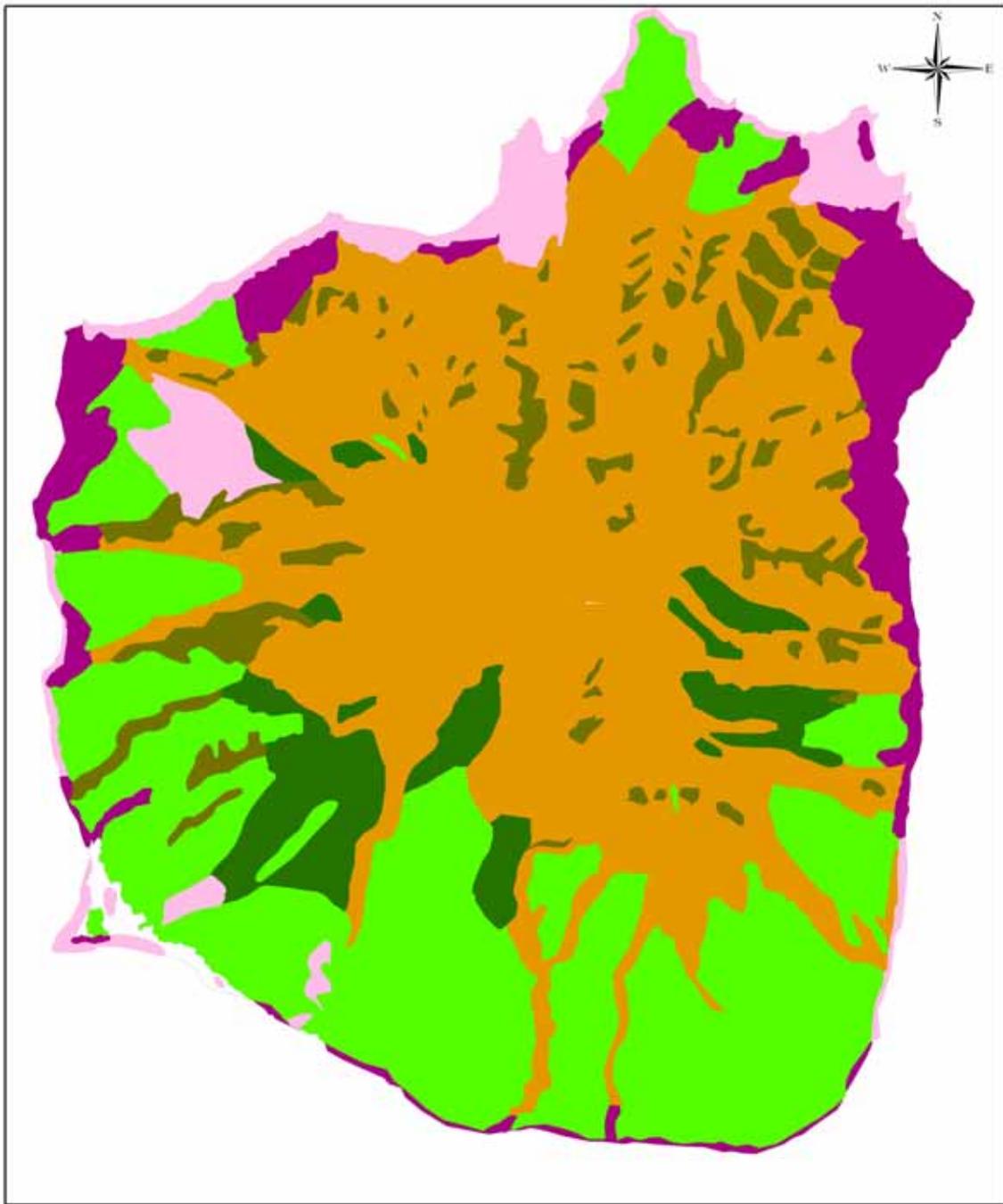
Originally Rare Ecosystems

Coastal rock stacks
Estuary
Lake margins
Subterranean basalt fields

Priorities for Protection

Freshwater wetlands
 Kahikatea swamp forest
 Coastal ecosystems including estuarine, wetlands, shrublands and forest
 Breeding sites and habitat for *Anas superciliosa superciliosa*
 Sites of originally rare ecosystems where these can be confirmed

Little Barrier Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp/Broadleaf/Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

7.4 Coromandel Ecological Region

7.4.1 Little Barrier ED

Location and Physical Description:

This district consists of Little Barrier Island and the rock stacks immediately surrounding the island, namely the Queen and Lots Wife. Little Barrier Island is 2,817ha, and lies 22km east from Cape Rodney and 17km west from Great Barrier Island. Little Barrier is volcanic in origin rising to 722m, the highest point in the Auckland Conservancy.

Ecosystems Originally Present:

The island contains the largest remaining area of relatively unmodified northern New Zealand forest. Most of the island has never been logged or browsed, however the presence of kiore (Polynesian rat) for several hundred years will have altered the abundance of some species (Campbell & Atkinson, 1999)

Existing Ecosystems:

The island has a diverse range of plant species and forest types, determined predominately by altitude. Forest types include pohutukawa, kanuka shrubland, kauri, kauri-hard beech, beech, rata-tawa, tawhero-tawa, and *Quintinia-Ixerba*-southern rata cloud forest, which is found along the summit ridge of the island.

Protection Status:

The entire ED is fully protected as the Little Barrier Island Nature Reserve administered by the Department of Conservation. The estimated original extent of ecosystems and their present extent are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	0	0	0	0	0
Coastal Forest	813	242	29	242	100
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	0	0	0	0	0
Kauri forest	+104	195	108	195	100
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	2146	1527	71	1527	100
Shrubland	N/A	1097	N/A	1097	100
Unclassified	0	0	0	0	0
Total	3064	3061	99	3061	100

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

+There are some anomalies in the data which in this case underestimates the amount of kauri forest that would have originally been present in the Little Barrier ED. This affects the percentages between the remaining kauri forest and the remaining podocarp/broadleaf and kauri forest but does not affect the overall percentage of remaining ecosystems.

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed		<i>Hebe speciosa</i>	<i>Brachyglottis kirkii</i> Kirks Daisy
<i>Senecio scaberulus</i> Native fireweed		<i>Rorippa divaricata</i> NZ watercress	<i>Dactylanthus taylorii</i> Wood rose
			<i>Euphorbia glauca</i> Shore

			spurge
			<i>Ptisania salicina</i> King fern
			<i>Pimelia tomentosa</i>
			<i>Pittosporum kirkii</i> Kirk's kohuhu
			<i>Peraxilla tetrapetala</i> Red mistletoe

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
		<i>Apteryx mantelli</i> North Island Brown kiwi	<i>Acanthisitta chloris granti</i> NI Rifleman
		<i>Chalinolobus tuberculata</i> (North Island) Long tailed bat	<i>Cyclodina ornata</i> Ornate skink
	<i>Callaeas cinerea wilsonii</i> NI Kokako	<i>Larus novaehollandiae scopulinus</i> Red billed gull	<i>Eudyptula minor iredalei</i> Northern little blue penguin
	<i>Deinacrida heteracantha</i> Wetapunga	<i>Nestor meridionalis septentrionalis</i> Kaka	<i>Hoplodactylus pacificus</i> Pacific gecko
	<i>Notiomystis cincta</i> Hihi (stitchbird)		<i>Naultinus elegans elegans</i> Auckland green gecko
	<i>Oligosoma homalonotum</i> Chevron skink		

Originally Rare Ecosystems

Cliffs, scarps and tors of silicic rock
Cloud forest
Coastal cliffs on silicic rock
Coastal rock stacks
Gumland
Seabird burrowed soils and/or guano deposits

7.4.2 Great Barrier ED

Location and Physical Description:

This district encompasses Great Barrier Island (Aotea) and its surrounding islands and islets, which include; Rakitu (Arid), Aiguilles, Kaikoura, the Broken Islands and the Grey Group. Great Barrier Island covers 28,500 ha and lies approximately 100km north east of downtown Auckland. The ecological descriptions are taken from Armitage (2001).

Ecosystems Originally Present:

Most of Great Barrier Island was originally covered in forest of similar composition to that found on the nearby Coromandel Peninsula, containing a variety of forest types including coastal forest, lowland mixed broadleaf forest, and montane forest dominated by kauri. A number of endemic plants were present reflecting the island's isolation. There were also extensive dune and wetland ecosystems and large areas of kahikatea-pukatea forest on waterlogged lowland alluvial flats.

Existing Ecosystems:

Much of Great Barrier has been highly modified by human activity including burning and logging of forests, mining, gumdigging and draining of wetlands to create productive farmland. However, the island still supports a high diversity of native flora including two endemic plants, despite the fact that most of the remaining forest has been subjected to severe browsing by goats. Steep coastal cliffs are dominated by pohutukawa, and the coastal forest also contains taraire, kohekohe and tawa. Kauri-rimu-towai forest remains between 200 and 300 metres. The higher altitude area around the summit of Mt Hobson consists of upper montane forest dominated by yellow-silver pine. Large areas of coastal forest are regenerating kanuka and manuka scrubland.

Protection Status:

Approximately 55% of the remaining native vegetation remnants on Great Barrier Island are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	334	N/A	144	43
Coastal Forest	13405	589	4	336	57
Dune vegetation	393	140	35	35	25
Freshwater wetland & wetland forest	1338	534	39	318	59
Kauri forest	+3306	3883	117	3555	91
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	10361	4562	44	3308	72
Shrubland	N/A	16917	N/A	7160	42
Unclassified	0	0	0	0	0
Total	28803	26959*	93	14909	55

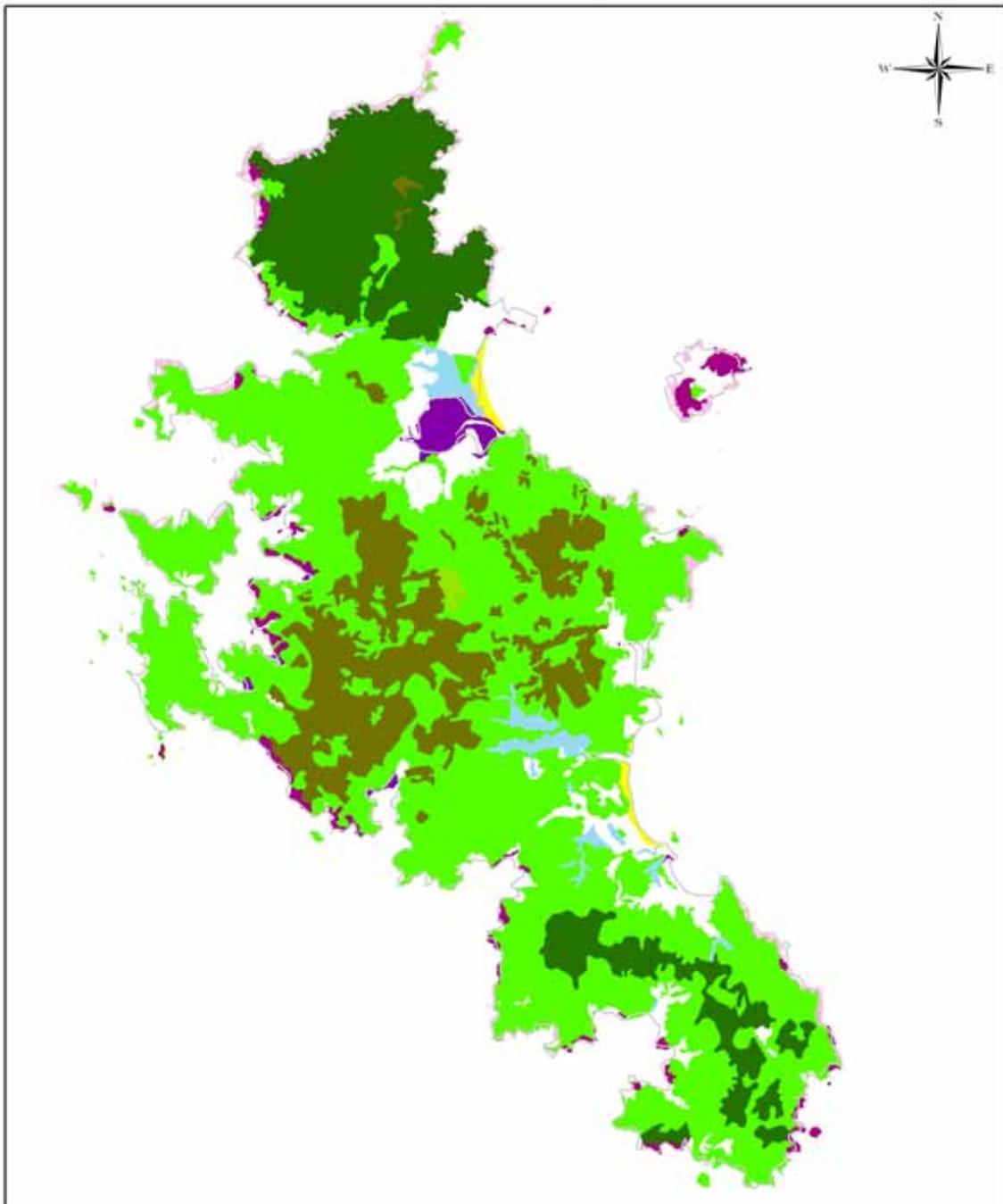
N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

+There are some anomalies in the data which in this case underestimates the amount of kauri forest that would have originally been present in the Great Barrier ED. This affects the percentages between the remaining kauri forest and the remaining podocarp/broadleaf and kauri forest but does not affect the overall percentage of remaining ecosystems.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

Ecosystems that are scarce in this ED are coastal forest, dune vegetation and freshwater wetlands.

Great Barrier Ecological District



Legend

Native Vegetation Class

 Kauri	 Shrubland	 Freshwater Wetland
 Podocarp\Broadleaf\Kauri	 Coastal Forest	 Brackish Estuarine
 Podocarp	 Coastal Shrubland	 unclassified
 Broadleaf	 Volcanic Boulderfield	
	 Dune Complex	

Threatened Species Recorded (Categories 1 – 4)

Flora

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Centipeda minima</i> Sneezeweed	<i>Amphibromus fluitans</i> Water brome	<i>Lepidium oleraceum</i> Cook's scurvy grass	<i>Austrofestuca littoralis</i> Sand tussock
<i>Daucus glochidiatus</i> NZ carrot	<i>Picris burbridgeae</i> Native oxtongue	<i>Rorippa divaricata</i> NZ watercress	<i>Brachyglottis kirkii</i> Kirk's daisy
<i>Ophioglossum petiolata</i> Stalked adder's tongue fern			<i>Dactylanthus taylorii</i> Wood rose (pollen only)
<i>Senecio scaberulus</i> Native fireweed			<i>Eleocharis neozelandica</i> Sand spike sedge
			<i>Euphorbia glauca</i>
			<i>Paspalum orbiculare</i> Native paspalum
			<i>Pimelia tomentosa</i>
			<i>Pittosporum kirkii</i> Kirk's kohuhu
			<i>Pterostylus paludosa</i>

Fauna

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Botaurus poiciloptilus</i> Australasian bittern	<i>Anarhynchus frontalis</i> Wrybill	<i>Anguilla dieffenbachii</i> Long fin eel
	<i>Nestor meridionalis</i> <i>septentrionalis</i> Kaka	<i>Chalinolobus tuberculata</i> (North Island) Long tailed bat	<i>Cyclodina ornata</i> Ornate skink
	<i>Oligosoma homalonotum</i> Chevron skink	<i>Charadrius bicinctus bicinctus</i> Banded dotterel	<i>Eudyptula minor iredalei</i> Northeren little blue penguin
		<i>Charadrius obscurus</i> <i>aquilonius</i> NZ Dotterel	<i>Galaxias argenteus</i> Giant kokupu
		<i>Hydropogon caspia</i> Caspian tern	<i>Hoplodactylus pacificus</i> Pacific gecko
		<i>Larus novaehollandiae</i> <i>scopulinus</i> Red billed gull	<i>Nautilnus elegans elegans</i> Auckland green gecko
			<i>Puffinus carneipes</i> Flesh footed shearwater

Originally Rare Ecosystems

Active sand dunes
Cliffs, scarps and tors of silicic rock
Cliffs, scarps and tors of silicic-intermediate rock
Cloud forest
Coastal cliffs on silicic bedrock
Coastal cliffs on silicic-intermediate rocks
Coastal rock stacks
Estuary
Gumland
Lake margin
Seabird burrowed soils and/or guano deposits

Priorities for Protection

Coastal ecosystems including dunes, estuarine, wetlands, shrublands and forest

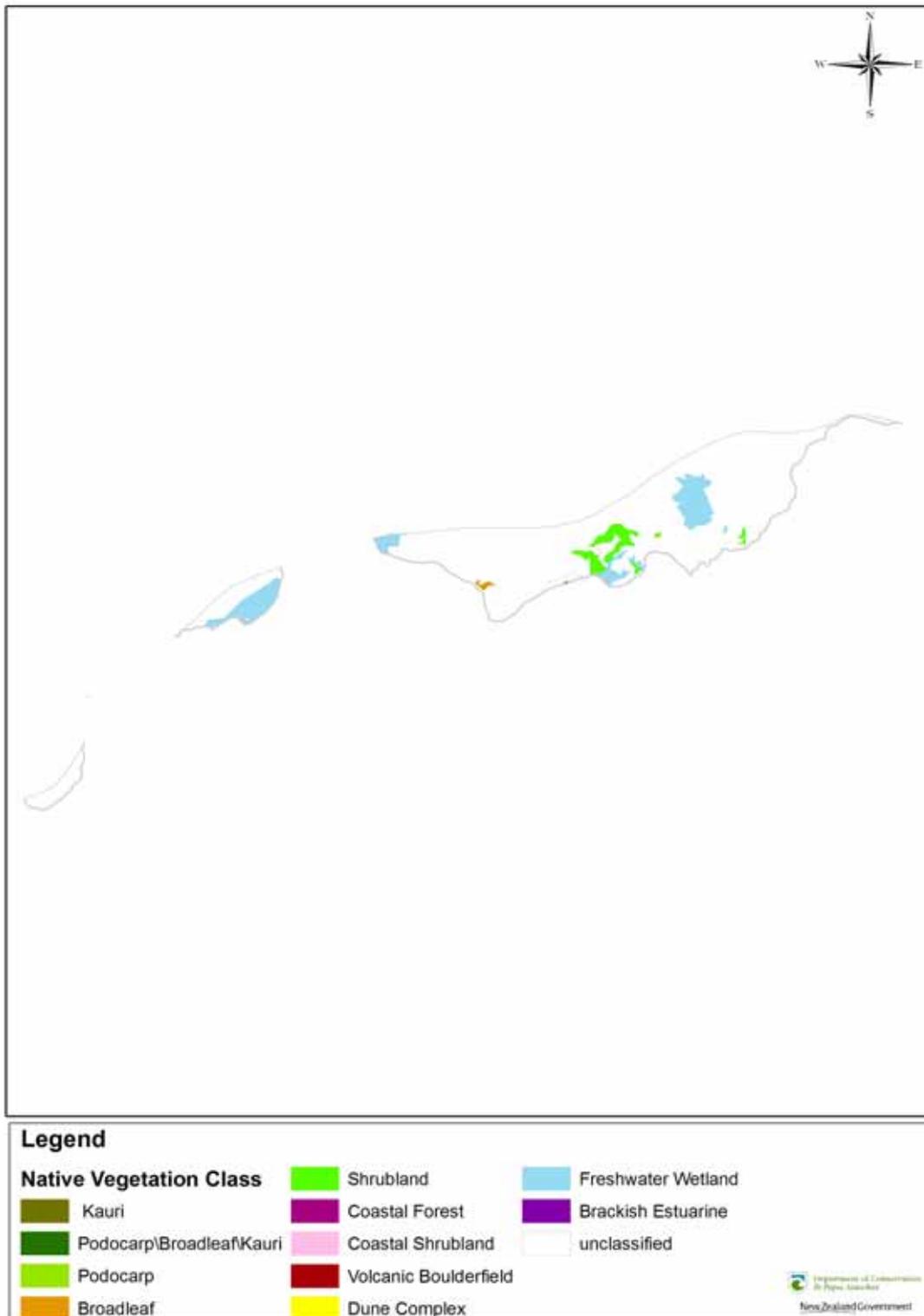
Sites of *Centipeda minima*, *Daucus glochidiatus*, *Ophioglossum petiolata* and *Senecio scaberulus*

Sites of plants endemic to Great Barrier Island

Breeding sites and habitat for *Anas superciliosa superciliosa*

Sites of originally rare ecosystems where these can be confirmed

Meremere Ecological District



7.5 Waikato Ecological Region

The majority of this ER is contained within the Waikato Conservancy with a very small proportion situated in Auckland Conservancy.

7.5.1 Meremere ED (part)

The Meremere ED covers the lowland basin surrounding the lower Waikato River, from Huntly to Port Waikato (Harding, 1997). A small area lies within the Auckland Conservancy.

Ecosystems Originally Present:

The vegetation was originally dominated by dense podocarp forest and wetland vegetation and a significant area of duneland vegetation was present at the Waikato River mouth.

Existing Ecosystems:

All ecosystems in this ED are severely depleted and many remaining ecosystems are dominated by exotic species.

Protection Status

There are 1077 hectares of the remaining native vegetation remnants in the Auckland Conservancy portion of the Meremere ED. Approximately 2% of these are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	0	0	0	0
Coastal Forest	304	16	5	0	0
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	3019	710	23	7	1
Kauri forest	3	0	0	0	0
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	3380	22	1	12	54
Shrubland	N/A	229	N/A	0	0
Unclassified	N/A	100	N/A	0	0
Total	6706	1077	16	19	2

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

Originally Rare Ecosystems

Coastal rocks stacks
Estuary
Lake margin
Subterranean basalt fields

All natural ecosystems in this part of the ED are severely depleted and only 2% of those remaining are protected.

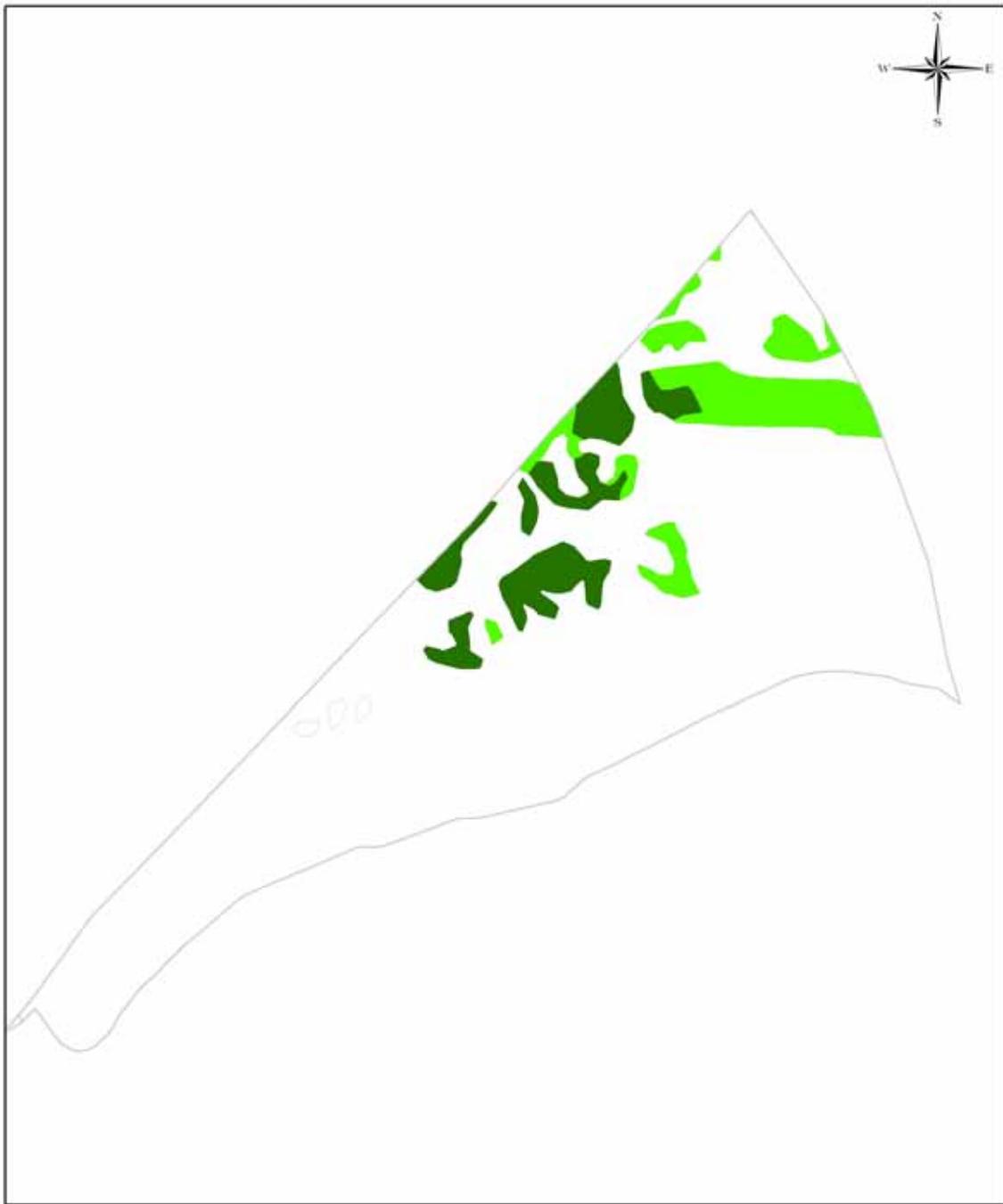
Priorities for protection

Freshwater wetlands

Coastal ecosystems including estuarine, wetlands, shrublands and forest

Sites of originally rare ecosystems where these can be confirmed

Hapuakohe Ecological District



Legend

block out_Hapuakohe	Broadleaf	Dune Complex
Native Vegetation Class	Shrubland	Freshwater Wetland
Kauri	Coastal Forest	Brackish Estuarine
Podocarp/Broadleaf/Kauri	Coastal Shrubland	unclassified
Podocarp	Volcanic Boulderfield	

7.5.2 Hapuakohe ED (part)

The Hapuakohe ED covers the Hapuakohe Range and the Hangawera Hills, between the Waikato River catchment and the Hauraki Plain (Harding, 1997). The Auckland Conservancy administers only a small part of this ED.

Protection Status

There are approximately 239 hectares of natural ecosystems in the Auckland Conservancy portion of the Hapuakohe ED, none of which are protected. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	0	0	0	0
Coastal Forest	0	0	0	0	0
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	169	0	0	0	0
Kauri forest	975	0	0	0	0
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	395	105	26	0	0
Shrubland	N/A	120	N/A	0	0
Unclassified	N/A	14	N/A	0	0
Total	1539	239	15	0	0

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

Originally Rare Ecosystems

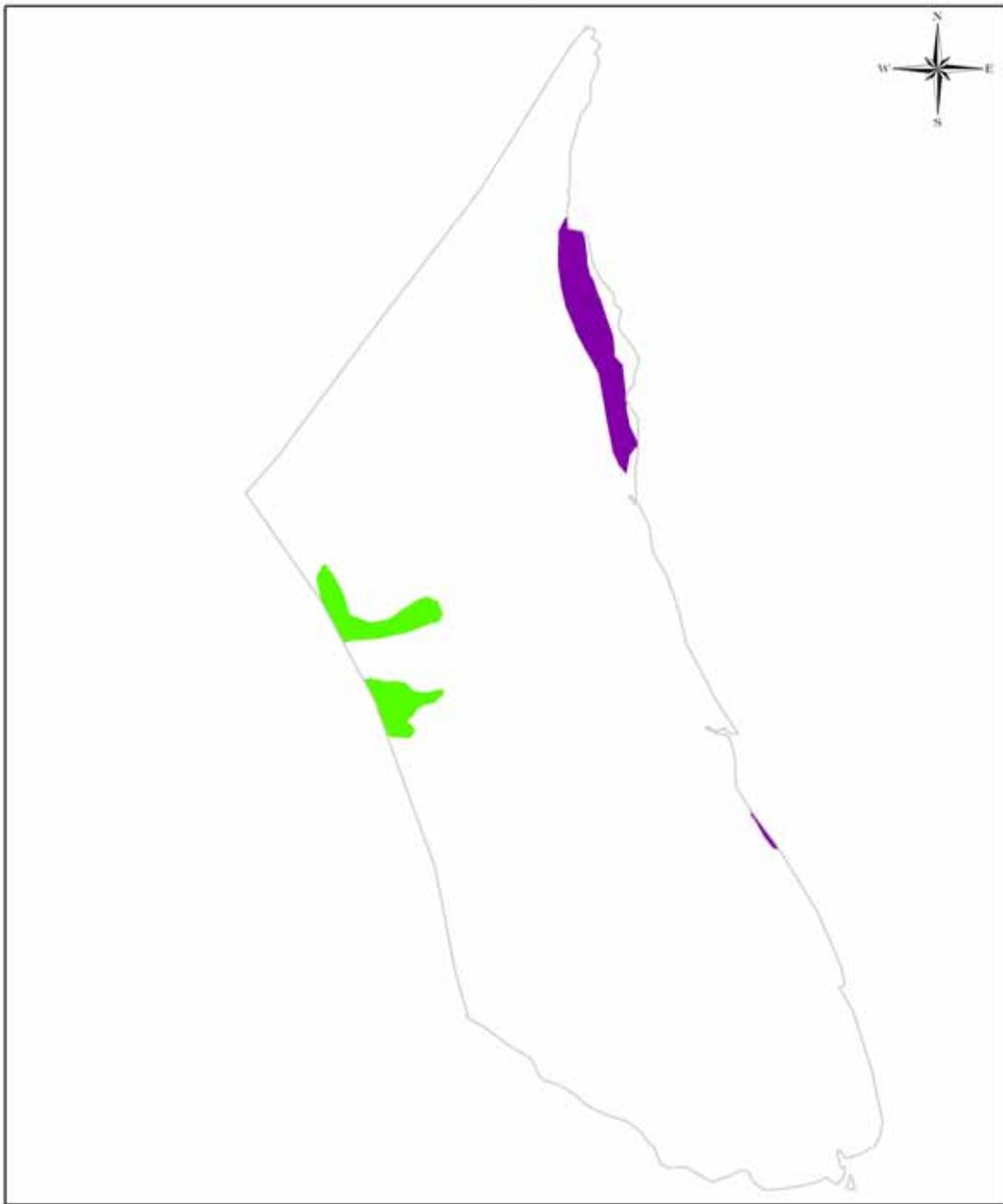
Gumland
Lake margin

Priorities for protection

Podocarp/broadleaf and kauri forest

Sites of originally rare ecosystems where these can be confirmed

Hauraki Ecological District



Legend

Native Vegetation Class

 Kauri

 Podocarp/Broadleaf/Kauri

 Podocarp

 Broadleaf

 Shrubland

 Coastal Forest

 Coastal Shrubland

 Volcanic Boulderfield

 Dune Complex

 Freshwater Wetland

 Brackish Estuarine

 unclassified

7.5.3 Hauraki ED (part)

The Hauraki ED covers the alluvial lowlands of the Hauraki Plains. Part of this ED is located in the south eastern edge of the Auckland Conservancy.

Protection Status

There are 72 hectares of remaining native vegetation remnants in the Auckland Conservancy part of this ED, 2% of which are in protected areas. The estimated original extent of ecosystems, their present extent and the proportion of their present extent that is protected are presented in the table below:

Vegetation Class	Original extent	Remain hectares	% remaining	Protected hectares	% protected
Brackish estuarine	N/A	39	N/A	22	56
Coastal Forest	68	0	0	0	0
Dune vegetation	0	0	0	0	0
Freshwater wetland & wetland forest	1155	0	0	0	0
Kauri forest	306	0	0	0	0
Volcanic boulderfield	0	0	0	0	0
Podocarp/broadleaf and kauri	258	0	0	0	0
Shrubland	N/A	33	N/A	0	0
Unclassified	N/A	0	0	0	0
Total	1787	*33	0	22	2

N/A indicates that it was not possible to estimate the original extent of the ecosystem from the available data therefore no comparison can be made. No comparison has been made from the shrubland data as it is assumed that most shrubland is regeneration of forest ecosystems which are included in the forest categories for the pre-human vegetation data and therefore cannot be compared with present day vegetation in this category.

*excludes estuarine as only land based canopy species were modelled by Leathwick et al.

Threatened Species Recorded (Categories 1 – 4)

Nationally critical	Nationally endangered	Nationally vulnerable	Declining
<i>Ardea modesta</i> White heron	<i>Botaurus poiciloptilus</i> Australasian bittern	<i>Anarhynchus frontalis</i> Wrybill	<i>Anthus novaeseelandiae novaeseelandiae</i> NZ Pipit
<i>Anas superciliosa superciliosa</i> Grey duck	<i>Larus bulleri</i> Black-billed gull	<i>Charadrius bicinctus bicinctus</i> Banded dotterel	<i>Himantopus himantopus leucocephalus</i> NZ Pied oystercatcher
		<i>Charadrius obscurus aquilonius</i> NZ Dotterel	<i>Sterna striata striata</i> White-fronted tern
		<i>Egretta sacra sacra</i> Reef Heron	
		<i>Hydropogon caspia</i> Caspian tern	
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	
		<i>Larus novaehollandiae scopulinus</i> Red billed gull	

Originally Rare Ecosystems

Estuary
Gumland
Lake margin
Shell barrier beach

Priorities for Protection

The Auckland Conservancy part of this ED is the Miranda chenier plain, an internationally important wading bird habitat which contains extensive saline wetlands, mangrove communities and salt meadows. Sites that buffer or enhance this protected area are of high priority.

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Appendix I

METHODOLOGY - DESCRIBING THE INDIGENOUS ECOSYSTEMS OF AUCKLAND – VEGETATION TYPES OF THE AUCKLAND REGION PAST AND PRESENT

This report is based on the best available data on vegetation cover, original ecosystem structure, and threatened species sites and was compiled using GIS in 2004.

Analysis of percentage of remaining ecosystems

To estimate how much of each vegetation class remained compared to its original extent two vegetation maps need to be created in a GIS to provide data for this analysis.

Firstly a vegetation map of remaining native vegetation was prepared for the Auckland Conservancy. The extent of areas remaining in native vegetation was identified from aerial photo interpretation. Land Cover Database 2 was used for initial identification and then further refined against high resolution aerial photography. Broad vegetation classes were then defined to provide a consistent Conservancy wide vegetation classification. These classes were then assigned to the areas based on vegetation data from a number of sources. The data mostly came from PNAP studies but also from reports and council information.

In order to compare original extent with remaining extent a pre human vegetation map was created. Vegetation class distribution is affected by climate, soil, and topography. These variables were used by Landcare Research to model potential vegetation distribution and the environmental requirements of canopy tree species (Leathwick 2001). This work was used as a basis for the Auckland Conservancy pre human vegetation map.

There are some anomalies in the data because of the difficulty in estimating original vegetation cover. No information exists on pre-human vegetation therefore it has been modelled using climate, soil, topography and the environmental requirements of canopy tree species (Leathwick 2001). The models were developed on a New Zealand wide scale and are most useful at that scale for species common throughout the country. For less common species with restricted range the models are less accurate and this is reflected with, for example, kauri in the Auckland Region.

Estimating the original extent of indigenous ecosystems (pre-human vegetation)

For Auckland Conservancy's original extent of prehuman vegetation classes Landcare Research's potential vegetation distribution data was modified to fit the vegetation classes into which the present day vegetation for the region had already been classified.

Part of the LENZ product that Landcare Research distributed includes a map of potential vegetation types. Vegetation types were predicted from regression analyses relating the distributions of major canopy tree species to environmental variables (Leathwick, 2001). Environmental variables used were annual and seasonal temperature, solar radiation, soil and atmospheric water deficit, soil leaching, slope, and soil parent material. These environmental data layers are from the set used to define the LENZ classification (Leathwick et al., 2003). The modelling produces predictions of likelihood/abundance of 31 canopy tree species and forest composition at a grid resolution of 100 m².

To enable a comparison between original and remaining vegetation extents, the Landcare potential individual tree species distribution information was used as the basis for constructing an original vegetation map. The models were developed on a New Zealand wide scale and are most useful at that scale for species common throughout the country. In consultation with botanical experts 31 individual species layers were used to predict vegetation coverage for this region rather than Landcare's forest composition predictions. For less common species with restricted range the models are less accurate and this is reflected with, for example, kauri in the Auckland region.

We used the potential kauri distribution layer to portray the original kauri class. The higher probabilities of occurrence of Landcare's puriri and taraire layers were used to define the coastal broadleaf forest layer.

To define dune vegetation, Landcare's duneland layer that was not already classified as coastal forest was used.

Seven LENZ level 4 classes associated with topography and waterlogged soils (A5.1a,A5.1b,A5.3b, A6.1b,A7.2a,A7.2b,G4.1c) and the freshwater layer and topography from the New Zealand 260 map series were used to define the original extent of freshwater and wetland forest.

Lava flows mapped from Searle (1981) were used to define the extent of original volcanic boulderfield.

Every thing remaining unclassified by the above classes was considered to be podocarp/broadleaf/kauri mosaic.

This provided the following classes for comparison

Kauri

Podocarp/Broadleaf/ Kauri

Broadleaf Coastal Forest

Volcanic boulderfield

Duneland

Wetland (including wetland forest)

It was not possible to determine an extent for shrubland or brackish estuarine ecosystems. The human disturbance factors resulting in shrubland vegetation extent today are too different to the natural disturbance factors of the past to allow for a useful comparison. Also, the Landcare data was restricted to land based species and did not provide a way to model brackish estuarine species.

The following are the vegetation types from the remaining vegetation classification and how they were amalgamated in each of these classes to enable a comparison analysis:

KAURI

Kauri forest

Kauri dominant or co-dominant in canopy, other species such as tanekaha often present, also rimu, miro and broadleaved species (puriri, taraire). Poor soils/low fertility sites, dry ridges, also 'swamp kauri'.

Mature kauri forest

Canopy dominated by mature/original kauri, with kauri grass, *Dracophyllum* etc. in understorey.

Younger kauri forest

Canopy dominated by kauri rickers with tanekaha often present.

Younger-aged kanuka-kauri-tanekaha scrubland/forest

Regenerating scrubland to forest with kanuka dominant in the canopy and varying amounts of kauri, tanekaha and occasionally rewarewa coming through the canopy.

PODOCARP BROADLEAF AND KAURI

Podocarp-kauri forest

Rimu and kauri dominant in canopy, miro may also be present, and some broadleaved present (particularly tawa, some puriri).

Podocarp-tawa forest

Rimu and lesser amounts of miro dominant in the canopy along with tawa, other broadleaved species particularly puriri may be present.

Podocarp-rata forest

Rimu and lesser amounts of miro dominant in the canopy along with rata, other broadleaved species particularly puriri may be present

Kauri-hard beech forest

Mixed kauri and hard beech, with lesser amounts of tanekaha, towai can also be present. This is often found as pockets on dry south facing hill slopes within larger areas of mixed kauri – broadleaved forest. Locations – small pockets in Hunua, Waiheke, Waitakere, Rodney and in the Upper Waitemata Harbour (Lucas and Helleyer Creeks).

Younger-aged kanuka-podocarp-broadleaved scrubland/forest

Regenerating scrubland to forest with kanuka dominant in the canopy and varying amounts of rimu, miro, tawa and/or puriri coming through the canopy.

Lowland totara-mixed broadleaved forest

Totara dominant often with kanuka, tanekaha, *Nestegis*, mahoe, tree ferns.

Podocarp-Tanekaha Forest

Younger regenerating forest with canopy dominated by tanekaha, with kauri rickers and kahikatea often also present.

Mixed podocarp-broadleaved complex

Kauri, tanekaha, rimu, kahikatea, puriri, taraire, tawa present in canopy. Often with podocarps and kauri on ridges and broadleaved species and kahikatea dominant in gullies. Common throughout the region – remnants which are regenerating from past clearance or from past logging and grazing. Often with kanuka in canopy also.

Lowland totara forest

Totara dominated forest often on well-drained river terraces, also hill slopes, minor amounts of broadleaved species due to grazing. This forest type is common in the Rodney ED.

BROADLEAF AND COASTAL FOREST

Taraire forest

With other broadleaved species, tawa, puriri, kohekohe, nikau and occasional podocarp. Common as fragments in Rodney ED.

Mixed broadleaved forest

Mixed broadleaved forest including puriri, tawa, taraire, titoki, mangeao, karaka, rewarewa and pukatea in the canopy (also pohutukawa in inland locations on sand dune country). Podocarps present in low amounts

Inland pohutukawa ridge forest

Pohutukawa, often with kauri in the canopy, tanekaha often present
Location: on islands in the Gulf, Awhitu sand country

Beech forest

Hard beech forest found on LBI and small patches on the North Shore in the Tamaki ED and in the Hunuas.

Kanuka-manuka scrubland

Dominated by manuka and kanuka, sometimes with exotic species (gorse, pampas, hakea) Also occurs as successional type with podocarps regenerating in understorey on hills slopes and ridges and broadleaved species (mahoe, nikau, puriri) in gullies.

Mixed kanuka–manuka broadleaved-treefern scrubland

Shrubs include mahoe, mapou, lancewood, hangehange and rangiora.

Gumland shrubland/wetland (present on podzolised soils)

Manuka shrubland with sedge (*Schoenus tendo*)-fern (*Gleichenia spp.*) understorey, regenerating kauri and/or tanekaha often present. Examples are found in Albany and Huia-Cornwallis.

Regenerating native forest with emergent pine

A common vegetation type in parts of North Shore, Rodney and Waitakere. Kanuka is dominant in the subcanopy with mapou and tanekaha.

Bluff shrubland/herbfield

Present in rocky bluffs in the Waitakere's and on Great Barrier Island.

Pohutukawa coastal forest

Pohutukawa with lesser amounts of other broadleaved species and few podocarps present in the canopy. Often with *Astelia banksii*, flax, houpara, kawakawa in understorey. Often all that is remaining are thin coastal strips – one tree wide.

Mixed broadleaved coastal forest

Mixed broadleaved species in canopy. Pohutukawa together with kohekohe, taraire, tawapou, puriri, nikau, kowhai. Found throughout the region, more commonly in gullies.

Riverine broadleaved - kowhai forest

In association with tidal creeks. Present along the Hotoe, Okura and Rangitopuni Rivers and upper Waitemata Harbour. In association with broadleaved species including titoki, puriri, taraire, kahikatea.

Kowhai forest

Present in dry coastal gravel fields such as along the Miranda coast and found in association with lichen communities and pohuehue on gravel ridges and in association with coastal wetlands in hollows.

Karo-houpara shrubland

Canopy dominated by karo and/or houpara, pohutukawa may be present, range of shrub broadleaved species also in canopy (such as kawakawa) More disturbed and exposed coastal locations particularly on cliffs and headlands, for example Fanal Island in the Taranga ED.

Flax-broadleaved-toetoe shrubland

Flax with range of shrub broadleaved species also present (such as kawakawa, houpara and hebe)

Kanuka-pohutukawa

Younger aged kanuka forest with pohutukawa, found on the North Shore (Tamaki ED)

VOLCANIC BOULDERFIELD**Pohutukawa-(rewarewa) lava flow forest**

On younger aged lava flows, e.g. Rangitoto Island.

Pohutukawa-broadleaved lava flow forest

Broadleaved species include titoki, kohekohe, mangeo and puriri. On older aged lava flows

Kanuka-(pohutukawa) scoria-ash forest

On younger aged scoria-ash cones

Puriri-(kohekohe-kowhai) scoria-ash forest

On older aged scoria-ash cones

DUNE VEGETATION

Dune systems with complexes of native pingao and spinifex, coastal forest and scrubland and coastal wetlands. For example, Waitakere west coast, South Kaipara, exposed east coast.

Mixed coastal dune forest/shrubland

Includes species such as kanuka, karaka, kowhai, kohekohe, puriri, tawapou, taraire, pohutukawa and titoki

Coastal dune shrubland

Toetoe, tauhinu, *Isolepis nodosa*.

Coastal foredune

Native sand binding sedges on dunes, some areas may be invaded by marram

Dune lake

Often with kuta, *Schoenoplectus*, *Baumea articulata*, raupo wetlands around fringes. Sometimes surrounded by regenerating forest communities. Location: Kaipara, Awhitu, Mangawhai.

WETLAND AND WETLAND FOREST**Maire tawake wetland forest**

Includes maire tawake, with some cabbage tree, and also flax in the understorey. Can include lesser amounts of kahikatea and pukatea in the canopy. Also putaputaweta, kiekie in the understorey. Found in the Tamaki, Waitakere, Manukau, Awhitu and Hunua EDs.

Lowland kahikatea forest

Kahikatea dominated forest present on river terraces, minor amounts of broadleaved species due to grazing (usually with a mix of broadleaf/podocarp species including pukatea and nikau).

Manuka/Cabbage tree wetland shrubland

Manuka or cabbage tree dominates the canopy, usually with some putaputaweta, while flax, sedges and rushes are present in the understorey.

Willow wetland forest

Willow forms a dominant canopy with native rushes, sedges, ferns, flax and various native shrubs in the understorey.

Raupo/flax wetland

Wetland dominated by raupo and flax.

Rushland/ sedgeland/ Grassland wetlands

Dominated by native and exotic *Juncus* spp, native *Carex* spp. *Baumea* spp, *Eleocharis* spp, giant umbrella sedge, native wetland grasses (*Isachne globosa*), with exotic grasses and herbs often present.

Brackish shrubland

Found on estuarine margins, stopbanks and reclaimed terraces. Manuka, *Olearia virgata*, marsh ribbonwood, oioi, *Baumea juncea*, sea rush and salt meadow species. Ngaio and/or flax can be present.

Mangrove forest/shrubland

Shoreline dominated by mangroves.

Estuarine rushland/grassland/ herbfield

Complexes of marsh ribbonwood, sea rush, oioi, and salt meadow species.

Brackish Dune wetlands

Back dune wetlands with association of coastal and freshwater wetland species ranging from *Bolboschoenus*, *Baumea juncea*, oioi, *Schoenoplectus*, flax, cabbage tree.

Shellbank communities

Shellbanks with native grasses, sedges and herbs such as *Auustrostipa stipoides*, glasswort, *Isolepis nodosa*, oioi.

Estimating the present extent of indigenous ecosystems

EDs are used as the framework for collecting and compiling vegetation survey information to produce PNAP reports. In order to make comparisons with the original vegetation map, a map of existing vegetation was constructed in GIS by combining all existing survey information. The descriptions of the original and existing ecosystems are taken directly from the PNAP reports or other indigenous survey reports for those EDs where no PNAP Report is published.

PNAP reports have been published for Hunua, Waitakere, Rodney, Kaipara/Otamatea, Manukau and Awhitu EDs. Where PNAP surveys have not been undertaken, District Council vegetation information (Tamaki, Hapuakohe, Hauraki, Meremere, Inner Gulf Islands), published articles and paper maps (Little Barrier Island, Great Barrier Island) and national datasets, Topographical New Zealand Map series, Land Cover Database 2 and the Wetland Resource Inventory were used.

Each survey, whether undertaken for the PNA programme or not, was found to have developed different vegetation classifications. These have been rationalised into broad vegetation classes to produce a consistent, conservancy-wide vegetation classification. The classification was necessarily limited by the degree of separation in the datasets, while some of the PNAP surveys had quite detailed vegetation information and numerous vegetation classes, other areas such as Great Barrier Island ED had broad vegetation classes. The regional classification necessarily had to be at the coarsest level of its composite data sets.

The table below briefly describes the sources used to compile the vegetation data for each ED and the local councils whose boundaries encompass each ED.

SOURCE DATA FOR VEGETATION TYPES

Many organisations and individuals provided the source data for the vegetation layers. The following list indicates the source of the data and the councils which hold information for each ED.

Eastern Northland Ecological Region	Source Data	Council jurisdiction
Taranga ED	DOC	Auckland Regional Council
Auckland Ecological Region		Auckland Regional Council
Rodney ED	Old PNAP survey maps, Davis 2002	Rodney District Council, North Shore City, Waitakere City
Tamaki ED	Myers 2005, (North Shore) Julian 1995 (Auckland isthmus), Andrea Julian 1995 (WCC)	North Shore City, Auckland City, Waitakere City, Manukau City

Waitakere ED	Denyer et al. 1993	Rodney District, Waitakere City
Rangitoto ED	DOC	Auckland City
Inner Gulf Islands ED	DOC, Fitzgibbon and Slaven 1998 (Waiheke)	Auckland City
Hunua ED	Tyrell et al. 1999, Wildlands Consultants	
Awhitu ED	ARC 2004	Franklin District
Manukau ED	ARC 2004	Papakura District, Manukau City, Franklin District
Kaipara Ecological Region		
Kaipara-Otamatea ED	Davis 2002	Rodney
Coromandel Ecological Region		
Little Barrier ED	DOC	Auckland
Great Barrier ED	DOC	Auckland
Waikato Ecological Region		
Meremere ED	Landcare Research, EW	Franklin
Hapuakohe ED	Landcare Research, EW	Franklin
Hauraki ED	Landcare Research ,EW	Franklin

Missing data

Of the 1712 native vegetation polygons in the Tamaki ED, 921 have no vegetation description attached to them.

In the Hunua ED there are 371 vegetation polygons amounting to 771ha that have no vegetation information attached to them.

Appendix II

METHODOLOGY - IDENTIFYING THE ORIGINALLY RARE ECOSYSTEMS IN THE AUCKLAND REGION

Thirty three originally rare terrestrial ecosystems, as defined by Landcare Research (Williams et al., 2006) occur in the Auckland Conservancy, excluding the Kermadec Islands.

Active sand dunes
Dune deflation hollows
Shell barrier beaches
Coastal turf
Stony beach ridges
Shingle beaches
Coastal rock stacks
Coastal cliffs on silicic bedrock
Coastal cliffs on silicic-intermediate rock
Coastal cliffs on mafic rock
Coastal cliffs on calcareous rocks
Recent lava flows
Boulderfields of silicic-intermediate rocks
Volcanic boulderfields
Debris flows or lahar
Cliffs, scarps, and tors of silicic rocks
Cliffs, scarps, and tors of silicic-intermediate rocks;
Cliffs, scarps, and tors of mafic rocks
Ultramafic hills
Cloud forest
Hydrothermally altered ground (now cool);
Geothermal streamsides
Seabird guano deposits
Seabird burrowed soil
Cave entrances
Subterranean basalt fields
Lake margins
Ephemeral wetlands
Gumland
Damp sand plains
Dune slacks
Estuary
Seepages and flushes.

Since this is only the first attempt to map originally rare ecosystems in the Auckland Conservancy, there is no warranty, expressed or implied, as to the accuracy, reliability, utility or completeness of this information and in some cases it may only indicate the possibility of an ecosystem being present. The ecosystems were mapped to various degrees of accuracy and detailed on-the-ground surveys to verify the data were not conducted. In terms of data completeness, an attempt was made to consult as many references as presently available. However, without field surveys, locations of the following ecosystems are likely to be under-represented: coastal turf, dune deflation hollows, ephemeral wetlands, seepages and flushes.

The majority of originally rare ecosystems were mapped as polygons. Points were used to depict ecosystems which are likely to be small in area (i.e. coastal turf, dune deflation hollows, geothermal

streamsides, ultramafic hills, cave entrances, ephemeral wetlands, seepages and flushes) but for which their spatial extent is unknown at the present time. Seabird burrowed soil and seabird guano deposits were mapped as both polygons and points, the reasoning for this is explained below. Polygons were used to map the various types of beaches, where the beach deposit extended inland, a polygon was also used.

Data has been assembled about vegetation and ecosystem types from information provided by PNAP reports and local authorities for the Auckland Protection Strategy and is referred to below as the Auckland Protection Strategy Project. Information about coastal ecosystems was assembled by interpretation of aerial photographs and is referred to below as the Coastal Project. BioWeb is a Department of Conservation database.

Ecosystems associated with igneous rocks

The following methods were used to map the originally rare ecosystems associated with igneous rocks:

- Coastal cliffs on silicic bedrock
- Coastal cliffs on silicic-intermediate rock
- Coastal cliffs on mafic rock
- Cliffs, scarps, and tors of silicic rocks
- Cliffs, scarps, and tors of silicic-intermediate rocks
- Cliffs, scarps, and tors of mafic rocks
- Boulderfields of silicic-intermediate rocks

Geology maps (Edbrooke, 2002; Searle, 1981; New Zealand Geological Survey 1972, 1982a&b) were used in conjunction with LENZ (Leathwick et al., 2002), level 3 (i.e. levels A1.1, A7.1, D1.1, and D1.2) to determine areas where igneous rocks occur. In instances where the geology map and LENZ were in agreement about rock type and polygon perimeter, the LENZ polygon was copied directly into GIS. In instances where the geology map and LENZ differed, the rock type and/or polygon was copied from the geology map. In instances where the various geology maps differed, information from the map at the highest resolution was used.

Four igneous rock types occur in the Auckland Conservancy: rhyolite, a silicic rock; dacite, a silicic-intermediate rock; andesite, an intermediate rock; and basalt, a mafic rock (Edbrooke, 2002; New Zealand Geological Survey 1972, 1982a&b). In locations where only one igneous rock type occurred, it was straightforward to determine which rare ecosystem was present. However, in locations such as throughout Rodney ED and Kawau Island where more than one igneous rock occurs (e.g. interbedded sandstone with volcanic breccia of andesite and basalt), it is difficult to determine which rare ecosystem is present. In these instances a 'best guess' was made and the full geological description is included in the 'description' field, should it be necessary to re-classify these areas.

The above rare ecosystems are split up based on whether they occur inland or on the coast.

Active sand dunes

Any polygons classified as duneland in the Auckland Protection Strategy Project were assumed to represent active sand dunes.

Dune deflation hollow

BioWeb threatened plant observations and selected records from the Auckland Herbarium were searched for the word 'hollow'. Observations which were located in a sand dune environment and included this word were classified as a 'dune deflation hollow'.

Shell barrier beach

Coastlines classified as composed of 'shell' in the Coastal Project and Kenny and Hayward (1996) were assumed to represent shell barrier beaches.

Coastal turf

The following species were chosen as 'indicators' of coastal turf: *Disphyma australe* subsp. *australe*, *Disphyma australe* subsp. *stricticaule*, *Gunnera dentata*, *Selliera radicans*, *Myosotis pygmaea* var. *pygmaea*, *Ranunculus acaulis*, *Selliera radicans*, *Zoysia minima*, and *Leptinella dispersa* subsp. *rupestris*. A location is recorded as having coastal turf if at least one of these species has been observed post-1970. Observations prior to 1970 were included only if a site visit has taken place to confirm that the species is not extinct at the site. Species observations were obtained from BioWeb Threatened Plants and the Auckland Herbarium.

Stony beach ridges

This ecosystem is defined by rock size as well as presence of a beach ridge. Stony beach ridges identified by Kenny and Hayward (1996) were assumed to represent this ecosystem type.

Shingle beaches

This ecosystem includes rocks which range in size from gravel to cobble. Therefore, coastlines classified as 'pebble' and 'cobble' in the Coastal Project were assumed to represent shingle beaches. The Coastal Project did not include western coastlines in the Auckland Conservancy. However, according to the New Zealand Map Series (NZMS) 260 topo maps the western coastline is composed mostly of sand or sand and mud so shingle beaches are unlikely to be present on this coastline.

Coastal rock stacks

Islands digitised from the New Zealand Map Series (NZMS) 260 were classified as a coastal rock stack if they were less than or equal to 5.73 ha in size.

Coastal cliffs on calcareous rocks

Cliffs identified by Kenny and Hayward (1996) which are composed of limestone or exposed coral reefs were assumed to represent this ecosystem type.

Recent lava flows

Estimated ages of volcanoes in the Auckland area (Searle, 1981) were used to confirm which volcanic flows occurred less than 1000 years ago.

Volcanic boulderfields

Polygons classified as volcanic in the Auckland Protection Priorities Project, along with two personal observations, have intact lava-flow vegetation present. These locations were assumed to represent volcanic boulderfields.

Debris flows or lahar

Debris flows of Parnell Grit beds (Kenny and Hayward, 1996) and folding/slumping of strata adjacent to Parnell Grit beds (Searle, 1981) are assumed to represent this ecosystem type.

Ultramafic hills

Of all the geology maps available only the Land Inventory (1982a, b) was done at a small enough scale to pick up the serpentinite deposits, a component of ultramafic hills, in the Rodney ED. All serpentinite deposits were mapped, regardless of whether they had been quarried or not because ultramafic vegetation could potentially still be present near the edges of the quarry (P J de Lange, pers. comm. Sept 2007).

Cloud forest

Vegetation associations were used to define the location of cloud forest. On Little Barrier Island the *Quintinia acutifolia*-*Ixerba brexioides*-*Metrosideros umbellata* forest class was used to define cloud forest. On Great Barrier Island the *Lepidothamnus intermedius* (yellow silver pine) – *Agathis australis* (kauri) forest class was used to define cloud forest. Though *Quintinia acutifolia* is present in the Waitekere Ranges (D Havell, pers. comm. 2007) a suite of cloud forest vegetation is not present because the peaks have a lower elevation and have less than 200 rain days per year.

Hydrothermally altered ground (now cool)

Geothermal springs identified in Houghton et al. (1989) which have ceased discharging were assumed to represent hydrothermally altered ground which is now cool.

Geothermal streamsides

Geothermal springs identified in Houghton et al. (1989) and Wilson et al. (1973) were assumed to represent geothermal streamsides.

Seabird burrowed soil and/or seabird guano deposits

These two ecosystems were lumped together as they are likely to overlap or occur in close proximity in nature. Various methods were used to map these ecosystems.

Polygons were used to delineate the spatial extent of seabird colonies for which locations are fairly well-known (i.e., Muriwai, Rangitoto, central peaks of Great Barrier Island). Second, experts were consulted to ascertain which islands in the Auckland Conservancy have, or are likely to have, seabirds present. Since exact seabird locations within each island are often not known, the entire island has been mapped as polygons. The experts consulted include:

- Chris Gaskin, Pterodroma Pelagics NZ
- David Towns, DoC Scientific Officer (Auckland Conservancy Office)
- Matthew Rayner, Auckland University
- Halema Jamieson, DoC Biodiversity Ranger (Great Barrier Area Office)

Experts supplied information on seabird species present and their abundance for selected islands; this information is included in the description field.

Several plant species, *Lepidium oleraceum*, *Lepidium flexicaule*, and *Rorripa divaricata* grow in or near seabird burrows. Observations of these species were obtained from BioWeb Threatened Plants and these points indicate likely locations of seabird burrowed soil and/or seabird guano deposits.

Cave entrances

Lava cave entrances identified by Kenny and Hayward (1996) were used to map this ecosystem.

Subterranean basalt fields

Surface lava flows depicted in Searle pg. 54 (1981) are assumed to represent the potential locations for subterranean basalt fields.

Ephemeral wetlands

The following species were chosen as 'indicators' of ephemeral wetlands:

Centipeda minima, *Centipeda minima* subsp. *minima*, *Epilobium pallidiflorum*, *Glossostigma elatinoides*, *Myriophyllum propinquum*, *Ranunculus amphitrichus*, *Carex sinclairii*, *Eleocharis acuta*, *Isolepis prolifer*, *Isolepis sepulcralis*, *Isolepis setacea*. A location is recorded as having an ephemeral wetland if at least one of these species has been observed post-1970. Observations prior to 1970 were included only if it a site visit has taken place to confirm that the species is not extinct at the site. Species observations were obtained from BioWeb Threatened Plants and the Auckland Herbarium.

Additionally BioWeb Threatened Plants were searched for the word 'ephemeral' and descriptions which indicated that the wetland water level fluctuated during the year or was dry and wet during different seasons. These types of descriptions were assumed to indicate an ephemeral wetland.

Lake margins

Any polygons classified as lake/open water in the Auckland Protection Priorities GIS Project were assumed to represent lake margins. However the amount of modification of the lake margins or whether the lakes are artificial (i.e. man-made) or natural is unknown.

Gumland

A location is recorded as having gumland if at least one of the following species is present in the understorey: *Schoenus tendo*, *Gleichenia* spp., and/or *Baumea* spp. and at least one of the following canopy species is present: *Leptospermum scoparium*, *Agathis australis*, and/or *Phyllocladus trichomanoides*. Only permanent PNAP plots from the Waitakere, Rodney, and Hunua EDs have detailed enough species data to determine where gumland is located in the Auckland Conservancy.

In locations where several plots of gumland vegetation are clumped together, a polygon was drawn to encompass all of these plots. When a plot of gumland vegetation was by itself, a 100m radius circle was drawn around the point even though the extent of the gumland vegetation is likely to be much larger. These gumland polygons were clipped with existing native vegetation from the Auckland Protection Strategy Project to ensure that polygons identified as gumland only covered areas where native vegetation is known to currently exist.

Damp sand plains

The only area in the Auckland Conservancy which could possibly fit the damp sand plains ecosystem is Whatipu. The polygon was created based on Land Information New Zealand (LINZ) aerial photos.

Dune slacks

Land Information New Zealand (LINZ) aerial photos along with polygons in the Auckland Protection Strategy Project were used to map dune slacks. A polygon was classified as a dune slack if it was entirely surrounded by a sand dune, larger than a 'dune lake', and was dark in colour – likely indicating the presence of water.

Estuary

Any polygons classified as estuarine/brackish in the Auckland Protection Strategy Project were assumed to represent estuaries.

Seepages and flushes

BioWeb threatened plant observations and selected records from the Auckland Herbarium were searched for the word 'seep', 'seepage', and 'flush'. Observations which included any of these words were classified as a 'seepages and flushes'.

Appendix III

METHODOLOGY – IDENTIFYING THE THREATENED SPECIES IN THE AUCKLAND REGION

Flora

The post-1970 occurrence of threatened and declining native plants (de Lange et al. 2008) have been taken from the following sources: records previously entered in BioWeb, records included in Rebecca Stanley's (ARC) threatened plant database but not entered into BioWeb, Auckland and Christchurch herbarium records, National Vegetation Survey Permanent plot data, GPS threatened plant data stored on the Auckland Conservancy computer system, species lists published in the Auckland Botanical Society Journal and Newsletter, and records from experienced botanists (Tricia Aspin, Maureen Young, Anne Grace and Arthur Dunne).

Fauna

The data on the occurrence of threatened and declining native birds (Miskelly et al. 2008) came from the New Zealand Ornithological Society Atlas of Bird Distribution 1999 – 2004. (Robertson et al. 2006).

Only plants and birds have been reclassified into the "threatened" and "declining" categories. All other fauna follow the classification of acutely and chronically threatened in Hitchmough et al. 2005.

The records of occurrence of acutely and chronically threatened and freshwater fish are from NIWAs' Freshwater Fish Database and the herpetofauna data is from DOC Bio Web compiled from the Amphibian and Reptile Distribution Scheme (ARDS). These records were collated in 2007 so do not include more recent records.

Occurrence of acutely and chronically threatened invertebrates is from Auckland Conservancy records.