Environment Waikato Internal Report 2007/14

Draft
Whangamata Harbour Plan
Looking forward to a healthier harbour



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Environment Waikato
REGIONAL COUNCIL

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Views, moorings, recreation, clean water and shellfish gathering are all important uses of Whangamata Harbour. (photo : John Barran)

Executive summary

The Draft Whangamata Harbour Plan is a non-statutory document developed in cooperation with the Department of Conservation (DOC), Forest & Bird, iwi and Thames-Coromandel District Council. It also draws on work by other groups such as Whangamata Harbour Care.

This document gives an overview of the issues facing the harbour, what could be done to address them and how we could work together to ensure the community's vision for the harbour is achieved. The possible actions outlined in this plan have been prioritised to help guide work programmes and funding applications. The plan also recognises that the harbour is affected by what is happening in its 'catchment' (the land surrounding the harbour) and that both need to be managed together. Given this, Environment Waikato has also prepared a Draft Whangamata Catchment Management Plan 2007[1] which sets out the priority works we propose to carry out to address the sedimentation and flooding issues identified in the harbour plan.

The key concerns and risks to the harbour covered in this plan are grouped into four core issues.

- Water quality.
- Habitat.
- Sedimentation and flooding.
- Recreation, boating, access and views.

A major issue affecting the long-term health of the harbour concerns sedimentation. This is caused by soil settling into the harbour and waterways as mud after being washed down from surrounding land by rainfall. Although sedimentation and erosion are essentially natural processes, people's land use activities (for example, through urban development and agricultural activities like forestry and farming) can increase how much soil is moved in this way. Contaminants from the land and invasive weeds and pests also need attention. Mangroves have spread by growing in the mud in the harbour and its waterways. Controlling further mangrove expansion and limited removal of mature mangroves are part of the harbour plan.

The mangrove management issue has remained unresolved throughout consultation and development of the harbour plan. Additional reports have been prepared to help resolve this issue.

This harbour plan, the catchment plan, mangrove management options report, overview document and a feedback form are available online at www.ew.govt.nz/projects/whangamata/index.htm. Printed copies can be ordered by calling Environment Waikato's freephone 0800 800 401.

1 Environment Waikato. 2007: *Draft Whangamata Catchment Management Plan*. Environment Waikato Internal Series 2007/13, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm

1 Introduction

The Whangamata Harbour and its catchment (see map of Whangamata catchment in Appendix I) have many uses and contain many types of habitat for plants and animals.

This natural environment provides attractive views as well as a place for recreation and food gathering. It is important that the harbour and its catchment can continue to provide for these multiple uses. Changing conditions within the harbour, impacts from the surrounding catchment and differing community opinions are placing pressure on the harbour and its habitats.

Harbour management needs to balance people's uses and activities in the harbour and its catchment while recognising different opinions. Being able to easily access information on issues affecting the harbour and their relative importance is an important part in decision-making. This document brings this information together and presents a list of actions that agencies, groups and individuals could undertake to contribute to improving the health of the harbour and its catchment.

2 Integrated management for Whangamata Harbour

The land and harbour are connected. To have a healthy harbour it is necessary to manage the harbour catchment and the harbour itself. For a healthy harbour it is important to look at what enters it from the land and sea. For example, run-off from surrounding land can contain sediment, bacteria and nutrients that can affect the health of the harbour. It is also important to consider the effects of invasive weeds and pests on marine and land habitats. This is why an 'integrated management approach' is required.

Integrated management means environmental concerns must be balanced with social, cultural and economic impacts affecting the catchment. This approach also recognises the importance of actively working with communities to identify and carry out solutions that ensure the aspirations of individual groups are accommodated as far as possible.

Identifying risks to the harbour, their severity of impact and the actions needed to eliminate or minimise the risks are an important part of integrated harbour management. For example, erosion in the catchment carries mud into the harbour, smothering shellfish beds, changing stream and harbour channels and altering habitats. One of the symptoms of increased mud is increased mangroves. These changes in the harbour are best managed by reducing erosion on the land, particularly where this is caused by people's activities (for example, through urban development and agricultural/forestry use). The methods of reducing erosion often involve fencing to exclude stock from stream banks, planting trees to hold the soil and managing the pests that damage vegetation. As a result, less mud, nutrients and bacteria enter the harbour, while habitat along the streams is also improved. Therefore an integrated approach can have many benefits.



A harbour plan involves looking at the harbour and its catchment. Better ways of managing the land are an important part of a harbour management plan.

2.1 Visions and goals for Whangamata's harbour and catchment

Over the years, community processes and community groups have helped people identify what they want for the harbour, both in broad terms and in detail (goals for achievement). Below is a summary from the various publications.

Specific visions and goals from existing documents

These are some of the **visions for the harbour** from the Whangamata Community Plan, Hauraki Iwi Environmental Plan and Whangamata Harbour Care Aspiration Plan.

- Maintain open water usage within the main body of Whangamata harbour.
- The harbour will have a stable, natural backdrop including forests, bush walks, and appropriate land use.
- The harbour will be a clean, ecologically healthy, sandy playground in which human activity is in balance with nature.
- Productive pipi and cockle beds.
- To ensure public access will be provided around the harbour margins.
- Catchment management will minimise any adverse environmental effects.
- Greater understanding of coastal values by communities.
- No longer any contaminants polluting the waterways or harbour; and many more wetlands exist because of community activities.

Here are some of the relevant goals for **water** from the Whangamata Community Plan and Hauraki Iwi Environmental Plan.

- To minimise the load to the wastewater system and ensure no pollutants enter the waters of Whangamata.
- To minimise the volume of run-off and pollutants entering the stormwater system.
- To ensure discharges to the waters of Whangamata will be managed to protect the wairua (spirit) of the estuaries and restore the health of the ecosystems.

Here are some of the relevant **goals for the harbour** from the Whangamata Community Plan and Hauraki Iwi Environmental Plan.

- To protect a range of diverse, healthy life in the harbour including birds, fish, shellfish and plants and ensure people will be able to harvest kaimoana (food from the sea) with confidence from productive and accessible beds.
- To protect and restore estuarine habitats and ecosystems.
- To plan how mangroves will be protected in identified areas, but kept out of areas where other ecosystem values and uses would be adversely affected by their presence.
- To develop a community education programme to foster awareness of our coastal environments and their values.

Here are some of the relevant goals for the **catchment** from the Whangamata Community Plan and Hauraki Iwi Environmental Plan.

- Riparian planting and sediment trapping strategies for improving harbour water clarity and the sandiness of intertidal sea beds.
- To ensure native vegetation will be cared for and will extend to cover the western face of the Peninsula.
- To protect the riparian area of the catchment from harmful effects.
- To ensure land use in the catchment will minimise erosion.
- To reintroduce birds into restored forest and wetland habitats.
- To increase inanga (whitebait) numbers and their spawning habitat.

A collective vision for the harbour

The visions and goals could be summarised as…

Agencies, community and Māori working together on actions and physical works that identify, enhance and restore cultural, recreational, ecological and visual values of the harbour.



2.2 Significance of Whangamata Harbour to Hauraki iwi

This statement of significance has been prepared by representatives of Hauraki iwi:

The Whangamata Harbour is of cultural, spiritual and historical significance to Hauraki iwi. The harbour provides social, cultural, environmental and economic opportunities for its use and development.

The philosophy of Hauraki iwi is to allow the present generation to use and develop the resources in a sustainable manner and to ensure that the resource is left in a better condition when it is handed to the next generation. What becomes important for Hauraki iwi is the balancing of Màori and community needs so that needs are not driven solely by economic development.

Listed below are **Hauraki iwi's goals** for the Hauraki environment.

- To ensure that we sustain and enhance the mauri of the environment as kaitiaki.
- That protecting our past including cultural heritage sites, waahi tapu, places, landscapes and associated knowledge is a priority for Hauraki kaitiaki.
- To maintain and enhance our kaitiaki roles.
- To make informed decisions about the Whangamata Harbour, its surrounding environment and heritage.
- To ensure that central and local government, industry and local communities are upholding their Treaty of Waitangi obligations and that these are reflected in the decisions that are made.
- To ensure that communities understand and value Hauraki iwi involvement in environmental management and heritage protection.[2]

In order for Hauraki iwi to ensure that these goals are achieved, particularly in relation to the Whangamata Harbour and its surrounding environs, then the following values will guide that process.

- Rangatiratanga - to exercise the right to make decisions over management, development, use and protection over taonga.
- Kaitiakitanga - to fulfil our ancestral obligations as kaitiaki.
- Wairuatanga - to spiritually respect taonga in recognition of the spiritual connection that exists between us and the natural world.
- Manaakitanga - to exercise our rights and responsibilities in a way that is beneficial to taonga.
- Whanaungatanga - to exercise our rights and responsibilities to taonga that acknowledges the whakapapa to each other and the natural world.
- Kotahitanga - to all work together and strive towards collective goals whilst recognizing the autonomy and needs of each participant.[3]

As kaitiaki, we will continue to move towards the collective vision, goals and values of Hauraki iwi for the better use, development, enhancement and protection of the Hauraki tribal region for current and future generations.

We will also work alongside of other community groups of like mindedness, local and central government to work actively towards the preservation, protection and enhancement of "*nga taonga tuku iho*" (those precious treasures that are passed down from generation to generation).

[2] *Hauraki Iwi Environmental Plan*, produced by Hauraki Màori Trust Board, March 2004, p. 12
[3] *Hauraki Iwi Environmental Plan*, produced by Hauraki Màori Trust Board, March 2004, p. 12

2.3 Management initiatives relating to the Whangamata Harbour and catchment

Date	Plans and projects	Content	Organisation
1999	The future of the Whangamata Catchment and harbour: what's important to the people?	Results of community consultation.	Environment Waikato.
2001	Whangamata Community Plan – our future.	Outlines for the Community Board and councils the direction for Whangamata supported by the participants at community forums.	Environment Waikato and Thames-Coromandel District Council.
2002	The Hauraki Gulf Marine Park Act.	To integrate the management of the Gulf.	Central government and Hauraki Gulf Forum.
2002 – Nov	Aspiration Plan Whangamata Harbour.	A draft document showing suggested zones for use in the harbour and their management.	Whangamata Harbour Care Inc.
2004 - March	Whaia te Mahere Taiao a Hauraki. Hauraki Iwi Environmental Plan.	A vision and strategic plan to sustain the mauri of the natural environment and improvement in abundance and quality of natural resources.	Hauraki Māori Trust Board.
2005 - October	Working together in Thames-Coromandel: guidelines for community planning.	Investigation into the Whangamata Community Plan giving weight to the need for integrated planning and action.	Parliamentary Commissioner for the Environment.
2005	Regional Coastal Plan.	Statutory policy document used for managing the coastal and marine areas.	Environment Waikato.

Date	Plans and projects	Content	Organisation
2003	Peninsula Project.	Erosion and flooding control including pest management.	Environment Waikato, DOC.
2004	Coastal Harbour Plans.	Developing integrated planning maps for future development directions in harbours and their catchments.	Environment Waikato, Thames-Coromandel District Council, DOC, iwi.
2004	Whangamata Heritage mapping.	Sites and areas of importance to tangata whenua	Environment Waikato and Hauraki Màori Trust Board.
2005	Coromandel Peninsula Blueprint Project/Coromandel Growth Strategy.	Planning for the future growth of communities and zoning of land and sea.	Thames-Coromandel District Council, Environment Waikato, DOC, iwi.
2005	Long-Term Council Community Plan (LTCCP).	Public input to council plans that help guide and direct work programmes.	Environment Waikato. Thames-Coromandel District Council.
2005	Landscape survey.	Survey of important landscapes on the Coromandel.	Thames-Coromandel District Council.

3 Issues and action

3.1 Layout of the issues and action section

Various goals for the harbour have been outlined in community documents and issues have been raised in community forums (for example, *The Future of the Whangamata Catchment and Harbour - Results of a Community Consultation*, Labour Weekend, October 1999). These are covered in the following section which is structured as follows.

Issues

These are the issues raised in previous reports or at community meetings. They have been arranged in order of subject.

- Water quality.
- Habitat.
- Sedimentation and flooding.
- Recreation, boating, access and views.

Some of the concerns raised relate to actual problems which need to be dealt with; others reflect situations where people believe there is a problem but this may not necessarily be the case. They also relate to community visions and goals developed through the harbour plan process and in previous consultations, as outlined in sections 2.1, 2.2 and 2.3 above. Where required, the harbour plan proposes a number of actions to be taken and also notes where past actions have occurred.

Evaluation

The available information and data provided has been used to assess the extent and environmental importance of the issues. This section uses references to published reports and summarises the results.

What is happening

This is a review of the relevant actions that agencies are currently undertaking.

What needs to be done

This section covers gaps or further actions that need to occur to address an issue.

3.2 Water quality

3.2.1 Issues

- Bacteria and nutrients, including:
  - contaminants from the wastewater treatment area affecting water quality
  - high amounts of bacteria in the water and in shellfish
  - contaminants in stormwater entering the harbour
  - increased nutrients in the water affecting the harbour.
- Accidental spills of oil or contaminants.
- Foams and scum floating on the water.
- The need for catchment based planning to protect water quality.

Sediment run-off from agricultural activities such as forestry and farming can also impact on water quality, increasing silt levels in waterways, introducing nutrients and bacteria and reducing water clarity where sediments are stirred up. For more information on sediment in water, see section 3.4.

3.2.2 Evaluation

- **Bacteria and nutrients**

At the time of its construction the Whangamata wastewater treatment plant won awards for its design. However, there has been significant growth in Whangamata since then. In particular there is a hugely variable population that has to be dealt with by the plant during the holiday summer period (for example, the population grew from 4,000 to 48,000 during the summer period in 2005). A summary of the history and issues of the Whangamata wastewater treatment plant was completed by Thames-Coromandel District Council in 2005.[4] That report covers the issues and monitoring results relevant to the plant and its associated irrigation areas and receiving streams. Future improvement options were also covered.

The main points are listed below.

- The consent stipulates maximum summer and winter irrigation rates of 35 millimetres per week and 20 millimetres per week respectively. Compliance with these consent conditions was poor during July and August 2004 with irrigation exceeding 20 millimetres per week during each week. Only two other non-compliances occurred during the 2004/05 period.
- The second other non-compliance was an irrigation rate of 77 millimetres per week following a period of very heavy rain. This indicates the available storage in the retention pond is insufficient to provide the required buffering of storm flows during serious wet weather events.
- Nitrate concentrations downstream of the irrigation field are significantly higher than those upstream, with the increase more pronounced during summer months.
- Infiltration of water into the sewer system during high rainfall events is currently a significant issue for the Whangamata reticulation leading to overfilling of the effluent retention pond.

Environment Waikato completed an audit report on the wastewater treatment plant in 2005.[5] The results showed that:

- on occasions the plant was adding bacteria to the stream
- on occasions upstream sources of bacteria could also be high
- increases in bacteria levels below the plant indicate the likely source to be overland flow from the irrigation area
- the treatment plant is adding considerable amounts of nitrate to the stream.

The table below shows results of monthly sampling of the Waikiekie stream above (upper) and below (lower) the treatment plant for April 2004 to March 2005.

[4] Thames-Coromandel District Council. 2005: *Eastern Seaboard Wastewater Treatment Plant Projects - Whangamata Status Report. 2005*. Thames-Coromandel District Council, Thames.
[5] *Audit Report on Whangamata Sewage Scheme, Waikiekie Road.* Environment Waikato doc #1023335.

Date	Monthly										
	Flow rate l/s Waikiekie		Faecal Coliform MPN/100 Waikiekie		pH Waikiekie		Nitrate-N Waikiekie		Nitrate-N in kg per day		
	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Difference
14-Apr-04	0.014	0.108	140	340	7.09	7.3	0.1	0.7	0.12	6.53	6.41
11-May-04	0.135	0.15	670	1600	7.39	7.33	0.3	1	3.50	12.96	9.46
15-Jun-04	0.098	0.136	46	62	7.59	7.29	0.2	1.7	1.69	19.98	18.28
12-Jul-04	0.187	0.258	180	270	7	7.05	0.285	1.21	4.60	26.97	22.37
13-Aug-04	0.085	0.22	160	145	7.28	7.24	0.272	1.42	2.00	26.99	24.99
09-Sep-04	0.335	0.509	10	145	6.87	6.98	0.122	0.802	3.53	35.27	31.74
11-Oct-04	0.188	0.288	184	248	6.98	7	0.31	0.87	5.04	21.65	16.61
12-Nov-04	0.08	0.182	1070	7500	7.17	7.21	0.14	0.52	0.97	8.18	7.21
09-Dec-04	0.19	0.132	240	430	7.31	7.26	0.13	1.21	2.13	13.80	11.67
10-Jan-05	0.145	0.102	320	670	7.6	7.57	0.077	2	0.96	17.63	16.66
11-Feb-05	0.072	0.142	2200	730	7.49	7.36	0.09	2.3	0.56	28.22	27.66
10-Mar-05	0.105	0.137	155	1030	7.77	7.68	0.036	1.6	0.33	18.94	18.61
					Average kg of Nitrate-N lost per day				2.12	19.76	17.64
					Tons of Nirate-N lost to the stream per year						6.44
					Tons of nitrogen discharged to the disposal area per year						18.88

Environment Waikato investigated contaminant loads from water entering the harbour from June 1999 to February 2000[6] and from January to March 2001.[7]

The 1999-2000 results showed that:

- bathing beaches in the harbour had low bacteria levels and were safe for swimming
- most of the contaminants entered the harbour from the land
- contaminant levels were at times high in the Moanaanuanu Estuary and near the mouth of the Waikiekie Stream
- contaminants found in the Moanaanuanu Estuary appeared to have come from the largely pastoral area catchment upstream of the Whangamata Golf Course
- there was no evidence of any substantial leak of contaminants from the Whangamata wastewater treatment pond but there was leakage from the spray irrigation area
- leakage from the effluent spray irrigation area was contributing a major load of nitrogen to the stream (and thus to the harbour).

The summary below is from the 1999-2000 report.

> *The bathing beaches were found to be suitable for swimming. In particular, the median level of enterococci at the harbour bathing beach site was <2 cfu/100 mL, or more than ten times lower than the national guideline level for safe bathing waters. This was despite the fact that substantially-higher levels of bacteria were found in the freshwaters which enter the harbour upstream of this site. Dilution with clean seawater was apparently sufficient to ensure that the water at this site was safe for bathing.*
>
> *At the time of sampling, the harbour waters were mostly (clean) seawater, and were generally in good condition: dissolved oxygen levels were generally high (>90% of saturation), and levels of nutrients and faecal bacteria were generally low. However, none of the surveys were undertaken during periods of high freshwater flow, and it is likely that levels of some contaminants may increase during and after flood events. Furthermore, although water quality was generally good over large areas of the harbour, it was found to be poorer in areas where moderately-contaminated river or stream water mixed with harbour water. As a result, contaminant levels were moderately-high at times in the Moanaanuanu Estuary, and near the mouth of the Waikiekie Stream.*

[6] Vant, B. 2000: *Whangamata Harbour water quality investigations, 1999-2000*. Environment Waikato technical report 2000/02. Environment Waikato, Hamilton.

[7] Environment Waikato. 2001: *Whangamata Harbour; Contaminant loads and water quality, 200*1. Environment Waikato Technical Report 2001/04, Environment Waikato, Hamilton.

In these areas, contaminant levels were generally highest when salinities were low, and vice versa. Most of the contaminants therefore entered the harbour from the land, rather than from the sea (although there may have been an exception to this at the time of the [very windy] December survey). The contaminants found in the Moanaanuanu Estuary appeared to have entered the Wentworth River from the catchment upstream of the Whangamata golf course. There was no evidence of any substantial leak of contaminants from the Whangamata wastewater treatment pond (which is located adjacent to a small stream which enters the Moanaanuanu Estuary downstream of the golf course).

Longitudinal surveys of the Wentworth River suggested that most of the contaminant load at the golf course entered the river from the largely pastoral area in the lower part of the catchment. Inspection of this area showed that livestock had unrestricted access to the river at places, and that contaminated runoff from the adjacent land was likely to enter the river. The moderate degree of contamination observed in the stream was broadly consistent with this type of land use.

Comparison of the levels of faecal bacteria in the Waikiekie Stream with those found in other small streams in the Waikato Region suggests that the bacterial load is partly due to the small amount of pastoral farming in the catchment, and partly to leakage from the spray irrigation area. The overall loads of faecal bacteria to the harbour from the Wentworth River and the Waikiekie Stream appear to be of similar magnitude.

Levels of nitrogen in the lower Waikiekie Stream were 30–100 times higher than in the Wentworth River. Together with the conclusions of a previous assessment, this fact suggests that leakage from the spray irrigation area is contributing a major load of nitrogen to the stream (and thus to the harbour). This load may have increased over the past decade. The potential for the nitrogen load to support nuisance plant growth in the harbour should be thoroughly assessed.

The 2001 results showed that:

- run-off water from storm events resulted in significantly increasing the bacteria levels in the harbour
- the amount of nitrogen and phosphorous entering the harbour was also greatly increased by storm events
- at other times bacteria levels in the harbour were within bathing water guidelines
- the majority of the nitrogen entering the harbour was from the Waikiekie Stream
- the effluent spray irrigation area was a source of contaminants
- high amounts of bacteria and phosphorus were coming from stormwater outlets during light rain
- feral animals in forested areas were contributing to bacteria levels in forested streams
- the pastoral area of the Wentworth River contributed most of the turbidity observed at the lower end of the river and at times contributed much of the loads of the other contaminants.

The summary below is from the 2001 report.

Four surveys of the loads of contaminants in the catchment of Whangamata Harbour were made during January-to-March 2001. Loads were calculated from measurements of stream flow and contaminant concentrations at sites on six streams and two stormwater outfalls flowing into the harbour. Loads were also measured at 11 sites in the catchment of the Wentworth River, the single largest inflow to the harbour. The water quality in two sub-estuaries of the harbour, which previous work had shown to be moderately contaminated, was determined. Samples were also collected from the coastal water flowing into and out of the harbour.

Contaminant loads in dry weather were found to be much lower than in wet weather. During the highest flow event surveyed - estimated to be a flow that is exceeded about 10% of the time—the total load of faecal coliform bacteria to the harbour was about 60 times higher than that measured during dry weather. The load of enterococci was about 30 times greater, while those of total phosphorus and total nitrogen were about 80 and 40 times higher, respectively. The high flow event appeared to flush-out the catchment to some extent, as specific yields of bacteria were much lower in a moderately-high flow survey a fortnight later.

The Wentworth sub-catchment contributed 40–60% of the total flow, and a similar proportion of many of the contaminants. The next largest sub-catchment, the Otuwheti, was also an important source of contaminants at times. The smaller Waikiekie sub-catchment contributed a disproportionate share of both the total nitrogen (30–70%) and the nitrate nitrogen (66–92%) entering the harbour. It was also an important source of faecal bacteria at times (up to 27%). In this case, most of the nitrate and perhaps half of the faecal bacteria probably enters the stream in surface and sub-surface runoff from the Whangamata wastewater spray-irrigation area.

Under conditions of light rain, the two surveyed stormwater outfalls contributed disproportionately high loads of contaminants. The combined loads of faecal bacteria were equal to about 20% of the total load from the streams, while the loads of turbidity and total phosphorus were equal to 25–40% of the stream loads.

In the Wentworth sub-catchment the area of native bush upstream of the upper-most sampling site contributed about half of the flow in the river. However, it generally contributed considerably smaller proportions of the faecal bacteria and total nitrogen, and only 10–14% of the turbidity. The rest of the loads came from the largely-pastoral area downstream of this site. Two permanent drains through areas of farmland contributed relatively high loads of nutrients and faecal bacteria.

Field measurements in the two estuaries showed that the less dense river water tended to flow downstream above a layer of more dense seawater. At the more landward sites, concentrations of faecal bacteria and nitrogen were usually higher—occasionally much higher—in the less saline near-surface layer. At the seaward sites, however, the contaminants were generally more evenly-distributed. There was no evidence of any substantial input of contaminants into the Moanaanuanu estuary in the vicinity of the Whangamata wastewater treatment pond.

On each survey, the quality of the coastal waters entering and leaving the harbour on the inflowing and outgoing tides tended to be similar. Relatively-high concentrations of faecal bacteria were measured in these waters during the high freshwater flow event. On this occasion most of the bacterial load

came from the Wentworth (28–39%), Otuwheti (20–35%) and Waikiekie (4–27%) sub-catchments. Flushing of the catchment over the following fortnight, however, meant that contaminant loads at the end of the fortnight were much lower. As a result, bacterial concentrations in the harbour and coastal waters were also lower on the two surveys following the high flow event. While individual heavy rain events can reduce the suitability of the harbour and nearby coastal waters for bathing, an extended period of moderate-to-high flows appears to offset this to some extent by flushing contaminants from the catchment.

Water and shellfish were tested for faecal coliforms in December 1998 and compared to safety thresholds because the Boardriders' Association had concerns about the water quality near the harbour bar (11 September to 13 October 1988). Overall, some beaches and rivers were safe to swim in but others weren't. Shellfish gathered from some locations were safe to eat but not from other locations. It was not safe to eat shellfish gathered from the boat ramp, particularly mussels. Only the bacteria levels were determined, not the source.

The results of a 1999-2000 survey[8] also concluded that shellfish gathered from the southern half of the harbour should probably not be eaten.

Note: There is some evidence that mangroves can assist in maintaining water quality – for more information see 'Mangrove history, distribution and ecological function' in section 3.3.2.

- **Accidental spills of oil or contaminants**

Environment Waikato operates a 24 hour ready response and marine oil spills service for dealing with spills and other pollution incidents that can't be dealt with routinely by staff during working hours. For most incidents (except those which are very minor) Environment Waikato staff will typically get to the site as soon as possible to assess the risks to the environment and to liaise and provide advice to the relevant agencies/people (for example, district council, fire service, contractors, site owner, potentially affected parties etc.). Environment Waikato staff liaise with the relevant parties to assist and make sure containment, clean up and notification processes happen. This liaison also helps Environment Waikato to find out the reasons and possible liability for the spill so potential enforcement or future preventative actions can be taken. Environment Waikato has experienced staff on hand in Whangamata, Whitianga and Paeroa. They have specific training in spill management as well as knowledge and contacts regarding appropriate spill containment equipment.

- **Foams and scum floating on the water**

The 1999-2000 survey[9] reported on foams and scums in the harbour. The main findings are listed below.

- Foams contained carbohydrates and bacteria levels were higher in the foam than in the water.
- Higher levels of bacteria were expected because bacteria in surface films can be many times higher than those in the underlying water.
- Foams occur in other harbours and are natural.
- There was no evidence that foams in Moanaanuanu Estuary are associated with sewage.

"These various observations suggest that the foams and scums observed in and near the Moanaanuanu Estuary, while being visually conspicuous - and having the potential to be aesthetically unpleasant, are likely to have been natural phenomena. There was

[8] Vant, B. 2000: *Whangamata Harbour water quality investigations, 1999-2000*. Environment Waikato technical report 2000/02. Environment Waikato, Hamilton.
[9] As in footnote (11) above.

no evidence from these observations that the features were directly associated with sewage." [10]

The extract below is from that report.[11]

> *On 12 December a reconnaissance was made of the Moanaanuanu estuarine mixing zone between the causeway and the golf course. Conspicuous surface features were observed at two locations near the time of high water (colour photographs were taken of these, and copies are available on request). The first was a patch of yellow-brown foam, about 2 m × 1 m in size which was observed in shallow water (c. 0.2 m deep) near the edge of the channel in an area of salt-marsh vegetation (map reference T12, 646 389). It appeared to be typical of the type of foam which is often observed in such areas. I consider it was likely to have been a naturally-occurring estuarine foam, resulting from wind and wave action on polysaccharide surfactants which had been released by coastal plants (e.g. microalgae).*
>
> 
> *An example of scum that occurs from time to time in Whangamata Harbour.*
>
> *Surface foams have also been observed on other Coromandel estuaries. A visual and microbiological assessment of foam collected from Tairua Harbour showed a high level of marine material including living and dead pennate diatom skeletons, aggregates of organic matter and inorganic particles. Bacteria were numerous and active. It was concluded that the foam "was most likely derived from a natural bloom of photosynthetic algae … probably pennate diatoms". It was observed that "these organisms coat their silica cell in mucilage and excrete further mucilage as a slime layer on which they move", and that the mucilage "may give rise to a stable foam when suspended from tidal flats on the incoming tide and worked by the wind". It was further concluded that "the foam itself is not indicative of, or resulting from, waste containing high levels of faecal bacteria".*
>
> *These various observations suggest that the foams and scums observed in and near the Moanaanuanu Estuary, while being visually conspicuous—and having the potential to be aesthetically unpleasant, are likely to have been natural phenomena*[12]*. There was no evidence from these observations that the features were directly associated with sewage.*

- **The need for catchment based planning to protect water quality**

[10] Vant, B. 2000: *Whangamata Harbour water quality investigations, 1999-2000*. Environment Waikato technical report 2000/02. Environment Waikato, Hamilton.
[11] As in footnote (13) above.
[12] Note that while the processes directly responsible for these phenomena may be described as "natural", the rates at which the processes occur may have increased as a result of catchment and urban development (for example, higher nutrient levels supporting larger amounts and clumps of algae, increased bank erosion producing higher loads of fine sediments).

The need for catchment based planning is clearly recognised by Environment Waikato's Regional Policy Statement (RPS). This forms the basis for Environment Waikato's activities and those of the district council.

Below is a list of relevant statements from the RPS.

- Assess objectives and policies relating to land and water resources to encourage the enhancement of the coastal environment and ensure that 'up-stream' activities have minimal adverse effects on coastal areas.
- Through liaison with territorial authorities (TAs), iwi and other agencies, promote the integrated management of land and water resources including the use of a catchment based approach for the management of contaminants, especially those from non-point sources.
- Through an environmental education programme developed in consultation with other parties, advocate: the rehabilitation of degraded soils; sustainable land management practices; riparian management for soil conservation purposes; protection, enhancement or restoration of vegetation (particularly indigenous vegetation) especially on land which has high erosion risk; and retirement of land subject to severe accelerated erosion.
- Through liaison with TAs, iwi and other agencies, promote the integrated management of land and water resources including the use of a catchment based approach.
- Through liaison with organisations with resource management responsibilities in the coastal environment, ensure integrated management of coastal resources.
- Through regional plans, district plans and resource consents identify and provide for the protection of significant characteristics of outstanding water bodies.
- Through liaison with TAs and interested parties, ensure the integrated management of land and water resources.
- Through regional plans, district plans, and resource consent applications, require the assessment of effects of land use development and subdivision on the significant characteristics of water quality.
- Through regional plans, district plans and resource consents ensure that stormwater discharges are managed to achieve the objectives and policies of the RPS.

For more information on proposed catchment works and services programmes, see this plan's supporting document, the Draft Whangamata Catchment Management Plan 2007.

3.2.3 What is happening

- **Bacteria and nutrients**

Contaminants from the wastewater treatment area affecting water quality

Significant community consultation was carried out in Whangamata to gain community input, particularly into potential effluent disposal options. The Community Board also initiated consultation in conjunction with Thames-Coromandel District Council on the issue of development in Whangamata, particularly infill subdivision, given that it is one source of additional load on the wastewater plant. For example, in 2005 all ratepayers (approximately 4500) were mailed a questionnaire seeking their views on the infill subdivision 'issue'. This is one area that the Community Board is keen to see considered early in Thames-Coromandel District Council's review of its Proposed District Plan and has an indirect link to Whangamata Harbour. The Whangamata Wastewater Plant has now been granted consents for its upgrade. Water quality standards were finalised as part of consents for the construction of the plant and disposal methods for the treated effluent.[13]

[13] The consented disposal method (after high level treatment within a new Sequential Batch Reactor based plant) is via an expanded forest irrigation system.

An upgrade of the wastewater plant should cut nitrogen losses by 60 per cent.

- The upgraded wastewater treatment plant is intended to provide treatment capacity for population expansion over the coming 30 years.
- The upgraded treatment plant will focus on improving the microbial quality of the discharge, and reducing nutrient concentrations in the treated effluent. Estimated time of completion is mid-2008. The plant will have the capacity to cope with peak population loads. The quality of the irrigated wastewater will be significantly better in terms of nitrogen and bacteria loads.

High amounts of bacteria in the water and in shellfish

There appears to be very little proactive action to help reduce bacteria in run-off from farmland or areas of native bush.

Contaminants in stormwater entering the harbour

Thames-Coromandel District Council has recently installed approximately 44 stormwater pit filters in the area from Hunt Road to the causeway and across to the wharf. Where possible each pit had a filter fitted, as stormwater in this area drains directly into to the harbour. A combination of the Ecosol and Enviropod products was used – roughly half of each – in an effort to remove some of the larger pollutants such as rubbish, cigarette butts etc.

The draft stormwater management plan for Whangamata is recommending a swale/soakage[14] approach to the treatment of stormwater rather than a comprehensive reticulated system.

Increased nutrients in water affecting the harbour

There is some fencing and planting along the edges of streams and rivers and shores ('riparian' areas) to help keep nutrient out of waterways but more is needed. Farmers applying annually over 60 kilograms of nitrogen per hectare are now required by Environment Waikato to have a Nutrient Management Plan.

- **Accidental spills of oil or contaminants**

Spills that happen in freshwater are responded to by Environment Waikato's ready response and marine oil spills teams. Anyone noticing such a spill should immediately notify Environment Waikato by calling **Environment Waikato's freephone 0800 800 401.**



Quick action halts harbour oil disaster

QUICK action by Whangamata Volunteer Fire Brigade helped prevent oil from spilling into Whangamata Harbour last week.

Thick black oil oozed out of a stormwater pipe by the Mayfair Avenue pony club grounds and into Moanaanuanu Stream on Wednesday afternoon and someone, believed to be a whitebaiter, raised the alarm.

He said this information is being given to Environment Waikato, which is dealing with the offence.

Whitianga-based EW resource officer Stacey Bunting points out that there are instant fines in excess of $300 and up to $2000 depending on the severity of the offence.

In major spills there are higher penalties and offenders can be prosecuted.

Coastal News 22 September 2005

[14] A swale is a low-lying stretch of land which can be used to hold and/or filter water.

- **Foams or scums floating on the water**

Foams and scums are natural occurrences and no action is required.

- **The need for catchment-based planning to protect water quality**

There are several projects underway that incorporate catchment based planning. These include the Peninsula project, the Wentworth 'Clean Streams' project and Whangamata's sewage plant upgrade. For more information, see the Draft Whangamata Catchment Management Plan 2007.

3.2.4 What needs to be done

Bacteria and nutrients

- Options for removal of contaminants from stormwater are in place or being investigated.
- Continue education to ensure people understand that chemicals and contaminants should not be poured down stormwater drains or onto surfaces draining to stormwater.
- Put in place processes to reduce high loads of contaminants coming from two permanent drains entering the Wentworth River.
- Encourage more farmers to fence and plant the waterways on their properties and install bridges and culverts for stock crossings
- Identify properties with high rates of nutrient leaching and run-off, and help the owners put in places practices that will improve their nutrient efficiency and reduce contaminant run-off.
- Carry out futher animal pest control in forested areas to reduce bacteria from feral animals.
- Excess or unnecessary fertiliser use needs to be avoided.

Accidental spills of oil or contaminants

- Regularly inspect high risk industries.
- Continue spill prevention and containment training.
- Ensure equipment for spills is readily available.
- Boaties need to be aware of spill prevention procedures and the actions they should take if a spill occurs.

The need for catchment-based planning to protect water quality

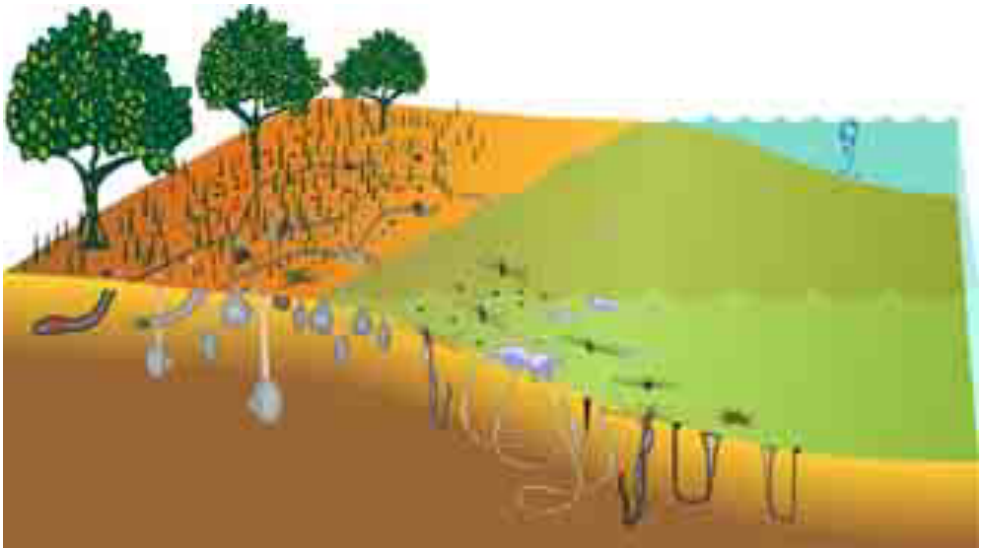
- Prioritise in regional and district planning documents the actions needed to improve water quality.

3.3 Habitat

Estuaries in the Whangamata Harbour area support a wide variety of plant and animal life, as illustrated in the two diagrams below.



This diagram shows the range of plant habitats the Waikato region's estuaries typically feature at each tidal level.



This diagram shows the variety of animals that can live in mud. (Graphic: *NIWA*)

However, land clearance for urban development, forestry and farming has changed the natural character of the area significantly; and remaining native vegetation areas need to be protected and increased wherever possible.

3.3.1 Issues

- Mangrove expansion displacing other habitats and open water.
- Unauthorised clearing of mangroves.
- Loss of wetlands by drainage and reclamation of the harbour edge.
- Harvesting pressures on shellfish.
- Invasive weeds and pests (land, freshwater and marine).
- Ecological corridors connecting the different ecosystems.
- Whitebait and eel numbers.

- **Mangrove expansion displacing other habitats and open water.**
- **Unauthorised clearing of mangroves.**
- **Loss of wetlands by drainage and reclamation of the harbour edge.**

Over time mangroves have spread throughout the harbour. Their expansion may be associated with the displacement of other habitats, a reduction in recreational areas of open water, increasingly restricted access to the coast, a decrease in the availability of intertidal feeding areas to birds and fish and the loss of some open water views.

For a full discussion on the pros and cons of mangrove removal in the Whangamata Harbour, see Environment Waikato's Whangamata Mangrove Management Options Report and Environment Waikato's mangroves webpage. This information can be found on our website at www.ew.govt.nz/projects/whangamata/index.htm.

Appendix II of the mangrove management options report also contains a copy of the National Institute for Water and Atmospheric Research's (NIWA) publication, '*For and Against Mangrove Control*''. Copies of this publication can also be found on NIWA's website at http://www.niwascience.co.nz/rc/freshwater/mangrove.pdf/view_pdf. This publication clarifies the facts about mangroves, the consequences of actions taken in relation to them and the likelihood of achieving goals through these actions.

Other councils are also dealing with the complex challenge of managing mangroves in their area. For example, Auckland Regional Council (ARC) and Environment Bay of Plenty (EBoP) conducted separate reviews of mangrove issues. EBoP's review focuses on mangroves management in their region, while ARC's review focuses on a technical review of the current state of knowledge of mangrove ecology, recent

expansion, and its effects. This information is available in PDF format on each council's website or by phoning the council concerned to order a printed copy.

- Environment Bay of Plenty – Estuary Care Review (2007).[15]
- Auckland Regional Council – The New Zealand Mangrove: Review of the Current State of Knowledge[16] and its summary booklet, 'New Zealand's Mangroves' (2007).[17]

- **Harvesting pressures on shellfish**

The collection of shellfish by increasing numbers of people and people taking more than the legal limit is an issue that needs to be monitored to ensure sustainable harvesting of the shellfish in the harbour.

- **Invasive weeds and pests (land, freshwater and marine)**

Undaria



The kelp *Undaria pinnatifida*, a native of the north-west Pacific, was introduced to New Zealand during the 1980s. *Undaria* (pictured right) was probably transported to New Zealand in the holds of ships as ballast water originating from Australia or Japan. Although *Undaria* has potential as a farmed sea vegetable, it is causing concern in a number of highly valued coastal areas in southern New Zealand. This is because it is threatening native algal biodiversity and ecosystem structure and function in these areas. *Undaria* has been found in the Firth of Thames.

Saltwater *Paspalum*

Saltwater *Paspalum* (*Paspalum vaginatum)* is an invasive introduced saltmarsh grass which occurs in many estuaries and along coastal foreshores of the northern half of the North Island. It has been reported in a number of estuaries in the Waikato region, including Manaia, Coromandel, Whangapoua, Whitianga, Tairua, Whangamata and Otahu harbours.

An assessment of estuarine vegetation cover in Whangamata Harbour for the period between 1997 and 2003[18] has shown that saltwater *Paspalum* has increased in extent by approximately one hectare. Although this increase accounts for less than one per cent of the total estuarine vegetation cover, the latest ground surveys (2007)[19] show that this species continues to expand rapidly in the harbour. It is likely that saltwater *Paspalum* may have similar impacts to those documented for *Spartina* (another saltmarsh grass causing problems in New Zealand), significantly threatening important habitats around the edges of the harbour (Graeme and Kendal, in Turner and Riddle, 2001).[20]

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[15] Environment Bay of Plenty, 2007*: Estuary Care Review*. Report to Council, report no. 010607, May, Catalyst Management Services. http://www.envbop.govt.nz/coast/media/pdf/Mangroves-Report-to-Council-010607.pdf.

[16] Morrisey, D., Beard, C., Morrison, M., Craggs, R. and Lowe, M., 2007: *The New Zealand Mangrove: Review of the Current State of Knowledge.* Auckland Regional Council Technical Publication Number 325, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?B1BFD2DD-BCD4-1A24-901C-9AD2050A42F2#mangrove.
Auckland Regional Council, 2007: Mangroves in New Zealand. Summary booklet. Auckland Regional Council, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.

[17] Auckland Regional Council, 2007: *Mangroves in New Zealand*. Summary booklet. Auckland Regional Council, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.

[18] Graeme, M. (1997): *Estuary Vegetation Survey Pilot Study: Whangamata, Wharekawa and Otahu. Natural Solutions Ltd:* Marine and Terrestrial Ecologists Report. Environment Waikato.

[19] Graeme, M. (2007): *Estuarine Vegetation Survey: Whangamata Harbour and Otahu Estuary*. Natural Solutions Ltd: Marine and Terrestrial Ecologists Report No. 07/067. Environment Waikato.

[20] Turner, S. and B. Riddle. 2001: *Estuarine sedimentation and vegetation – management issues and monitoring priorities.* Environment Waikato Internal Series 2001/05. Environment Waikato, Hamilton.

The 2007 survey showed that saltwater *Paspalum* in the Whangamata Harbour is already out-competing natural sea-meadow communities and reducing the extent of other native vegetation such as saltmarsh ribbonwood and rushes. It also grows in the open estuary where it traps sediment. If saltwater *Paspalum* is allowed to continue spreading, it will not only further threaten native vegetation, but also help increase the rate of harbour infilling.

Sea squirt

A new invasive species of sea squirt (*Styela clava*) has been found in some parts of New Zealand. This sea squirt (pictured below) prefers sheltered harbours and attaches to hard structures below the low tide mark. More information can be found on the Biosecurity New Zealand web site.[21]



Rats

It has been suggested that mangroves and the scrubby shoreline support large numbers of rats. If so, this would affect birds' use of mangrove habitats. At certain times of low tide and no moon, numerous rat tracks are observed on the mud flats.

Other animal pests

Animal pests such as possums are impacting on native plants and animals, and their impact on vegetation is resulting in erosion and soil run-off in some areas of the catchment (particularly in the forested areas of the upper catchment).

- **Ecological corridors connecting the different ecosystems**

The connection of different ecosystems is necessary for some species. Whitebait for example need both harbour and stream habitat. They are dependent on grassed stream edges for breeding and also need to be able to reach shady forested streams. A continuous natural connection between the different habitats allows birds to easy move from one habitat to another at different times of the year.

- **Whitebait and eel numbers**

Continued food gathering from the harbour and streams is important and an increase in theses food sources is desirable.

[21] www.biosecurity.govt.nz/seasquirt

3.3.2 Evaluation

- **Mangrove expansion displacing other habitats and open water**
- **Unauthorised clearing of mangroves**
- **Loss of wetlands by drainage and reclamation of the harbour edge**

Vegetation surveys for the harbour were done in 1995/96 and 2004. The methods for assessing the area of the harbour may have differed and both give different areas for the harbour. However, areas of vegetation should be comparable. A further vegetation survey has been carried out by Environment Waikato in 2007.[22]

Areas of vegetation and habitat based on Environment Waikato's 1995/96 survey[20]

Vegetation/habitat	Hectares 1995/96	Per cent of harbour
Seagrass	50.9	12.4
Mangrove	105.4	25.7
Saltmarsh	22.4	5.5
Invasive weeds	<1	0.004
Intertidal flats and channel	203.9	56.4
TOTAL	409.5	100

Areas of vegetation and habitat based on Wildlands 2004 survey[23]

Vegetation/habitat	Hectares 2004	Per cent of harbour
Saltmarsh	10.9	2.3
Saltmarsh with patches of marsh ribbonwood	8.6	1.8
Mangrove-dominant	100.9	21.6
Seagrass	70.9	15.2
Sand beaches	2.9	0.6
Intertidal flats	200	44.0
Subtidal channel	67.8	14.5
TOTAL	467.4	100.0

The tables above show that between 1995/96 and 2005:

- seagrass has increased
- the area of mangroves has remained unchanged (this may be the result of unauthorised hand removal of seedlings)[24]
- saltmarsh has decreased slightly.

[22] Graeme, M. (2007): *Estuarine Vegetation Survey: Whangamata Harbour and Otahu Estuary*. Natural Solutions Ltd: Marine and Terrestrial Ecologists Report No. 07/067. Environment Waikato.

[23] Statement of Evidence: William Bruce Shaw on behalf of Hauraki Màori Trust Board and Te Kupenga O Ngati Hako. Environment Court evidence in regard to the proposed Whangamata Marina, November 2004.

[24] It could be argued that the unauthorised removal of seedlings may have assisted in halting the spread of mangroves in these areas. However, these actions were not carried out under specific consent conditions and monitoring designed to minimise any harmful effects was not done. Therefore it is uncertain how these actions have impacted on plant and animal life in these areas of the estuary.

Habitat

The Waikato Regional Coastal Plan recognises the upper Whangamata Harbour as an area of significant conservation value.

Mr Roxburgh (DOC) stated in evidence for the Whangamata marina: "The harbour and its environs were ranked as a site of "high" wildlife value (SSWI) by the Wildlife Service in 1981. This is the second highest in a five tier system ranging from Outstanding to Potential. The Coromandel Peninsula was surveyed as part of a "national survey" of wildlife habitats completed by the Fauna Survey Unit of the Wildlife Service. The expressed intention of the survey was to rank habitats according to their value in supporting and maintaining local, regional and national populations of endemic, indigenous and introduced wildlife…These rankings are due to the presence of the following threatened species; Caspian tern Hydroprogne caspia, banded rail Rallus philippensis assimilis, Australasian bittern Botaurus stellaris poicilloptilus, the NZ dotterel Charadrius obscurus, and the variable oystercatcher Haemotopus unicolor. A number of international migratory waders also frequent the harbour, the most common of these is the bar tailed godwit Limosa lapponica baueri."[25]

Mr Roxburgh also stated that Whangamata is a "significant" site for the dotterel on the south eastern Coromandel Peninsula due to the presence of up to 16 flocking birds (recorded in 1994). He suggested that it "may well be" the second most preferred site. In the past three years there has been a noticeable increase in both nesting and flocking birds in Whangamata. About 60 birds were flocking in 2007. Whangamata remains an important area for the dotterel. Dotterel in the past nested in the harbour but lately this has not occurred and may be related to disturbance. The Otahu estuary remains their preferred nesting site. Oystercatchers however continue to nest in the harbour.[26]

Direct human disturbance poses the most immediate and direct threat to the remaining saltmarsh areas.[27] Saltmarsh is particularly vulnerable to people walking or driving across it, particularly with heavy machinery. Human disturbance also affects habitat use by birds, fish and invertebrates. Fire is also a very obvious threat.

Rare skink discovered

An investigation initiated by Environment Waikato following unauthorised mangrove clearance and burning of saltmarsh areas discovered that an apparently healthy population of Moko Skink (*Oligosoma moco*) is present on the causeway.[27] Numerous individuals were sighted sun-basking along the causeway banks immediately above the cleared mangrove area. This species (pictured below) is confined to northern New Zealand and has mostly been recorded from offshore islands, with only a few known mainland populations in Northland, Auckland and the Bay of Plenty. This population had not previously been recorded (Leigh Marshall, *personal comment*) and must be regarded as highly significant.

[25] Review of evidence regarding ecological values – proposed Whangamata Marina site. Environment Waikato doc. #977026.
[26] Graeme Webb; personal comment.
[27] Whangamata Mangrove Clearance & Saltmarsh Damage, November 2005; letter to Environment Waikato by Kessels & Associates Ltd.



Moko Skink *(Oligosoma moco)* on Moanaanuanu Estuary causeway**.**

Mangrove history, distribution and ecological function in New Zealand[28]

History

The mangrove in New Zealand has been identified as the species *Avicennia marina var. australasica.*[29] This variety of mangrove also occurs along the eastern coast of Australia from Adelaide and Melbourne to southern Queensland, Lord Howe Island and New Caledonia. This taxonomic determination has been confirmed by genetic analysis.[30]

The earliest known pollen record for *Avicennia* in New Zealand is 14,000 years ago,[31] as New Zealand was entering the current interglacial period. This is the earliest record currently reported but it doesn't necessarily establish the time of arrival. *Avicennia* pollen does not enter the pollen record easily (*Avicennia* is "extremely under-represented in pollen spectra")[32] and *Avicennia* may have been present on shorelines that have now been covered by sea-level changes. Earlier records at times of different shorelines may not be available to us. Therefore, mangroves may have been present in New Zealand earlier than 14,000 years ago but we don't have any records of them available to us yet.

It does seems likely that mangroves were either not present in New Zealand or very restricted in distribution (in northern refuges) during the last and preceding glaciations (or 'ice ages') when, for example, there was beech forest growing in Auckland. However, mangroves were probably present in New Zealand during between these periods. This is because reinvasion is probable from the eastern Australian coast whenever conditions in New Zealand are suitable for mangrove existence. Duke,

[28] Based on evidence of Bruce Burns from Landcare Research in an application for resource consent by Tauranga District Council for mangrove removal 2004.

[29] Duke, N.C. 1991: A systematic revision of the mangrove genus Avicennia (Avicenniaceae) in Australasia. *Australian Systematic Botany* 4: 299-324.

[30] Duke, N.C.; Benzie, J.A.H.; Goodall, J.A. and Ballment, E.R. 1998: Genetic structure and evolution of species in the mangrove genus *Avicennia (Avicenniaceae*) in the Indo-West Pacific. *Evolution* 52(6):1612-1626.

[31] Pocknall, D.T.; Gregory, M.R. and Greig, D.A. 1989: Palynology of core 80/20 and its implications for understanding Holocene sea level changes in the Firth of Thames, New Zealand. *Journal of the Royal Society of New Zealand* 19: 171-179.

[32] Horrocks, M.; Ogden, J.; Nichol, S.L.; Aloway, V. and Sutton, D.G. 2000: Palynology, sedimentology, and environmental significance of Holocene swamps at northern Kaitoke, Great Barrier Island, New Zealand. *Journal of the Royal Society of New Zealand* 30(1): 27-47.

Benzie, Goodall and Ballment (1998)[33] have studied the genetic structure of the genus *Avicennia*, including the relationship of the New Zealand example to those in Australia. They also plotted patterns of gene flow between populations, which suggested that migration of seedlings ('propagules') from Australia, Lord Howe Island or New Caledonia to New Zealand occurs on an infrequent but regular basis. Therefore, even if *Avicennia* became extinct during glacial periods in New Zealand, a continuous supply of propagules present on the east coast of Australia which are regularly dispersed to New Zealand enables that species to reinvade any time conditions become suitable.

This paper (Duke *et al.,* 1998)[34] also suggests that this variety (*A. marina var. australasica*) appears to have developed separately from other varieties in Australia approximately two million years ago. It has been around in the Tasman Sea for long enough to host the development of its own dependent plant and animal life. For example, the tortricid[35] moth - the mangrove leafroller (*Planotortrix avicenniae*) - is a moth found only in New Zealand mangroves.[36] Another species only found in New Zealand mangroves is *Aceria avicenniae*, which is a plant-feeding wormlike (or 'eriophyid)' mite.[37] These species would not have developed in New Zealand without long co-existence with mangroves.

Distribution

Mangroves in New Zealand occur in intertidal areas of estuaries, harbours, and sheltered bays in the northern half of the North Island. Mangroves have greatly expanded seaward within many harbours in New Zealand over the last few decades, probably in response to increased sediment infilling of harbours.[38] [39] [40]

The seaward boundary of mangroves lies at mean (or average) sea level in open estuaries in south eastern Australia but boundary indications have not been measured in New Zealand. Bird (1971)[41] researched mangrove colonisation at Westernport Bay in Victoria. He found that *Avicennia* colonisation depended on the mud flats building up to mid-tide level first. Each year, numerous *Avicennia* seedlings took root in the mud flats seaward of this mangrove fringe, but only survived on areas where the mud flats had built up to above mid-tide level. Elsewhere, the seedlings soon died. Clarke and Myerscough (1993)[42] found that the low survival of seedlings forward of this seaward boundary appeared to relate to wave and current effects preventing them from establishing themselves and those that did get a foothold suffered from the effects of waterlogging or fouling. Therefore, it seems likely that the seaward expansion of mangroves in New Zealand is a response to the building up of mud flats creating areas above mid-tide level.

[33] Duke, N.C., Benzie, J.A.H., Goodall, J.A., Ballment, E.R. 1998: Genetic structure and evolution of species in the mangrove genus *Avicennia (Avicenniaceae*) in the Indo-West Pacific. Evolution 52(6): 1612-1626.
[34] As in footnote 35 above.
[35] Tortricid moths are those which belong to the scientific family *Tortricidae*. These are small stout-bodied moths. Many of their larvae feed within fruits.
[36] Dugdale, J.S. 1990: Reassessment of Ctenopseustis Meyrick and Planotortrix Dugdale with descriptions of two new genera (*Lepidoptera: Tortricidae*). New Zealand Journal of Zoology 17(3): 437-465.
[37] Brownell, B. 2001: *Mangroves: the cornerstone of a dynamic coastal environment.* In Muddy Feet: Firth of Thames Ramsar site update 2001. EcoQuest Education Foundation Report Series No. 1.
[38] Young, B.M., Harvey, L.E. 1996: A spatial analysis of the relationship between mangrove (*Avicennia marina var. australasica*) physiognomy and sediment accretion in the Hauraki Plains, New Zealand. *Estuarine, Coastal and Shelf Science* 42: 231-146.
[39] Nichol, S.L., Augustinus, P.C., Gregory, M.R., Creese, R., Horrocks, M. 2000: Geomorphic and sedimentary evidence of human impact on the New Zealand coastal landscape. *Physical Geography* 21: 109-132.
[40] Morrisey, D.J.; Skilleter, G.A., Ellis, J.I., Burns, B.R., Kemp, C.E.; Burt, K. 2003: Differences in benthic fauna and sediment among mangrove (*Avicennia marina var. australasica*) stands of different age in New Zealand. *Estuarine, Coastal and Shelf Science 56:* 581-592.
[41] Bird, E.C.F. 1971: Mangroves as land builders. *Victorian Naturalist* 88: 189-197.
[42] Clarke, P.J., Myerscough, P.J. 1993: The intertidal distribution of the grey mangrove (*Avicennia marina*) in southeastern Australia: the effects of physical conditions, interspecific competition, and predation on propagule establishment and survival. *Australian Journal of Ecology* 18: 307-315.

Ecological function

Although comprised solely of one species of mangrove, *Avicennia* forests in New Zealand support a wide range of other plant and animal life (biota).

Mangroves provide general habitat for birds more commonly associated with land-based forests and other parts of estuaries and wetlands. Only one species, the banded rail, is more specifically associated with mangroves.[43] [44] [45] The New Zealand kingfisher is the most common native species found in mangrove forests, where they nest in hollows in mangrove trees. Mangrove habitats also support birds that feed in tidal creeks (for example, the white faced heron, pied stilt, black shag, gulls and terns).

About 30 species of fish in New Zealand make use of mangrove areas and other harbour areas at some stage in their life history.[46] Of these, about 13 species are common in the estuarine habitat including mangrove areas. These include juvenile yellow-eyed mullet, which graze on algae or bits of organic material (or 'detritus') found deep beneath the water. Like other fish that feed amongst the mangroves, they migrate in and out with the tide. In the tidal creeks small particles of detritus from the mangrove trees are broken down by micro-organisms that provide food for shrimps and young fish which are in turn fed upon by yellow eyed mullet and kahawai.[47] [48] Mangroves have 'pneumatophores' or partially exposed vertical roots which allow them to take in extra oxygen from the atmosphere. These exposed roots provide a place to grow on for periphytons (for example, algae) and filter feeders such as oysters and mussels. Periphytons are organisms that live attached to underwater surfaces. They provide a valuable food source for grazing fish to feed upon. The red algae *Caloglossa leprieurii* and *Catenella nipae* are specific epiphytes (plants which grow on other plants) which are found growing on the exposed roots of mangroves.

The muds of mangrove forests contain a diverse range of 'benthic' fauna – aquatic animals which live at the bottom of a body of water. However, there are no mangrove specialists amongst the benthic fauna found in New Zealand mangroves (a situation similar to temperate Australia).[49] [50]

We know little about the tree-dwelling invertebrates of mangrove forests. Apart from the leafroller and mite mentioned previously, Trevor Crosby, Head Curator of the New Zealand Arthropod Collection, knew of very few terrestrial invertebrates known to feed exclusively on mangroves (T. Crosby, *personal comment*).

Several studies on the productivity of mangroves in New Zealand have been carried out by assessing quantities of litterfall over time. Woodroffe (1982a[51] and 1985[52]) measured litter production (and decomposition) in Tuff Crater, Auckland (3.7 – 8.1 tonnes per hectare per year), and May (1999)[53] measured litterfall at Rangaunu Harbour, Northland (1.8 – 6.2 tonnes per hectare per year). These rates are close to those predicted for *Avicennia* according to latitude and tree height[54] in Australia. Comparisons of mangrove litterfall in New Zealand with that of other forests in New Zealand show that it produces as much, if not more, weight of litterfall than most native

[43] Cox, G.J. 1977: *Utilisation of New Zealand mangrove swamps by birds.* Unpublished MSc thesis, University of Auckland.
[44] Crisp, P., Daniel, L., Tortell, P. 1990: *Mangroves in New Zealand. Trees in the Tide.* Government Press, Wellington.
[45] Walsby, J. 1992: Forests in the sea. *New Zealand Geographic* 15: 40-64.
[46] Ritchie, L.D. 1976: *Fish and fisheries.* Paper presented at "Why are Mangroves Important?" Proceedings of a symposium organised by Nature Conservation Council, Whangarei.
[47] Davenport, M.W. 1979: Zooplankton and fish of mangroves. Unpublished MSc thesis, University of Auckland.
[48] May, J.D. 1979: Fish utilisation of a New Zealand mangrove creek with particular reference to Aldrichetta forsteri. Unpublished MSc thesis, University of Auckland.
[49] Hutchings, P.A., Recher, H.F. 1982: The fauna of Australian mangroves. Proceedings of the Linnean Society of New South Wales 106(1): 83-121.
[50] Hutchings, P.A., Saenger, P. 1987: Ecology of mangroves. University of Queensland Press. St Lucia, Queensland.
[51] Woodroffe, C.D. 1982: Litter production and decomposition in the New Zealand Mangrove, *Avicennia marina var. resinifera.* New Zealand Journal of Marine and Freshwater Research 16: 179-188.
[52] Woodroffe, C.D. 1985: Studies of a mangrove basin, Tuff Crater, New Zealand: Part 1. Mangrove biomass and production of detritus. *Estuarine, Coastal and Shelf Science* 20: 265-280.
[53] May, J.D. 1999: Spatial variation in litter production by the mangrove *Avicennia marina var. australasica* in Rangaunu Harbour, Northland, New Zealand. New Zealand Journal of Marine and Freshwater Research 33(2): 163-172.
[54] Saenger, P., Snedaker, S.C. 1993: Pan-tropical trends in mangrove above-ground litter fall. *Oecologia* 96: 293-299.

and exotic forest types (Woodroffe, 1982b).[55] Organic matter is also produced from the algae growing on the exposed roots of mangroves, and this also contributes to ecosystem production. Mangroves therefore undoubtedly contribute substantially to organic material available to estuarine food chains in New Zealand. However, May (1999)[56] concluded that without nutrition studies (tropic studies) carried out using a resolution provided by stable carbon isotope techniques, the importance of mangrove detritus relative to other carbon sources in estuaries was still uncertain in New Zealand.

There has been little work on pollutant storage in mangrove sediments in New Zealand. However, overseas literature reports that mangrove soils can retain and accumulate nutrients and heavy metal pollutants.[57] [58] [59] [60] Petroleum is the primary pollutant of Caribbean mangroves and hydrocarbons can persist in mangrove sediments for decades.[61] If mangrove sediments in New Zealand accumulate pollutants of this type, then stirring up the sediments through removal of mud or mangrove plants may potentially release these pollutants and toxins to the wider estuarine ecosystem.

A bacterium has also been isolated from mangrove soil overseas that degrades sea sludge, suggesting that mangrove soil may have a role in maintaining water quality in estuaries.[62]

Mangroves provide a physical buffer between land and sea protecting the coast from waves, storm surges and floodwaters. Maxwell (1971)[63] and Young and Harvey (1996)[64] particularly discuss the natural protection role of mangroves for coastal stopbanks of agricultural land in the Firth of Thames. However, there appears to be no more specific work that details how this functional role is achieved in New Zealand.

Pneumataphores (the aerial roots of mangroves that extend vertically through the mud) act to trap and fix sediment that would otherwise have remained mobile. This has been demonstrated by experiments where pegs were set out as artificial pneumataphores and the sediment build-up is then compared against control areas.[65] [66] Therefore pneumataphores at the mangrove fringe can act to help seedlings become established by raising the sediment surface above the critical level and allowing expansion of the mangrove population. However, this has to be put in the context of the total sediment build-up or erosion rates experienced at a site in the absence of mangroves and may not be the dominant effect.

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[55] Woodroffe, C.D. 1982: Litter production and decomposition in the New Zealand Mangrove, Avicennia marina var. resinifera. *New Zealand Journal of Marine and Freshwater Research* 16: 179-188.

[56] May, J.D. 1999: Spatial variation in litter production by the mangrove *Avicennia marina var. australasica* in Rangaunu Harbour, Northland, New Zealand. *New Zealand Journal of Marine and Freshwater Research 33*(2): 163-172.

[57] Clough, B.F., Boto, K.G., Attiwill, P.M. 1983: Mangroves and sewage: a re-evaluation. Chapter 17 in Teas, H.J. (ed.). Biology and ecology of mangroves. *Tasks for vegetation science* 8. Dr W. Junk Publishers.

[58] Tam, N.F.Y., Wong, Y.S. 1996: Retention of wastewater-borne nitrogen and phosporus in mangrove soils. *Environmental Technology 17*(8): 851-859.

[59] Tam, N.F.Y., Wong, Y.S. 1997: Accumulation and distribution of heavy metals in a simulated mangrove system treated with sewage. *Hydrobiologia* 352: 67-75.

[60] Tam, N.F.Y., Wong, Y.S. 1999: Mangrove soils in removing pollutants from municipal wastewater of different salinities. *Journal of Environmental Quality* 28(2): 556-564.

[61] Ellison, A.M., Farnsworth, E.J. 1996: Anthropogenic disturbance of Caribbean mangrove ecosystems – past impacts, present trends, and future predictions. *Biotropica* 28 (4 Part A): 549-565.

[62] Ando, Y., Mitsugi, N., Yano, K., Karube, I. 2001: Isolation of a bacterium from mangrove soil for degradation of sea sludge. *Applied Biochemistry and Biotechnology* 95(3): 175-182.

[63] Maxwell, G.S. 1971: *A Phytophthora species in mangrove communities at Piako, New Zealand*. Unpublished MSc thesis, University of Auckland.

[64] Young, B.M., *Harvey, L.E. 1996:* A spatial analysis of the relationship between mangrove *(Avicennia marina var. australasica*) physiognomy and sediment accretion in the Hauraki Plains, New Zealand. *Estuarine, Coastal and Shelf Science* 42: 231-146.

[65] Bird, E.C.F. 1972: Mangroves and coastal morphology in Cairns Bay, North Queensland. *Tropical Geography* 34: 10-18.

[66] Young, B.M., Harvey, L.E. 1996: A spatial analysis of the relationship between mangrove (*Avicennia marina var. australasica*) physiognomy and sediment accretion in the Hauraki Plains, New Zealand. *Estuarine, Coastal and Shelf Science* 42: 231-146.

Mangroves in Whangamata Harbour

Comparison of the 1995/96 and 2004 vegetation surveys shows that the extent of mangroves has not increased in about eight years. Over this time the area of mangroves has decreased in area by about four hectares. This is the result of unauthorised and consented removal of mature mangroves and unauthorised pulling of seedlings to stop expansion. Although the overall area of mangroves has not increased, there is concern that in some locations their distribution is changing and moving into areas of saltmarsh.

Environment Waikato summarised knowledge of estuarine sedimentation and vegetation issues in the report by Turner and Riddle (2001).[67] Findings in that report showed that in 1997/1999:

- the spatial extent (or spread) of mangroves in the estuary had been mapped from historical aerial photographs (1944 and 1983) and this indicated that the density and distribution of mangroves had increased over that period, with mangrove colonisation most rapid in the upper and middle estuary[68]
- colonisation of the Moanaanuanu Estuary in Whangamata Harbour (to the west of the Whangamata township) has also been rapid - probably in response to the construction of a causeway across the estuary.

Analysis of 1993 aerial photographs by Swales and Hume (1994)[69] suggests that the extension of mangroves in the upper and middle estuary has continued. In another study by Robertson, Frisk and Gillespie (2000)[70] documented an increase in the spatial extent of mangroves from a total area of 31 hectares in 1944 to 44 hectares in 1965 and then to 101 hectares in 1998.



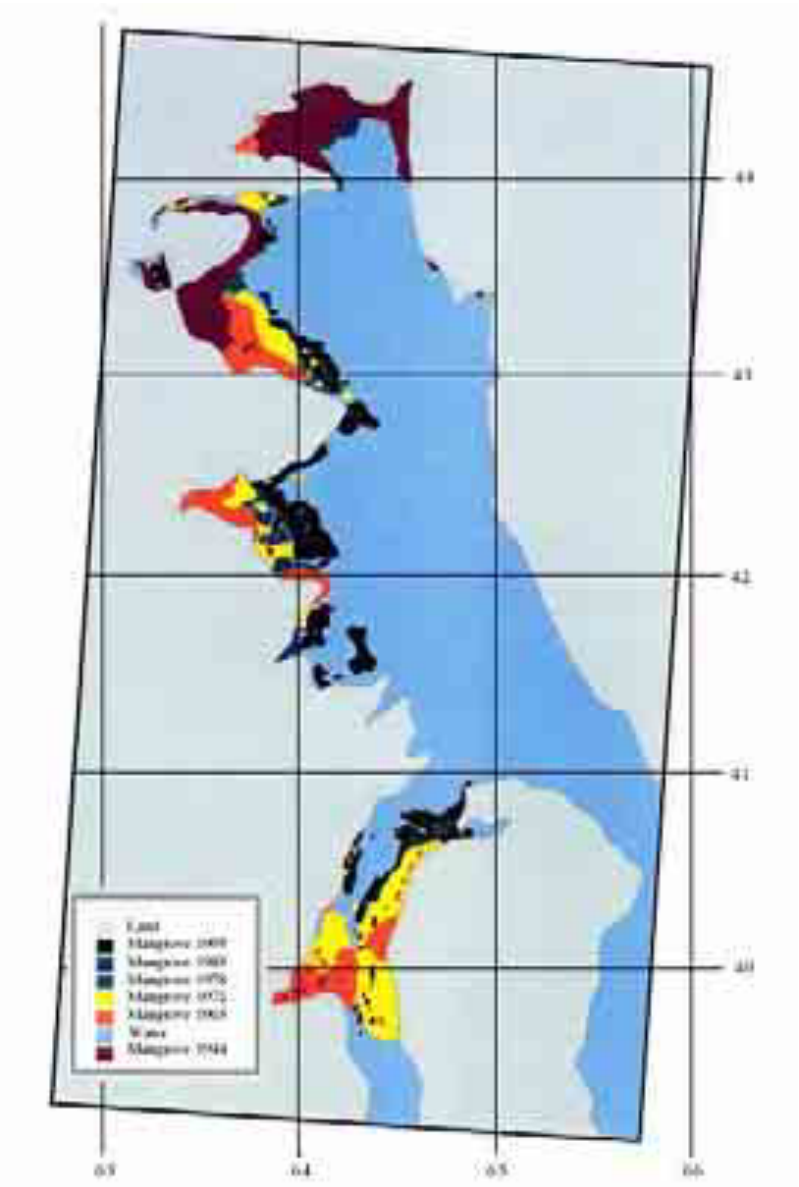
An area of dense mangroves in Whangamata Harbour.

[67] Turner, S. and B. Riddle. 2001: *Estuarine sedimentation and vegetation – management issues and monitoring priorities.* Environment Waikato Internal Series 2001/05. Environment Waikato, Hamilton.

[68] Sheffield, A.T. 1991: *The sedimentology and hydrodynamics of the Whangamata Harbour*. Master of Science thesis, University of Waikato. 190p.

[69] Swales, A. and Hume, T.M. 1994: *Sedimentation history and potential future impacts of production forestry on the Whangamata estuary, Coromandel Peninsula*. NIWA, Consultancy Report CHH003.

[70] Robertson, B., Frisk, S. and Gillespie, P. 2000: *Monitoring Protocol for New Zealand Estuaries. Developing a Benthic Indicator Approach. SMF Project 5096 Interim Report and Summary of Approach*. Report prepared for the Ministry for the Environment.



This map diagram shows the spread of mangroves in Whangamata Harbour since 1944.[71]

Maps showing historic mangrove distribution for 1944, 1965, 1978, 1993 and 2002 ('current day') and a map of the originally proposed 'eight hectares' of targeted mangrove sites initially selected for removal[72] are available in Environment Waikato's Draft Whangamata Mangrove Management Options Report. See 'Mangroves' in section 3.3.3 of this harbour plan for more information about what is happening regarding these targeted sites.

In 2002 Environment Waikato contributed to an investigation into the role nutrients play in the spread of mangroves in Whangamata Harbour.[73] The findings showed the following.

[71] Whangamata Harbour Care Inc,'s Aspiration Plan for Whangamata Harbour 2002.
[72] Some of these sites have been consented and removed; the rest remain proposed sites for future consideration.
[73] Schwarz, A. 2002: *The role of nutrients in contributing to mangrove expansion*. Report prepared for Environment Waikato and Department of Conservation. NIWA Client Report HAM2002-051, NIWA project EVW02237. NIWA, Hamilton.

- There is probably more than one factor causing the spread of mangroves.
- The highest rates of spread of mangroves did not occur where the highest nutrient concentrations were in the sediment.
- Nutrients may be able to increase rates of growth of mangroves in some locations and potentially the spread of mangroves but the results gave no definite evidence that nutrients were the main factor causing mangroves to spread in the estuary in general.
- Nutrients may have site-specific effects.
- Nutrient levels in mangrove leaves indicated that the mangrove growth is limited by nitrogen: maybe it should be considered what effect human activities on the land surrounding the harbour are having on the input of nutrients and consequent increased mangrove growth rate and spread.
- If mangroves are nutrient limited, it is possible that there will be greater mangrove growth in areas where nutrient concentrations are the greatest.
- Highest nutrient concentrations in the sediment were:
  - near sites closer to freshwater inflows
  - at sites closer to the head of the estuary
  - where there was more mud in the sediment.

Life amongst mangroves

The main invertebrates within the mangroves are the snail *Amphibola crenata* and the crab *Helice crassa*.[27] *Helice* burrows are widely scattered. Swarms of minute mysid[74] shrimps are present in shallow films of water. The small black mussel *Xenostrobus pulex* occurs in scattered clumps on the mangrove stems and the high-spired snail *Zeacumantus subcarinatus* is mainly confined to the region along the main channel. *Amphibola* is also quite common in the saltmarsh, although most are quite small. Far more abundant (although not easy to see because of their size) is the small snail *Potamopyrgus estuarinus.*

Consented mangrove removal Patiki Bay

In 2001 an experimental mangrove removal trial in Patiki Bay occurred and in 2004 a further 50 plants were removed. Monitoring of changes in biological and sediment properties was carried out by Coffey[75] [76] as part of the consent.

Unauthorised mangrove clearing

In October 2005 and January 2007 unauthorised clearance of mature mangroves and mangrove seedlings occurred in the Moanaanuanu Estuary. The clearance of mature plants in other parts of the harbour has also occurred. Seedling removal has been a common practice over the years.

Seagrass

Comparison of aerial photographs of seagrass in Whangamata indicates that the beds increased from 79 hectares in 1944 to 101 hectares in 1965, but declined in spatial extent to 60 hectares in 1998. The decline in spatial extent of seagrass and the change in its distribution in Whangamata Harbour has been attributed to a reduction in suitable habitats for seagrass survival (due to the expansion of mud flats). Some of the areas where seagrass occurred historically have now been completely overgrown by mangroves.[20]

[74] Mysid shrimp: Any of various small, shrimplike, chiefly marine crustaceans of the order *Mysidacea*. The females of these species carry their eggs in a pouch beneath the thorax.

[75] Coffey, B. T. 2000: Resource consent 102475: Monitoring Report Trial clearance of Mangroves Patiki Place Reserve, Whangamata Harbour.

[76] Coffey, B. 2005: *Mangrove Clearance Whangamata Harbour, October 2004: Sediment Monitoring Programme to meet Condition 10 of Resource Consent 107665.* Prepared on behalf of Whangamata HarbourCare Inc. for Environment Waikato, Hamilton.

- **Harvesting pressures on shellfish**

The Ministry of Fisheries undertakes annual intertidal shellfish surveys as part of its responsibilities to manage fisheries resources under the Fisheries Act 1996. The cockle and pipi resource at Whangamata Harbour has been surveyed from 2000 to 2005, and 2007. Cockle abundance has varied between 31 and 47 million for all sizes, and numbers are relatively stable. Pipi abundance has shown a generally declining trend in numbers of all sizes from 7.5 to 2.3 million individuals.

- **Invasive weeds and pests (land, freshwater and marine)**

Weeds such as pampas, kikuyu grass and saltwater *Paspalum* have the potential to smother native vegetation and habitats. These weeds can encroach when sources of native seed are scarce or absent and weeds are not controlled. Weeds are common on the harbour fringe and in some of the drier wetlands.





(Left) Saltwater *Paspalum* in the harbour encroaching on seagrass and saltmarsh plants. (Right) Close up of saltwater *Paspalum*.

Responses to date have mainly been focused on ragwort and nodding thistle but these species are now at a point where only minor incidences of them are occurring. There has been the occasional minor infestation of woolly nightshade and wild ginger which are dealt with promptly. In 2000 a survey of the township for regionally important weeds was completed and infestations plotted onto maps. Land owners were then notified of control required and a very successful outcome was achieved. Last year boneseed was discovered for the first time on the Peninsula on several properties in and around Whangamata township and all infestations were controlled.

In the vicinity of the causeway the most serious weed threat in the saltmarsh would be pampas,[77] which is already widespread, and likely to spread further. Purple morning glory and *Montbretia* also have the potential to spread further. Other significant weed species, particularly in the manuka, are black wattle and Sydney golden wattle. All of

[77] Kessels & Associates Ltd; *Whangamata Mangrove Clearance & Saltmarsh Damage, Nov., 2005;* Letter to Environment Waikato by Kessels & Associates Ltd.

these, however, will be limited in their spread by their intolerance of the high salt levels (salinity) within saltmarsh areas.

Other sources of invasive plants come from dumping garden waste on the harbour edge or planting the harbour edge with inappropriate plants that can take over or smother the coastal vegetation (or alter the balance of native plants on the harbour edge).

Neither *Undaria* nor the invasive sea squirt has been found in Whangamata Harbour. Two small patches of saltwater *Paspalum* were recorded in the 1995/96 survey[78] at the point at the end of Aileen Place and at the southern point at the end of Awarua Place. However, the findings of the 1997-2003[79] assessment of estuarine vegetation cover in Whangamata Harbour (an increase in these areas of approximately 1 hectare) and the 2007 ground surveys[80] indicate that this species continues to expand rapidly in the harbour.

Mangrove expansion does not normally occur in saltmarsh areas because of the high and variable salinity. Landward colonisation of mangroves into saltmarsh areas could occur if these conditions change. For example, if freshwater inputs through the saltmarsh decreased, this could change the salinity and allow mangrove colonisation.[81]

Rats

Rats are more common on the fringes of the mangrove areas, preferring dry ground and cover. Mangroves are unlikely to be a preferred habitat. Abundant rat tracks are seen on the mud flats at certain low tides and when there was been no moon. This indicates that they are out on the mud flats and most likely feeding on mud-living creatures. They could be competing for food with shore birds and marine animals.

The Mangrove Steering Group meeting of May 26, 2005 initiated feedback on the topic of rats in mangroves. The following is a selection of the responses.

Stuart Slade, Nukuhou Marshland care Group

Our care group has been monitoring the local saltmarsh (about 60 acres) which borders on a mangrove area, for the last 2 years. We use Trakka cards in tunnels, and run them quarterly: Feb, May, Aug, Nov. We follow DOC protocol, baiting with peanut butter for 1 night, and with rabbit bait for the consectutive 2 nights. We have 30 tracking tunnels, set at 50 m intervals, in three lines of ten, effectively covering 3 sides of the marshland area.

Results to date would indicate that rats tend to be found in greater numbers closer to the drier areas i.e. further away from the mangrove areas. Those tunnels closest to the mangrove area are tracking 100% mice, and this May, 20% (2) stoats! The one rat tracked was in the tunnel closest to the road and farmland.

J Russell, Auckland University

Rats do enjoy browsing the inter-tidal area, but then they would run back up into the forest each night to nest. They have nightly movements around 100's of metres so running from a ridge 500 m to the mangroves would not be an issue. Whether the habitat was mangrove or just silt I imagine is of no difference, it's the amphipods and insects in seaweed etc they go for. I don't imagine them living in mangroves or attacking birds there, or reaching high numbers (whether it be mangroves or any intertidal area) but I stand to be corrected.

In Whangamata there are Norway rats around presumably, which would be very comfortable in the water, though ship rats would be okay too.

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[78] See footnote 22.

[79] Graeme, M. (1997): *Estuary Vegetation Survey Pilot Study: Whangamata, Wharekawa and Otahu. Natural Solutions Ltd:* Marine and Terrestrial Ecologists Report. Environment Waikato.

[80] Graeme, M. (2007): *Estuarine Vegetation Survey: Whangamata Harbour and Otahu Estuary*. Natural Solutions Ltd: Marine and Terrestrial Ecologists Report No. 07/067. Environment Waikato.

[81] Evidence of Bruce Burns from Landcare Research in an application for resource consent by Tauranga District Council for mangrove removal 2004.

A Walker DOC
I'd be surprised if this theory held much weight. Sure there is food there but I don't think the nature of the environment would lead to populations greater than terrestrial sites. Some of the eastern Bay Of Islands islands are infested with Norway rats, much kikuyu, no mangroves.

P Anderson, DOC
I have seen rat prints in mangroves, but these are generally restricted to peripheral areas near dry land and the prints I have observed are less than those I have sighted in other habitats e.g. some silty stream margins in both native forest and farmland. I assume that the prints I have observed in mangroves would be those of Norway rat which are much less common than the more ubiquitous ships rats.

The fact that the banded rail is today mainly confined to mangrove habitats (and can be in good numbers here), particularly where adjoining saltmarsh is present, suggests that rat numbers would be minimal in a mangrove environment. Further, banded rail are either rare or not present at all in other habitats in NZ that don't have mangroves (except for some rat free islands, e.g. Three Kings and the saltmarshes of Nth. West Nelson); strongly suggests to me that mangroves have low numbers of rats and stoats, ferrets, weasels and cats.

Other animal pests

Some animal pests (such as possums) are impacting on native plants and animals. Their grazing impact on vegetation is resulting in erosion and soil run-off, particularly in forested areas of the upper catchment. The Peninsula Project's pest control management has provisions for extending this work into such areas where required.

- **Ecological corridors connecting the different ecosystems**

Ecological corridors are designed to allow movement of wildlife between existing habitat – they allow movement from somewhere to somewhere else. Their design is species-specific and to function they must connect areas of suitable, and safe, habitat for the target species. For native animals living in plantation forests, corridors may also act as conduits to wildlife refuges for survivors of pine harvest. Wildlife corridors may take several forms, such as unbroken strips of habitat, 'stepping stones', or engineered structures (for example, road underpasses or overpasses). Plantation forest itself is also likely to act as a wildlife corridor.

New Zealand is a land of birds, reptiles, and insects. Our only land mammals (bats) are capable of flight. Many forest bird species such as kaka, kereru, and tui are highly mobile and readily travel over open ground or sea. They may utilise small fragments or even suburban gardens to move about the landscape and to seek seasonal food. They do not need continuous forested corridors. Many wetland birds are similarly mobile, as they need to be to access a naturally dispersed habitat.

Kiwi are known to cross open land. In a Northland study, kiwi regularly crossed gaps of 80 metres and in some instances up to 330 metres in less than 10 minutes. They travelled further (up to 1200 metres) where small (less than 4 hectares) forest fragment stepping stones were present. Kiwi will also utilise and live in mature pine forest.

Many other native forest species such as frogs, reptiles and some invertebrates (for example, snails, stag beetles and weta) are small and probably have relatively poor dispersal ability (though there is anecdotal evidence of geckos travelling up to 500 metres in a day). These species are likely to be naturally confined in their distribution because of poor dispersal ability or requirements as individual organisms. They are not likely to need to move large distances on a regular basis to find resources. However, there is little readily available information in the literature to confirm these statements.

Corridors for species with poor dispersal ability are likely to be required for genetic mixing and re-colonisation of habitats where extinctions have occurred. In these instances, however, the corridor must act as a habitat for breeding populations, not a temporary conduit. The animals are unlikely to travel directly over many hundreds of metres along a corridor to reach a target habitat. For the corridor to be effective,

therefore, either long-lived individuals, or successive generations must move in the desired direction along it, each generation inhabiting a section of the corridor ever closer to the destination fragment. An inhabited corridor should be of high quality, and contain forest interior conditions. Such a corridor should have a permanently forested buffer zone of 50-60 metres on each side to ensure forest microclimate conditions exist in part of the corridor.

Some forest species are capable of dispersing across open country, but are highly territorial or edge-shy and tend to do this rarely, or are at great risk of predation if they do. North Island bird species that would benefit from wildlife corridors as conduits include North Island brown kiwi, kokako, tomtit, and New Zealand robin. It has been recommended that such corridors be of good habitat quality for their entire length, and they are likely to need to be very wide to contain a large core with forest interior conditions.

Important aspects of corridors are that they are species specific, different species will need different designs.

Mangroves around the harbour edges can provide vegetation corridors connecting the different shoreline ecosystems and some of those on the land. Currently, however, it is considered that for terrestrial (forest and scrub) species the priority is for pest control and habitat protection.

- **Whitebait and eel numbers**

Inanga, or whitebait, need grassy stream or river edges (riparian habitat) on low banks to live under so they can spawn near the upstream limit of the spring tide salt wedge of coastal streams and creeks. Stock grazing to the edge of these parts of streams prior to and over February to July can damage spawning habitat and road culverts with a fall at their outlet can limit upstream access for migrating whitebait. In 2001[82] Environment Waikato surveyed public road culverts in the Coromandel Peninsula. The survey showed that, of the 17 culverts surveyed in the Whangamata Harbour catchment, four were rated as having no or minimal effect on fish passage, eight were considered likely to be barriers at low flows, and five were considered likely to be barriers at most flows. Since then there have been some major weather events which may have altered the degree to which different culverts limit fish passage.

The Wentworth River and other streams draining catchments with native forested headwaters are expected to have a diverse indigenous fish fauna with several diadromous fish species (fish that regularly migrate between freshwater and seawater) which would necessarily pass through the inlet to complete their life cycles. Predictions of fish distributions throughout the Waikato indicate that Coromandel streams, as well as providing habitat for the main whitebait species (inanga) in coastal areas, also provide regionally important habitat for red-finned bully and for banded kokopu (another member of the whitebait catch). Other fish species recorded in streams draining into Whangamata Harbour include smelt, short-finned and long-finned eels, torrentfish, common bully, giant kokopu. Long-finned eels and giant kokopu are classified as threatened by the Department of Conservation.

3.3.3 What is happening

- **Mangrove expansion displacing other habitats and open water**
- **Unauthorised clearing of mangroves**
- **Loss of wetlands by drainage and reclamation of the harbour edge**

[82] Speirs, D. and Kelly, J. 2001: *Fish Passage at Culverts – A Survey of the Coromandel Peninsula and Whaingaroa Catchment (11/00 - 04/01)*. Environment Waikato Technical Report 2001/08, Environment Waikato, Hamilton.

Habitat

To date, very little is happening in regards to managing the habitats in the Whangamata catchment and harbour. Many of the wetland and saltmarsh habitats are slowly degrading as a result of pressures from weeds and pests, sedimentation, mangrove expansion and stock damage. The purpose of this harbour plan is to help address these issues.

Fencing to exclude stock from some freshwater wetlands, streams and bush has occurred but more still needs to be done.

Vegetation habitat in the harbour was remapped in 2004[83] and more recently an updated survey was completed in 2007 by Environment Waikato.[84] Results for the 2004 survey are shown on Environment Waikato's website (http://www.ew.govt.nz/enviroinfo/indicators/coasts/biodiversity/index.htm).

Identification of locations of harbour habitats suitable for restoration and management are part of this report (see maps in Appendix I). Locations for restoration and management are based on agreement with Environment Waikato, and the Department of Conservation.

A Moanaanuanu Estuary Rehabilitation Concept[85] has been developed and will be used to guide future restoration work in this area. The concept report is now with the Thames-Coromandel District Council for consideration.

Mangroves

In November 2005 Whangamata Harbour Care Inc. lodged a consent application with Environment Waikato seeking to be able to remove mangrove seedlings. The consent was granted in December 2006 by the Environment Court for a 12 year period, with certain conditions to protect bird life, cultural sites and the environment. Mangrove seedlings can be removed between January and July. Mangrove seedling removal from August to December is not permitted, due to the risk of disturbing bird nesting sites.

The area of seedling removal covers a significant part of the harbour, but excludes removing seedlings within mature mangrove areas, or in specified cultural or conservation sites. Only mangrove seedlings with a single stem can be removed and **the removal must be by hand**.

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[83] *Statement of Evidence William Bruce Shaw on behalf of Hauraki Māori Trust Board and Te Kupenga O Ngati Hako*. Environment Court evidence in regard to the proposed Whangamata Marina, Nov,. 2004.

[84] Graeme, M. (2007): *Estuarine Vegetation Survey: Whangamata Harbour and Otahu Estuary*. Natural Solutions Ltd: Marine and Terrestrial Ecologists Report No. 07/067. Environment Waikato.

[85] Beca Carter Hollings & Ferner Ltd. 2007: *Moanaanuanu Estuary Rehabilitation Concept*. 4250648/PFD: T1:65537-SAJ74R01.DOC. Beca Carter Hollings & Ferner Ltd, Tauranga.



Mangrove seedlings can be removed under specific consented conditions between January and July each year.

At the community's request, a further study, limited consultation and a site visit by Environment Waikato ecologists was carried out in early in 2007. A number of sites were selected as proposed areas for the removal of mature mangroves. The areas within these sites (totalling approximately eight hectares) were categorised for proposed removal based on whether they were:

- contributing to sediment accumulation
- spreading into seagrass habitat
- reducing tidal access to wetlands
- spreading into saltmarsh habitat.

A small number of these areas have had consented and monitored mangrove removal carried out by Environment Waikato. Ongoing monitoring in these areas will ensure any harmful or unwanted effects are prevented or reduced. Information gathered through this monitoring will also be useful in decision-making and consultation on future mangrove management required in the Whangamata Harbour. The remaining as yet untouched targeted sites now become part of further consultation provided through the mangrove management options report.

No further mangrove removal will take place until further consultation has been gathered and assessed following the distribution of the Draft Whangamata Mangrove Management Options Report. Currently, **mangrove seedlings only** can be removed under the conditions of the current resource consent granted to Whangamata Harbour Care Inc. earlier in 2007.

For further discussion on the pros and cons of mangrove removal in the Whangamata Harbour, see Environment Waikato's Draft Whangamata Mangrove Management Options Report and Environment Waikato's mangroves webpage. This information can be found in on our website at www.ew.govt.nz/projects/whangamata/index.htm.

Appendix II of the mangrove management options report also contains a copy of the National Institute for Water and Atmospheric Research's (NIWA) publication, '*For and Against Mangrove Control*''. Copies of this publication can also be found on NIWA's website at http://www.niwascience.co.nz/rc/freshwater/mangrove.pdf/view_pdf. This publication clarifies the facts about mangroves, the consequences of actions taken in relation to them and the likelihood of achieving goals through these actions.

Other councils are also dealing with the complex challenge of managing mangroves in their area. For example, Auckland Regional Council (ARC) and Environment Bay of Plenty (EBoP) conducted separate reviews of mangrove issues. EBoP's review focuses on mangroves management in their region, while ARC's review focuses on a technical review of the current state of knowledge of mangrove ecology, recent expansion, and its effects. This information is available in PDF format on each council's website or by phoning the council concerned to order a printed copy.

- Environment Bay of Plenty – Estuary Care Review (2007).86
- Auckland Regional Council – The New Zealand Mangrove: Review of the Current State of Knowledge87 and its summary booklet, 'New Zealand's Mangroves' (2007).88

- **Harvesting pressures on shellfish**

Ngati Puu has done surveys of the shellfish and has monitored the harvest over several years.

- **Invasive weeds and pests (land, freshwater and marine)**

Whangamata is one of the few areas on the Coromandel where little animal pest control is undertaken, however, some independent pest control has carried out by individuals from time to time. For example, a few individual land owners undertake possum control on their own properties but this is not part of any co-ordinated possum control effort. Goat control occurs in the upper catchment, as shown in the map below. No formal pest control for other species (for example rats or mustelids) is undertaken in or around Whangamata harbour or the wider catchment.

Thames-Coromandel District Council is continuing to work with land owners and agencies such as Environment Waikato and the Department of Conservation to establish a consistent approach for dealing with pest control in these areas.

[86] Environment Bay of Plenty, 2007*: Estuary Care Review*. Report to Council, report no. 010607, May, Catalyst Management Services. http://www.envbop.govt.nz/coast/media/pdf/Mangroves-Report-to-Council-010607.pdf.

[87] Morrisey, D., Beard, C., Morrison, M., Craggs, R. and Lowe, M., 2007: *The New Zealand Mangrove: Review of the Current State of Knowledge.* Auckland Regional Council Technical Publication Number 325, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?B1BFD2DD-BCD4-1A24-901C-9AD2050A42F2#mangrove.
Auckland Regional Council, 2007: Mangroves in New Zealand. Summary booklet. Auckland Regional Council, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.

[88] Auckland Regional Council, 2007*: Mangroves in New Zealand*. Summary booklet. Auckland Regional Council, Auckland, New Zealand. http://www.arc.govt.nz/arc/index.cfm?BB3A7F29-BCD4-1A24-9734-A117F8A54F0E.



The bright green area shows where DOC has carried out goat control in the Whangamata Harbour catchment.

Pest control is part of the Peninsula Project and will occur in the Whangamata Harbour catchment but no time has been set at this stage.

The Ministry of Fisheries manages marine biosecurity in New Zealand. Marine biosecurity focuses on the management of exotic (foreign) marine organisms under the Biosecurity Act 1993. Regional councils may become involved in managing exotic or established species that are having harmful effects on a regional scale.

Undaria

The potential impacts of *Undaria* on coastal biodiversity in New Zealand have led to a government funded research programme, which is currently being undertaken by the Cawthron Institute, on the processes of establishment and ecological impacts of *Undaria*. The Ministry of Fisheries is developing a proposal for a National Pest Management Strategy for *Undaria*, which includes input from Cawthron's research findings. In addition, the Department of Conservation is carrying out an *Undaria* eradication campaign on the relatively pristine Stewart Island, where the kelp was discovered in early 1997.

Sea squirt

A lucky result – see item below.

> In October 2001 the Whangamata Harbourmaster noticed a growth dominating wharf piles in Whangamata Harbour. Environment Waikato commissioned a study to describe the distribution and pest potential of the organism. The organism was an *ascidian* (a variety of sea squirt). While previously undescribed it was likely to be native to New Zealand and it is particularly suited for colonising vertical structures such as wharf piles. The bloom in Whangamata Harbour is most likely a natural occurrence. For more information see http://www.fish.govt.nz/sustainability/ballast/pests/squirt.html.

Seagrass

The changes in extent of seagrass are monitored by Environment Waikato as part of the habitat mapping described above.

Rats

In December 2006 the Whangamata Rat Project began with the support of local residents, Environment Waikato and DOC. The project has over 30 rat traps and is currently trapping around the Moanaanuanu Estuary.

Other animal pests

As mentioned above, little animal pest control is currently undertaken in the Whangamata catchment.

- **Ecological corridors connecting the different ecosystems**

The Wentworth Rivercare Group has been working for several years to fence and plant the whole length of the river. This work has been supported by the Environmental Education Programme from its beginning and now also attracts funding from Environment Waikato's 'Clean Streams' project. The group has also been financially support by Thames-Coromandel District Council through the Whangamata Community Board for a number of years.

- **Whitebait and eel numbers**

All road culverts surveyed throughout the region that are considered to form some barrier to upstream fish movement are currently being prioritised to determine those which are the highest priority to fix (remediation). This ranking exercise is taking into account distance of the culvert from the sea and the length of habitat and amount of forest upstream. Initial results suggest that many of the culverts considered of high priority for remediation are likely to occur in the Coromandel reflecting the short nature of the streams there and the presence of native forest headwater habitat. Three of the top 100 priority culverts occur in the Whangamata catchment.

3.3.4 What needs to be done

Marine and saltmarsh habitat management and restoration

- Assess saltmarsh areas, identify key locations for restoration and develop individual restoration plan. Set up care groups.
- Carry out the recommendations in the Moanaanuanu Estuary Rehabilitation Concept report.

Bush and wetland habitat management and restoration

- Identify key locations for restoration and develop individual restoration plans for these locations. Set up care groups and apply for funding.
- Carry out the recommendations in the Moanaanuanu Estuary Rehabilitation Concept report.
- Follow up and rectify any unauthorised infilling or dumping activities.

Invasive weeds and pests (land, freshwater and marine)

- Set up local weed and pest control schemes and projects in key locations.
- Carry out animal pest control work through the Peninsula Project.
- Inform householders about the dangers of planting potentially invasive exotic plants on the harbour's edge.
- Manage and replant existing areas.
- Routinely inspect key locations for invasive marine organisms.
- Spread material removed from stormwater drains in the Wentworth instead of piling it along the bank.
- Control saltwater *Paspalum* in the harbour.

Mangrove expansion

- Continue to remove seedlings in consented areas.
- Continue monitoring areas where consented mangrove removal has already been carried out to ensure harmful or unwanted effects are prevented or reduced.
- Carry out ongoing consultation on mangrove management to resolve the issue of mature mangroves in the harbour.
- Prepare a consent for removing mature mangroves in selected areas, if required.

Whitebait and eel (inanga) numbers

- Exclude stock from riparian and wetland areas, particularly those with a tidal influence as these stream banks are whitebait spawning sites.
- Modify culverts blocking fish passage.

Ecological corridors connecting the different ecosystems

- Fence and plant areas that connect habitats.
- Ensure corridors are included in pest control programmes.
- Seek advice from specialist wildlife experts to determine suitable ecological corridor design and location.

Harvesting pressures on shellfish

- Continue to police and enforce shellfish gathering regulations.
- Continue to routinely assess the shellfish beds to ensure over-harvesting is not occurring.

3.4 Sedimentation and flooding

3.4.1 Issues

- Too much sediment entering the harbour from:
  - forestry and land clearance
  - urban development
  - stream bank erosion, slips, roadways and tracks.
- Sediment accumulating around the causeway.
- Mangroves retaining sediment.
- Contaminants in estuarine mud.
- Silt and smothering effects affecting shellfish, kina and paua.
- Flooding caused by mangroves blocking stream mouths and drainage to the harbour.
- Flooding in low lying areas.
- Animal pests contributing to erosion.

As mentioned before, sedimentation and erosion are natural processes; however in the Whangamata catchment these processes have been accelerated by what people have been doing on the land. To specifically manage this situation, the Draft Whangamata Catchment Management Plan 2007 has been developed in conjunction with the Draft Whangamata Harbour Plan 2007. This catchment plan has more detailed information regarding proposed work programmes and activities related to managing sedimentation and flooding in the Whangamata Harbour catchment. Environment Waikato has also developed the Wentworth River Flood Hazard Assessment Report 2007.[89]

3.4.2 Evaluation

> *"Let it be emphasized that the relative explosion in mangrove numbers and associated expansion of mangroves on their seaward front, are symptoms rather than the cause of the 'mangrove problem': the fundamental causal factor being availability of sediment! ".* Dr. G. S. Maxwell[101]

- **Too much sediment entering the harbour**

Sedimentation can fill in parts of the harbour and smother marine life. The effects can be permanent or slow to recover and often cover large areas. Changes in habitat occur as channels are infilled and the estuary gets shallower and larger areas become intertidal. This general 'shallowing' of the water causes more sediment to become suspended in the water again by wave action, increasing the levels of suspended sediments in the water. These broad scale changes in estuarine habitats cause changes in estuarine vegetation, such as expansion of mangroves. Most sediment enters estuaries during storm events and during storms sediment loads can be orders of magnitude higher than average[90], as can levels of suspended sediments in the water column.[91]

[89] Environment Waikato. 2007: *Wentworth River Flood Hazard Assessment 2007*. Environment Waikato Technical Report 2007/16, Environment Waikato, Hamilton.

[90] Hicks, D.M; Gomez, B; Trustrum, N.A; 2000: Erosion thresholds and suspended sediment yields, Waipaoa River Basin, New Zealand. *Water Resource Research* 36: 1129-1142.

[91] Fahey, B.D; Coker, R.J; 1992: Sediment production from forest roads in Queen Charlotte Forest and potential impacts on marine water quality, Marlborough Sounds, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 26:187-195.



Sediment in Patiki Bay on May 30, 2006.

Some sediment is transported out of estuaries by tidal flows, and some is deposited within the estuary (the exact amount of each will vary between estuaries depending on their characteristics). Fine sediments may eventually be moved out of the harbour by waves and tide. Sediment in sheltered bays, or heavier sediment transported by floods, is less likely to move and can accumulate in parts of the harbour.

High concentrations of fine suspended sediment in the water can harm plants and organisms on soft sediments and rocky reefs. Increased levels of suspended sediments can:

- decrease the amount of food ingested by filter feeders (for example, cockles, pipi) because the majority of particles ingested will be sediments
- clog filter-feeding structures
- damage the gills of bivalve shellfish
- decrease light levels at the seabed, thereby harming plant growth like algae as well as larger plants such as seagrass and seaweeds.

Microscopic algae form a major food source for invertebrates that graze on the sediment surface (for example, marine snails) or ingest sediments and extract organic material from them (for example, many marine worms and the wedge shell *Macomona*, common prey for wading bird species). Filter feeders and other bivalve shellfish provide food for the many wading bird species that live in, or frequent, estuaries.

National Institute for Water and Atmospheric Research (NIWA) research from estuaries within the Waikato and Auckland regions indicates that deposits of soil sediments as thin as three millimetres can cause changes in intertidal soft sediment animal communities[92] and that deposits of more than two centimetres depletes the sediments of oxygen and as a result kills the intertidal animals.[93] Recovery of an intertidal soft

[92] Lohrer et al. 2004: Terrestrially derived sediment: response of marine macrobenthic communities to thin terrigenous deposits. *Marine Ecology Progress Series 273:* 121-138.

[93] Thrush et al. 2004: Muddy waters: elevating sediment input to coastal and estuarine habitat. *Frontiers in Ecology and the Environment 2 (6):* 299-306.

sediment community following deposition of sediments can take a long time – for thin deposits more than one month and for thicker deposits more than 600 days.[94] Because of these long recovery times, repeated deposition of sediments can lead to progressive degradation of animal communities.[95]

Environment Waikato summarised knowledge of estuarine sedimentation and vegetation issues in the 2001 report by S. Turner and B. Riddle, "*Estuarine sedimentation and vegetation – management issues and monitoring priorities"* (Environment Waikato Internal Series 2001/05).

Key findings in that report are listed below.

- Swales and Hume's (1994)96 data (examining four cores from Whangamata Harbour to investigate changes in sedimentation due to historical land-use changes) indicated that background sedimentation rates prior to 1916 A.D. were extremely low (0.1 – 0.18 millimetres per year). Since the 1940s, average sedimentation rates increased to approximately five millimetres per year, with the upper 25-30 centimetres of material deposited over the last 50 years.
- Sedimentation rates of 3.6-7.2 millimetres per year were estimated during times of catchment deforestation at Whangamata (1880-1945 A.D.) (Sheffield, 1991)[97]

Erosion in forested areas

A significant percentage of the catchment is in production forestry (largely in the steeper areas) and in the first few years following harvesting there can be a higher risk of erosion leading to increased sediment run-off effects.

High intensity storms can result in erosion in harvested forest areas on steeper slopes. These are obvious erosion features but they may not always contribute to sediment in the streams. Often the sediment from the slip must travel many metres if it is to reach the stream and is often retained by lower slope and riparian vegetation.

High intensity storms and deforested slopes can, however, combine to produce high run-off events. In these circumstances stream bank erosion can be significant. Bank erosion places material directly into the stream and the high flows mean that this sediment is carried rapidly to the harbour. Such is the run-off intensity that stream bank erosion occurs even with dense, mature, bank vegetation. In these circumstances the stream bank sediment that is eroded may have originated from past inappropriate land practices and will take many storms over many years before it is removed from the system and the stream cleared of the material.

Sediment from stream bank erosion, slips, roadways and tracks

There appears to be no information available on the contribution of sediment from stream bank erosion, slips, roadways and tracks.

[94] Lohrer et al. 2003: Impact of terrigenous material deposition on subtidal benthic communities. *ARC Technical Publication* 217. National Institute of Water & Atmospheric Research Ltd (NIWA), Hamilton; Thrush et al. 2004: Muddy waters: elevating sediment input to coastal and estuarine habitat. *Frontiers in Ecology and the Environment* 2(6): 299-306.

[95] Lohrer et al. 2004: Terrestrially derived sediment: response of marine macrobenthic communities to thin terrigenous deposits. *Marine Ecology Progress Series* 273: 121-138. ; Thrush et al. 2003: Macrobenthic recovery processes following catastrophic sedimentation on estuarine sandflats. *Ecological Applications* 13(5): 1433-1455.

[96] Swales, A., and T. Hume. 1994. *Sedimentation history and potential future impacts of Catchment logging on the Whangamata Estuary.* Prepared for Carter Holt Harvey. NIWA Consultancy Report CHH003.

[97] Sheffield, A.T. 1991: *The sedimentology and hydrodynamics of the Whangamata Harbour.* Master of Science thesis, University of Waikato. 190p.



Sediment deposited in Patiki Bay from the Waikiekie stream on January 26, 2006.

- **Sedimentation accumulating around the causeway**
- There appears to be no information available on the contribution of sediment from urban development to the harbour. Sediment estimation models are available to estimate risk of sediment slugs occurring during the earthworks phase of greenfields development.
- There are no consented quarries in the catchment.
- The construction of the Moanaanuanu Estuary causeway in 1976 altered the flow and sedimentation pattern of the Wentworth River and of the wave and sediment pattern along the shoreline. The causeway acts as a dam and as a result, sediment is building up next to the causeway and is a permanent condition whether mangroves are present or not.
- There is also a causeway by Papamaire Island that has a similar effect to the Moanaanuanu Estuary causeway.
- Mangroves are accumulating sediment.
- Mangroves are known to accelerate the accumulation of mud. However, establishment of mangroves is often difficult unless mud is first present. The investigations by Coffey[98 99] showed that removal of mangroves can result in a slow removal of mud and a change to sandy mud.
- Monitoring in Patiki Bay (as part of a consent to remove mangroves) showed:
  - a change in the surface sediments depended on whether or not mangroves were removed
  - where mangroves were removed the sediment changed from mud to sandy-mud
  - sediments remained muddy where mangroves were not removed

[98] Coffey, B. T. 2000: *Resource consent 102475: Monitoring Report Trial clearance of Mangroves Patiki Place Reserve, Whangamata Harbour.*

[99] Coffey, B.T. 2005: *Mangrove Clearance Whangamata Harbour, October 2004: Sediment Monitoring Programme to meet Condition 10 of Resource Consent 107665.* Prepared on behalf of Whangamata HarbourCare Inc. for Environment Waikato, Hamilton.

- between March 28 to July 31 2005 there were at least three significant rainfall events which increased the sediment transported into the Wentworth and Waikiekie streams and then into the harbour
- the whole area was covered with a new layer of sticky silt and mud up to eight centimetres thick.

- Studies detailed in the Wentworth River Flood Hazard Assessment Report 2007 note the effect of mangroves on sediment accumulation; and the resulting increased flooding risk in the Wentworth River and Moanaanuanu Estuary areas.
- A complicating factor will be the new marina and its effects on wave and sediment movement. The access channel to the marina would likely block any movement of sand to the Moanaanuanu Estuary.

- **Contaminants in estuarine mud**

From the limited literature available on this topic it appears that mangrove soils are good traps (sinks) for wastewater-borne phosphorus and heavy metals (Tam & Wong, 1995).[100] These studies were conducted in sub-tropical southern China with a mangrove assemblage that equates ecologically to New Zealand's stands. Mangroves in this region too were able to capture ('bank') heavy metals (for example, manganese, zinc, chromium, lead) and they remained within the tissues. This means that heavy metals were not in bioavailable form. So, rather than mobilise such toxins both mangrove soils (sediments) and the plants themselves can immobilise potentially polluting heavy metals and even nutrients such as ammonia (a nitrogen source).[101] Further to this, previous studies have shown that it is unlikely that there are contaminants within Whangamata's estuarine sediments and that levels of contaminants in sediments in the Waikato region are naturally quite low (*Nick Kim, Environment Waikato Chemist, pers. comm*.).

Given the above, it is unlikely that contaminants in estuarine mud are an issue in relation to mangrove removal or sediment and flooding works in Whangamata.[102]

- **Silt and smothering effects affecting shellfish, kina and paua**

The impact of consented mangrove removal in Patiki Bay in 2004 was monitored by Coffey[103] as part of the consent. However, the 2005 findings showed the overriding effect of repeated storm events which increased silt accumulation in Patiki Bay.

- Silt deposits had negative effects on shellfish: following a May 17 and 18 2005 storm, pipi and other shellfish were reported dying at the surface where silt was recently deposited.
- The abundance of some animals and plants was reduced because:
  - the numbers of shellfish living at the surface and burrowing mud crabs decreased.
  - silt deposits appeared to negatively affect and decrease the amount of Neptune's necklace (a seaweed) communities along the southern shoreline.

- **Flooding caused by mangroves blocking stream mouths and drainage to the harbour, and flooding in low lying areas**

The Whangamata area, as with many other parts of the Coromandel Peninsula, is subject to frequent high intensity rainfall events which can cause widespread flooding resulting in road closures, erosion, and inundation of low-lying areas. Parts of the Whangamata community have been established on the floodplains of streams which

[100] Tam, N.F.Y and Wong, Y.S; 1995: Mangrove soils as sinks for wastewater-borne pollutants. *Hydrobiologia*, 295: 231-241.

[101] Maxwell, G.S. 2005: *The removal* of mangrove seedlings from Whangamata Harbour. An assessment of environmental effects. Prepared for Environment Waikato, Hamilton.

[102] Environment Waikato internal correspondence, 1 December 2005, *Technical Assessment (marine ecology) mangrove seedling removal Whangamata* – Malene Felsing to Rebecca Cheatly. Environment Waikato, Hamilton.

[103] Coffey, B. 2005: *Mangrove Clearance Whangamata Harbour, October 2004: Sediment Monitoring Programme to meet Condition 10 of Resource Consent 107665.* Prepared on behalf of Whangamata HarbourCare Inc. for Environment Waikato, Hamilton.

will naturally flood. In addition to this, middle and upper catchment areas have been developed and modified over time, exacerbating the potential for increased run-off in a high rainfall event.

The Wentworth River Flood Hazard Assessment Report 2007 notes that there is general flooding within the main channel and that in the future (100 years) sediment accumulation in the channel may result in flooding affecting low lying commercial and residential properties. This flooding would occur whether mangroves were present or not.

Wentworth River and golf course

The golf course lies within the floodplain of the Wentworth River and is often subject to flooding in storm events. While significant areas are inundated, it is usually short term; normally clearing within the next tidal cycle. The floodplain area should therefore be kept clear of any further development.

The floodplain downstream of the golf course needs to be managed so as to allow floodwaters to flow freely. As vegetation (mangroves, pampas etc.) builds up in this area, so too does the silt deposition, resulting in a deterioration in drainage/flood relief.

A minimum clear and open floodway needs to be established and maintained through this reach.

Other streams flowing into Whangamata Harbour

There are a number of streams that feed into the harbour system; the main ones being the Wentworth, Waikiekie and Te Weiti. The latter two have predominantly production forestry catchments and can at times have a high silt loading during flooding. As there is little 'fall' (gradient) between State Highway 25 and the harbour fringes, silt often settles in this area and seriously impacts on the existing stream channels. The presence of vegetation, including mangroves, significantly slows down the flood flows and encourages the silt to settle and accumulate at key areas, especially where the stream meets with the harbour system.

In the case of the Te Weiti Stream, for example, the natural channel that previously ran through the mangroves was completely filled in and the base flow had diverted itself onto neighbouring farmland. The State Highway 25 box culvert had silted up by 80 per cent of its capacity as a result. The channel for the Te Weiti Stream was reinstated in 2006.

Both the Waikiekie and Te Weiti streams have had urban development occur in their lower reaches and their silted channel systems flood in high rainfall events, impacting on nearby dwellings. Other streams that enter the harbour also have the potential to cause heavy silt deposition and flooding at the harbour entry point. This isn't currently causing problems because no dwellings or infrastructure[104] are at risk. However, this may change in the future.

Mangrove removal may be necessary on an ongoing basis on the Waikiekie, Te Weiti and other streams in order to be able to maintain the channels effectively where they enter the harbour.

Industrial area

The industrial area lies immediately upstream of the causeway and relies heavily on the existing stormwater system for drainage. Flooding has been occurring in this area due to the mangroves blocking stormwater drainage outlets.

[104] Examples of infrastructure include roads, powerlines, sewage systems, water services and other organisational structures and services.

- **Animal pests contributing to erosion**

Animal pests such as possums are impacting on native plants and animals, erosion and soil run-off in some areas of the catchment (particularly in the forested areas of the upper catchment).

3.4.3 What is happening

- **Too much sediment entering the harbour**

Erosion in forested areas

Forest harvesting and associated activities (for example, stream crossings, earthworks, quarrying etc.) typically, but not always, require resource consents from Environment Waikato. Part of Tairua Forest drains to the Whangamata Harbour and most forest harvesting to date has been authorised by resource consents from Environment Waikato. Much of Tairua forest is now into its second or third rotation so the need to build new roads and landings during harvesting is diminishing. Typically forest harvesting and earthworks consents contain a wide range of conditions, covering the following matters.

- Compliance with relevant guidelines, for example:
  - The Principles for Commercial Plantation Forest Management in New Zealand.
  - New Zealand Forest Code of Practice.
  - New Zealand Forest Accord.
- Agrichemical Users Code of Practice.
- Erosion and Sediment Control Guidelines for Soil Disturbing Activities.
- Restrictions on the clearance of indigenous vegetation.
- Catchment harvesting constraints.
- Riparian management requirements and specified minimum stream planting setbacks (typically 10 metres for streams draining more than 50 hectares and five metres for streams draining less than 50 hectares).
- Protection of specific ecological values/sites (for example, kiwi, archaeological sites).
- Erosion and sediment controls for earthworks.
- Replanting, site oversowing and re-vegetation.
- Stream monitoring.
- Operational monitoring and reporting.
- Iwi monitoring and liaison.
- Consent review provisions.

Environment Waikato undertakes site monitoring in several ways, including:

- in response to any complaints received
- routine spots checks on operational activities
- full forest audits
- technical review of stream monitoring reports.

Earthworks guidelines

Environment Waikato has developed a comprehensive erosion and sediment control guideline manual for earthworks which is available in hard copy or online at http://www.ew.govt.nz/enviroinfo/land/erosion/sediment.htm. This manual contains a wealth of information on specific erosion and sediment control measures, including detailed designs and practical implementation advice. These guidelines are being increasingly used throughout the region, providing a sound basis for the preparation of site specific erosion and sediment control plans and training courses run by Environment Waikato for contractors and consultants. The guideline manual is the standard reference for consent requirements relating to earthworks such as earthworks for urban developments.

Erosion from urban development

In the case of greenfields development the developer needs to approach the authorities in advance (in order to gain consent) with a plan for how the greenfields are to be developed. The plan will include not only the final look of the development (lot size, housing density, road network, stormwater services and so on) but also how the development is actually going to be carried out. This will include plans for things like staging the development, building access roads, and controlling erosion during earthworks.

Stream bank erosion, slips, roadways and tracks

The Peninsula Project was established in 2004 to improve the health of the peninsula's environment and the safety of its communities by stabilising catchments and reducing the impacts of flooding in the Coromandel area. A 'whole of catchment' approach is taken and the project aims to work with other agencies, iwi, land owners and communities.

Environment Waikato supports land owners, groups and communities through the Peninsula Project and the Clean Streams initiative, to carry out erosion protection, environmental enhancement, river management, animal pest control and flood protection. Technical support, information and advice from Peninsula Project staff are available and funding assistance can be provided.

In addition, the Draft Whangamata Catchment Management Plan 2007 has more specific information regarding proposed work programmes and activities related to managing sedimentation and flooding in the Whangamata Harbour catchment.

Wentworth Rivercare Group

The Wentworth Valley is the only significant area of farmland in the catchment and Environment Waikato has been working with the Wentworth Rivercare Group for a number of years to fence and plant the length of the river. These efforts focus on the area above the golf course. This includes the main channel as well as tributaries. The group is now working on a 3-5 year management plan and looking at different planting techniques and plant species.

Future work the group is considering includes:

- fencing
- planting of appropriate native species
- removal of weed species including willow from stream banks
- removal of blockages in the main channel
- possible re-shaping of banks in areas where erosion has occurred due to willow or blockages.
- seeking further support from the wider community.

Environment Waikato's Wentworth River Flood Hazard Assessment Report 2007 has relevant information which will be useful in making decisions related to dealing with potential blockages by mangroves in the Wentworth River and the Moanaanuanu Estuary.

- **Flooding caused by mangroves blocking stream mouths and drainage to the harbour, and flooding in low lying areas**

In 2006 Environment Waikato removed selected mature mangroves from Te Weiti Stream to increase its capacity to carry floodwaters. The works were carried out under the Peninsula Project.

- **Animal pests contributing to erosion**

As mentioned in the habitat section above, little animal pest control is currently undertaken in the Whangamata catchment.

3.4.4 What needs to be done

A general outline of work which needs to be done is contained in the section below. For more detailed information on proposed works and programmes, see the Draft Whangamata Catchment Management Plan 2007 and the Wentworth River Flood Hazard Assessment Report 2007.

Too much sediment entering the harbour

General

- An analysis of slope, geology and land use needs to be done to identify slopes of high erosion risk. This assessment would cover the entire catchment, including forestry.
- Ensure the land use or land management of high risk steeper areas is appropriate for the slope.
- Removing sediment-trapping mangroves to clear stream channels and flood paths will enhance sediment entry into the harbour. Sediment retention areas may therefore need to be created to trap sediment before it reaches the harbour. These can be deepened stream beds, artificial ponding areas or structures that trap sediment on route to the harbour. Such retention areas would require periodic removal of sediment and maintenance. Natural areas of sediment accumulation such as wetlands and even mangrove areas could also be utilised for this purpose. They may require some modification and could provide both wetland and sediment trapping functions. These natural areas would also require periodic removal of the accumulated sediment. Suitable locations for creating sediment traps may be present on the Waikiekie and Te Weiti streams as well as on other minor streams flowing into the harbour.
- No structures or dumping of material should be allowed in the harbour that may encourage the accumulation of sediment by forming higher ground or a bund that would result in long-term infilling in any part of the harbour.

Erosion in forested areas

- Continue monitoring existing consents to ensure forestry activities follow best practice and comply with the appropriate standards.
- Monitor the annual rate of forestry harvest in each catchment to avoid removing significant areas in short timeframes.

Erosion from urban development

- Continue to require consents for earthworks in high risk erosion areas and to promote the use of existing guidelines through consents, advocacy and training.
- Establish ongoing ownership of consents for when developers have moved on to ensure someone will be accountable for ongoing issues associated with sedimentation, erosion and stormwater.
- Use a sediment model as part of the consenting process to estimate the risk of large amounts of sediment being produced at one time (sediment ‘slugs’) during the proposed development. If the risk is considered to be too high, the developer could be required to alter the plans.

Stream bank erosion, slips, roadways and tracks

- Fence and plant waterways and eroding areas like hill slopes on farm land. This would involve the following actions.
  - Determine the current vegetation cover and type, stock access to waterways and animal pest numbers in the upper, mid and lower reaches of the catchment
  - Develop an erosion management plan for the catchment, which includes guidelines of what to plant and where.
  - Explore the possibility of working with the golf club to form a care group for river protection. Also seek their input into managing the club’s riparian areas, which are currently grassed right to the waters edge and mown.
  - Advocate community support for groups who need help with planting days, weed releasing and maintenance of plantings.

  - Ensure pines are not planted or harvested near streams.
- Explore ways to manage bank erosion along the Wentworth River, including the option of reshaping the banks to prevent continued undermining and collapse into the river.



Stream bank erosion on the Wentworth River could be a major contributor of sediment to the Moanaanuanu Estuary – note how deeply cut-in and vertical the banks are.

Sediment accumulating around the causeway

- Report on the sediment effects of replacing the causeway with culverts or a bridge.
- Carry out the recommendations in the Wentworth River Flood Hazard Assessment Report 2007. These include:
  - controlling existing mangroves in the Moanaanuanu Estuary to extent they are currently controlled
  - continuing to carry out surveys of sedimentation trends in both the Wentworth River and Moanaanuanu Estuary be to assist in decision-making for future flood management options for the river/estuary system.

Mangroves retaining sediment

- Carry out consultation on mangrove management to determine how mangroves will be managed.
- Develop a habitat restoration plan to manage mangroves in key locations.

Flooding caused by mangroves blocking stream mouths and drainage to the harbour

- Establish and maintain a clear channel for water to flow to the sea to ensure the golf course and other fringe areas are not adversely affected by the spread of mangroves and the associated build up of sedimentation. This would involve:
  - determining the required width
  - clearing obstructing mangroves and removing any surplus build up of silt that is affecting drainage and impacting on upstream properties (for example, the golf course)
  - ensuring the efficiency of the stormwater system established by the Thames-Coromandel District Council is preserved.

Flooding in low lying areas

- Investigate options for managing the river and floodway as part of the Peninsula Project and the Whangamata Catchment Management Plan.
- Carry out the recommendations in the Wentworth River Flood Hazard Assessment Report 2007, including:
  - planning controls
  - flood control works
  - catchment and river management and improvement work
  - mangrove removal and/or control
  - existing mangroves in the Moanaanuanu Estuary to be controlled to current extents

- continued surveys of sedimentation trends in both the Wentworth River and Moanaanuanu Estuary be carried out to assist in decision-making for future management options for the river/estuary system.

Animal pests contributing to erosion

- Carry out further animal pest control work where animal pests are impacting on erosion and soil run-off (for example, in the forested areas of the upper catchment) as part of the Peninsula Project's pest control operations.

3.5 Recreation, boating, access and views

3.5.1 Issues

- Accidental spills of oil or contaminants.
- Antifouling paints affecting sea life.
- Dredging affecting the harbour.
- Mangroves blocking navigation access up to Mum's Store.
- Public access to the harbour.
- Marina pros and cons.
- Views need to be protected.
- Native vegetation needs to be extended to cover the western face of the peninsula (Te Puia Point).

3.5.2 Evaluation

- **Accidental spills of oil or contaminants in harbour**

Environment Waikato works with other agencies to prevent and plan for marine oil spills so we can minimise the impact these incidents may have on our environment. In the first instance, whoever spills oil in the marine environment is responsible for:

- cleaning up the spill (if capability allows)
- any costs involved in cleaning up the spill
- immediately notifying Environment Waikato's marine oil spills and ready response teams on **Environment Waikato's freephone 0800 800 401** – no matter how big or small the spill is.

The most likely marine spill scenario in the Whangamata Harbour coastline is from boat owners or operators being careless when refuelling at wharves, jetties or marinas.

Under the *Maritime Transport Act 1994*, Environment Waikato prepares for marine oil spills in its coastal marine areas and responds to them should they occur. Marine oil spills that require a response from Environment Waikato are dealt with by our 'Marine Oil Spills Response Team'. Oil spills that happen in freshwater such as lakes and rivers are responded to by our 'Ready Response Team'. However, during large spills, our marine and freshwater response teams work together with other agencies. In New Zealand, marine oil spill response is classified into three tiers or levels as follows:

Tier 1 – the spiller is known and is able to respond adequately to the spill. All industries with oil refuelling sites along the shoreline must have a contingency plan approved by Environment Waikato to deal with spills.

Tier 2 – a spill is within Council's territorial sea boundary (less than 12 nautical miles), the spiller (if known) is unable to deal with the spill, and the council is able to adequately respond to the spill.

Tier 3 – a spill is outside the council's territorial sea boundary (more than 12 nautical miles) but within the 200 nautical mile Exclusive Economic Zones (EEZ). If the spill is beyond the resources of the council, Maritime New Zealand (MNZ) is requested by the council to take over responsibility.

Environment Waikato has prepared a Marine Oil Spill Contingency Plan which is approved every three years by Maritime New Zealand. The plan outlines how we can reduce the impacts of a marine oil spill and help restore any damage to the environment resulting from the spill. We also carry out regular separate and combined training exercises involving our marine oil spill and ready response teams. Teams attend regular training courses and we also keep and maintain a substantial amount of response equipment on behalf of Maritime New Zealand.

Under the *Maritime Transport Act 1994*, Environment Waikato can prosecute individuals or organisations who cause a marine oil spill in our coastal marine area.

Available equipment

- The Whangamata fire brigade has a boom that can be used to contain spills.
- While there is no equipment held by Caltex for its fuel pump on the wharf, all Caltex road tankers (which service the pump) carry an oil spill response kit on board.
- Environment Waikato has limited equipment (predominantly booms) stored at the Whitianga Marina.
- Environment Waikato has a wide range of equipment stored at its main base in Gordonton near Hamilton.

Additional actions that need to be carried out have been identified in section 3.2.4 of this plan.

- **Antifouling paints affecting sea life**

The two chemicals found in antifouling paints (diuron and irgarol) were measured in water and sediment in Whangamata Harbour.[105]

The levels of diuron and irgarol in the seawater at Whangamata were safe.

- Diuron and irgarol concentrations were not close to New Zealand marine protection guidelines and not likely to have negative effects on sensitive marine species such as algae.
- Irgarol limit was 24 ng/L but it was not detected at Whangamata.
- Irgarol concentrations were low by global standards.
- Diuron limit is 1800 ng/L but concentrations at Whangamata were only 10 ng/L.
- Diuron concentrations were much lower than the maximum level measured in other harbours in New Zealand (190 ng/L in Picton Harbour).
- The primary source of diuron in seawater is the leaching of antifouling paints from boat hulls. Diuron stays dissolved in seawater so is transported out of estuaries with the tide. Consequently, diuron builds up in seawater when several boats are present and the movement of water out with the tide is limited.
- The levels of diuron and irgarol in the sediment at Whangamata were safe:[106]
- Diuron concentrations were less than 5 ng/g.
- Irgarol marine environmental protection limit in New Zealand is 1400 ng/g but concentrations were less than 5 ng/g.
- Irgarol concentrations were much lower than the highest concentration recorded in this study 1450 ng/g (at the Picton boat repainting yard in sediment 5 -10 centimetres below the surface).

Wastewater run-off from washing boats carries discrete paint particles and cause higher concentrations of diuron and irgarol in marine sediments adjacent to boat hull-washing facilities at other locations in New Zealand. However not all slipways were sources of high levels.

[105] Stewart, C. 2003: *Antifouling co-biocides in New Zealand coastal waters*. Prepared for the Ministry for the Environment.

[106] Measurements: ng/g = nanograms per gram; ng/L = nanograms per litre.

Wastewater needs to be disposed of carefully where boat hulls are washed and repainted because it can be a major source of contaminants to coastal waters and can be prevented.

- **Dredging affecting the harbour**

The channel to the boat launching ramp has been dredged in the past but has silted up relatively quickly. As a result of this a modified scallop dredge is run over the channel on a monthly basis to re-suspend the sediment. This is timed to occur on a 'king' outgoing tide to maximise tidal movement of this material out of the harbour. This has resulted in the channel depth being maintained with minimum disturbance of sedentary marine species that occupy habitats in this area. It is anticipated that this will continue to occur.

However, there is some concern that increased/decreased sedimentation into the harbour and dredging or similar activities may impact on the sediment supply to the harbour's bar, affecting the quality of the bar for surfing. It is therefore preferable that any dredged sand is deposited within the beach sand system.



Space for moorings, boating, access to the water and views are all important aspects of using the harbour.

- **Mangroves blocking navigation access up to Mum's Store**

This was investigated and mangroves are not blocking access. However, other vegetation and overhanging branches are.

- **Public ccess to the harbour**

There are currently esplanade reserves and public access to much of the urban areas of the harbour. However, access to the water is not always possible because of mangroves and saltmarsh. Access for boats to the water is via the Beach Road boat ramp.

- **Marina pros and cons**

Issues and effects resulting from the recently approved Whangamata marina are dealt with in the conditions of its resource consent.

- **Views need to be protected, and native vegetation needs to be extended to cover the western face of the peninsula (Te Puia Point)**

The current Thames Coromandel District Plan has zoned the land on the western face of the Te Puia Point as coastal. This indicates that the land has special characteristics including outstanding landscape values. There are no special conditions encouraging its reversion to native vegetation. Thames-Coromandel District Council has undertaken a District Landscape Assessment which includes public input into what are important landscapes.

3.5.3 What is happening

- **General**

Ports and Harbours Risk Management Plan

The Ports and Harbours Risk Management Plan has been developed and sent to Maritime New Zealand for comment and approval. The plan has been developed in line with the New Zealand Port and Harbour Marine Safety Code (the Code) produced by Maritime New Zealand. The aim of this plan is to promote good practice in the conduct of safe marine operations in ports and harbours throughout the Waikato region. The plan also aims to establish a system covering all marine operations in the region's harbours to ensure that risks are both tolerable and managed to ensure they are reduced to as low as reasonably practicable. This involved identifying the risks to navigation in and around the harbour as well as the ways in which those risks could be reduced or removed. This has resulted in the introduction of various navigation mechanisms to lessen the likelihood of a boating accident.

Moorings in Whangamata Harbour

The Regional Coastal Plan specifies a maximum number of 157 moorings within a zoned mooring area. This number is less than the current number of existing moorings. Therefore, no swing moorings can be transferred until such time as the mooring numbers have been reduced to below the maximum number. Currently there are 84 pole moorings and 103 swing moorings. The zoned mooring area and moorings are shown below.



Moorings in Whangamata Harbour. The red dots show swing moorings and the green are pole moorings

- **Public access to the harbour**
  Boat ramps and trailer parking

As mentioned in section 3.5.2, the channel to the boat ramp is dredged on a monthly basis to maintain boat access to the harbour. Further to this, Thames-Coromandel District Council carried out a survey of Coromandel Peninsula boat ramps in 2005.[107] They have also carried out work on the levels of service and provision of facilities associated with recreational boating, particularly trailer boats and provision of boat ramps (2006a, 2006b).[108] [109]

The Draft Boat Ramp Levels of Service report (2006a)[110] suggested one 'district' standard boat ramp be provided in Whangamata. A discussion amongst the local Harbour Committee and Community Board in response to this report concerned whether the ramp should remain as is (that is, natural sand) or be concreted. There are also issues regarding sufficient provision of boat trailer parking.

- **Views need to be protected, and native vegetation needs to be extended to cover the western face of the peninsula (Te Puia Point)**

Thames-Coromandel District Council's Coromandel Peninsula Blueprint Project[111] is being developed to help guide future development of the district. Important views and landscapes for each settlement/catchment and the harbour, and any related special building requirements, or need for protection from development, will be identified in this process and protected via the district plan. The public will be able to comment on such future plan changes.

3.5.4 What needs to be done

Antifouling paints affecting sea life

- Although the levels of diuron and irgarol in the water were safe, areas used for hull scraping and washing should be carefully managed to prevent contaminants entering the harbour.

Public access to the harbour

- Continue to provide access to and around esplanade reserves.
- Provide suitable launching ramps.
- Start thinking about options for meeting boat trailer parking needs – this is an emerging issue.

Views of the western slopes

- This issue cannot be addressed through the harbour plan. However, important views and landscapes for each settlement/catchment will be identified through the Coromandel Peninsula Blueprint project.

Harbour views

- This issue cannot be addressed through the harbour plan. However, important views across the harbour and any related special building requirements, or need for protection from development, will be identified through the Coromandel Peninsula Blueprint project. Note, this is not related to private household views of the harbour.

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[107] Thames-Coromandel District Council (2005): Thames-Coromandel Boat Ramp Users Survey (January 2005): Summary of Results. Unpublished report by the Thames-Coromandel District Council.

[108] Thames-Coromandel District Council, (2006a): *Draft TCDC Boat Ramps - Level of Service Report*. Prepared by ProphetiAM consultants, Tauranga.

[109] Thames-Coromandel District Council, (2006b): *Commercial and Recreational Use of Harbour Facilities Within the TCDC District – Trends and Issues.* (March 2006). Prepared by Progressive Business Consulting Limited, Thames.

[110] Thames-Coromandel District Council, (2006a): *Draft TCDC Boat Ramps - Level of Service Report*. Prepared by ProphetiAM consultants, Tauranga.

[111] This is a joint project between Thames-Coromandel District Council, Environment Waikato, the Department of Conservation and Hauraki Iwi.

4 An integrated plan

4.1 Integrating actions in the catchment and harbour

Section 4 of this plan has detailed and evaluated the various issues facing the harbour identified during the plan's development from a wide range of sources as previously mentioned. These have been prioritised based on the risk of occurrence, impact and existing or planned activities to manage the issue. A high priority ranking has been given to issues that have high risk and high impact and require further action. Details on the recommended actions and those who could undertake the actions have also been noted.

4.1.1 Prioritisation of issues

The table below highlights the main risks to the harbour in order of priority. The priorities are based on what is currently underway to correct the issue and the long-term impact on the harbour of doing nothing. If future conditions change, then the priorities will also change. For example, nutrients from agriculture are currently not a serious issue but if agricultural use intensified then nutrient run-off from farmland would become important.

Main environmental issues facing the harbour

Issue	Comment	Risk	Impact	Priority for action
Sedimentation	Infilling is potentially permanent or difficult to reverse. Affects habitats and usable area of harbour, mud versus sand substrate linked to mangrove spread.	High	Very high	Very high
Invasive weeds and pests (land, freshwater and marine)	Weeds can smother habitats. Pests such as rats can deplete bird life. Pests such as possums can damage vegetation which contributes to erosion in forested areas.	High	High	High
Harvesting pressures on shellfish	Likely to be important. Needs investigation.	High	High	Low – Ngati Puu routinely monitor shellfish stocks
Habitat management and restoration	Wetlands and saltmarsh are most at risk and need management to maintain extent and improve quality.	High	Medium	High
Bacteria in water	Health risk affecting shellfish gathering. Wastewater plant will be upgraded. Sources from farmland and bush with animal pests.	High	Medium	Medium
Mangrove expansion	Mangroves have not expanded since 1995. A consent to pull seedlings	Low – because spread is	Medium – because of	Medium

Issue	Comment	Risk	Impact	Priority for action
	is underway. Further consultation on mangrove management is imminent.	largely under control	invading other habitats	
Flooding	Risk is to private property in specific locations.	Medium	Low	Medium
Whitebait and eel numbers	Riparian planting and stock exclusion would increase breeding and places to feed. This is being done.	Low	Medium	Low – because fencing is underway, but more is needed
Accidental spills of oil or contaminants	From land or sea. Control measures are in place.	Low	Medium	Low
Nutrients in water	This problem is coming mostly from the wastewater irrigation area. A consent has now been granted for an upgrade of the Whangamata Wastewater Plant. This upgrade (by 2008) will reduce the amount of nutrients entering the harbour from this source. Much of the catchment is in forest which has low nutrient levels.	Low	Low	Low – process to upgrade wastewater plant is underway
Contaminants in stormwater	Filters installed to remove contaminants in most locations. Work is underway. Where required, additional filtering such as cesspits or biological filters (for example, wetlands) could be installed.	Low	Medium	Low – because work is underway
Reclaiming land by filling in wetlands	Minor occurrences where this has happened, thus few wetland areas need to be restored.	Low	Low	Low
Ecological corridors connecting the different ecosystems	Desirable but not essential. Will occur with riparian plantings.	Low	Low	Low
Dredging	Managed by resource consent conditions.	Low	Low	Low
Foams and scum	Visual only.	Nil	Nil	Nil
Contamination from antifouling paints	Investigations show no impacts.	Nil	Nil	Nil – but may change in the future

The following figures (1-4) summarise the importance of the various issues for the Whangamata catchment and harbour and the importance of the actions needed to manage or prevent the impacts.

Figure 1. Issues and actions relating to harbour water quality

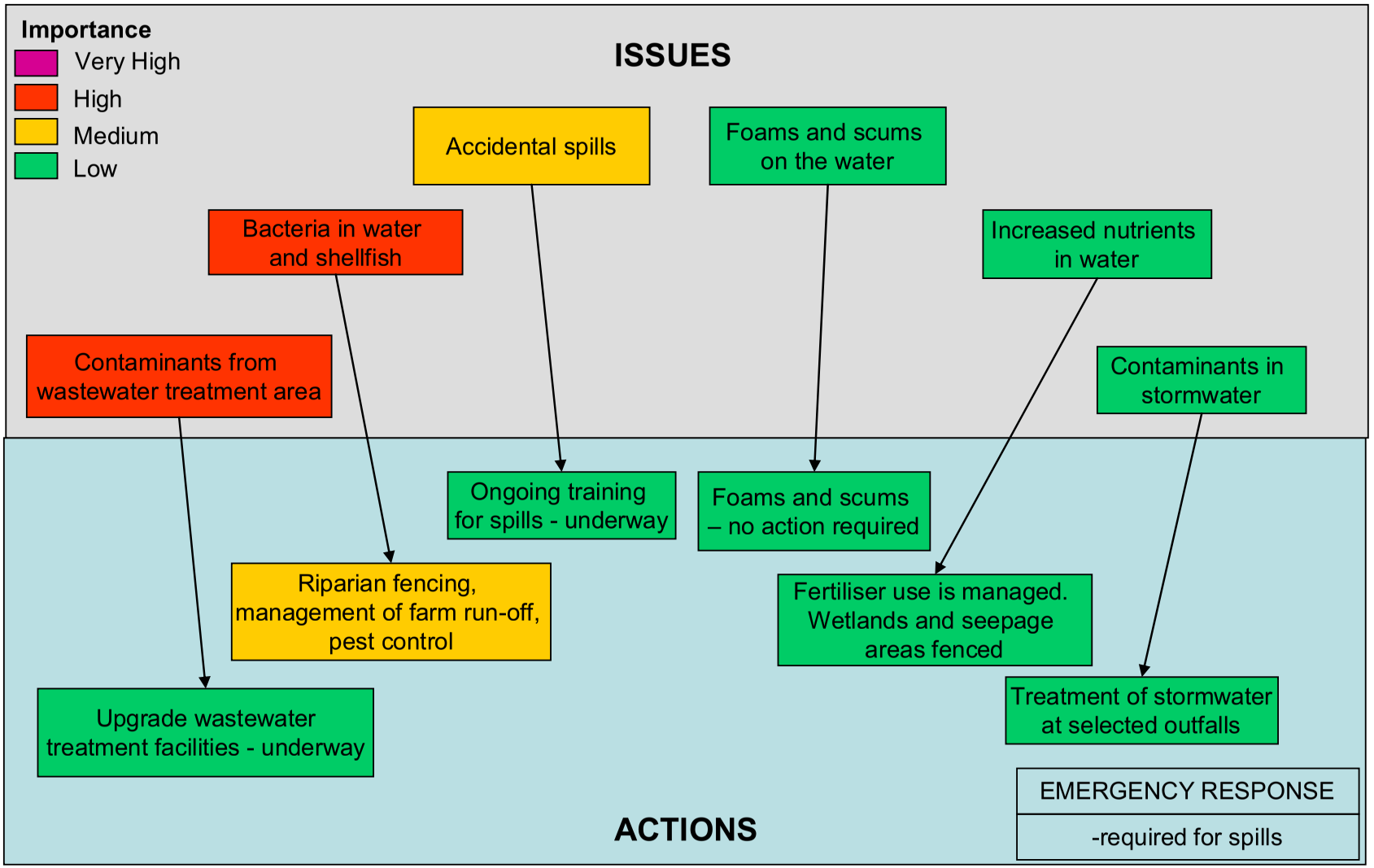


Figure 2. Issues and actions relating to harbour sedimentation

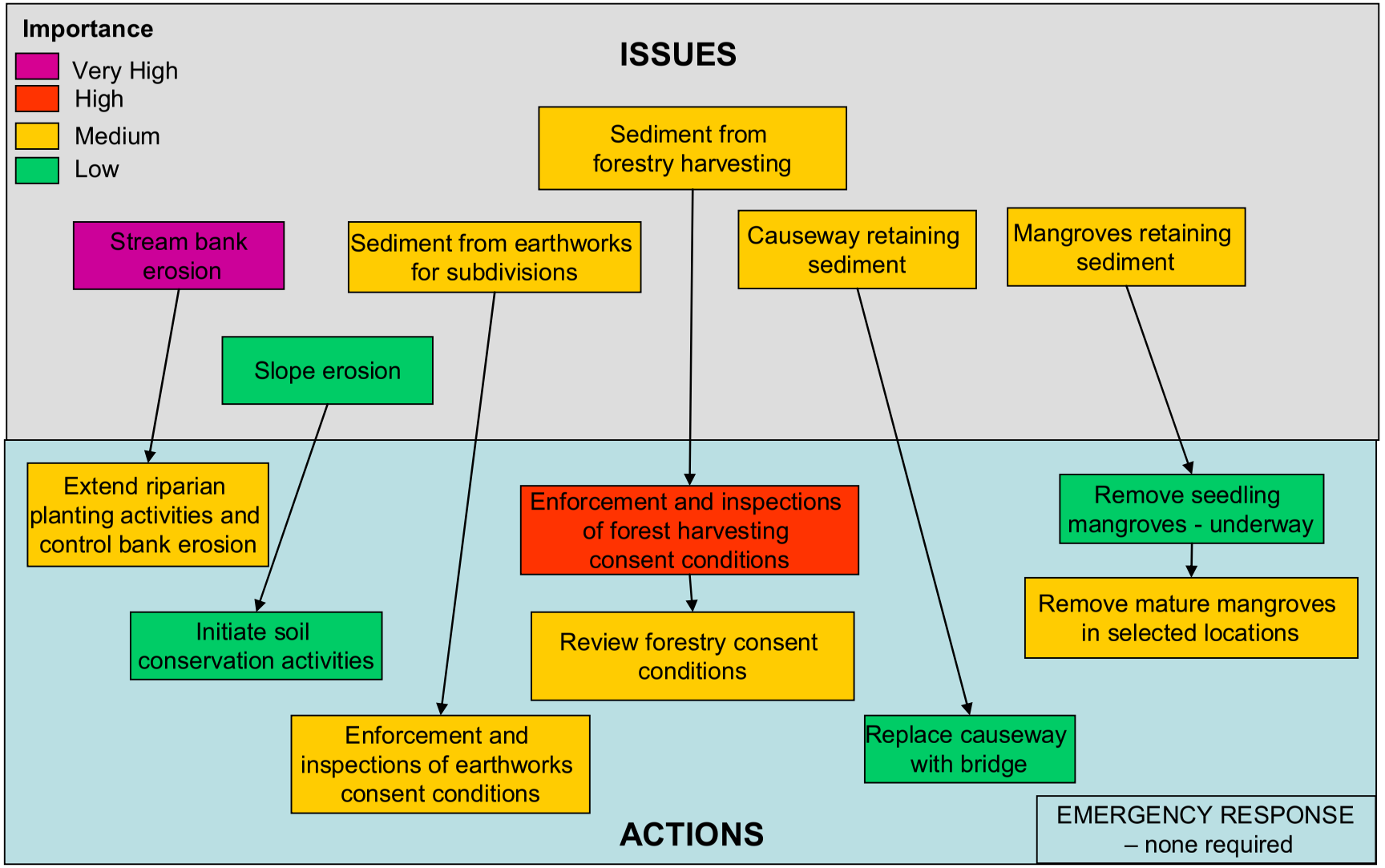


Figure 3. Issues and actions relating to harbour habitat

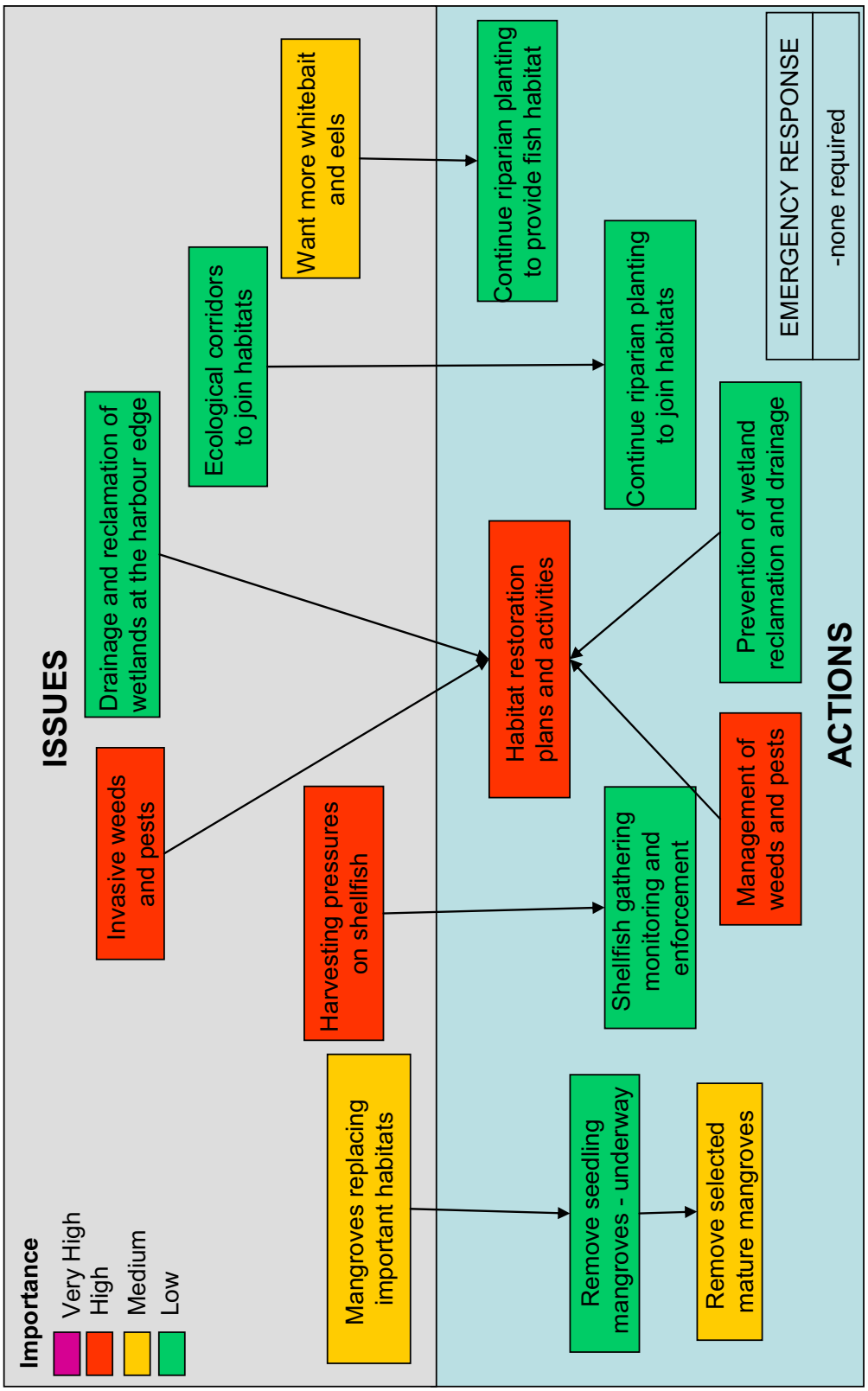
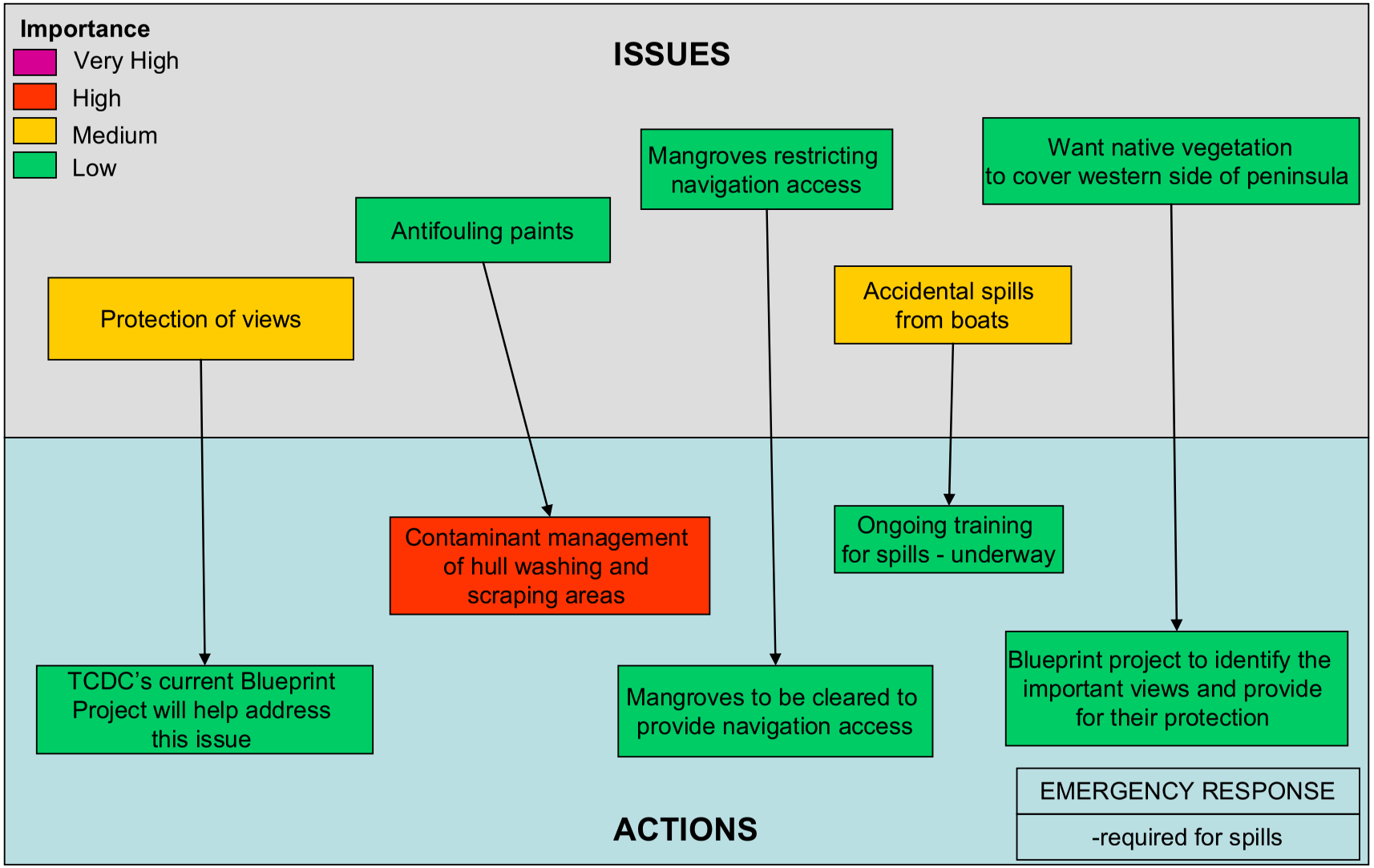


Figure 4. Issues and actions relating to harbour recreation, boating, access and views



4.1.2 Actions

The Draft Whangamata Harbour Plan is a non-statutory document that gives an overview of the issues facing the harbour and the actions needed to achieve improvement. These have been prioritised to help guide activities of the various groups working in the catchment and harbour. The required actions may also become part of government agency work plans and form the basis for funding applications. For example, implementation of any mangrove management would be through the consent process and by those who wish to have them managed. Any outstanding items not dealt with in the current actions proposed by this harbour plan and its associated documents can be addressed through council processes, such as the Long-Term Council Community Plan (LTCCP), or by community processes such as through the Whangamata Community Plan or Care groups.

- Ongoing community consultation will include the distribution of the Draft Whangamata Harbour Plan 2007 and Draft Whangamata Catchment Management Plan 2007 documents and a questionnaire for feedback. Environment Waikato will also distribute a Whangamata Mangrove Management Options Report to Whangamata ratepayers for comment and feedback.
- There may also be coordination through the Whangamata Community Board and the Coromandel Liaison Subcommittee. It is envisioned that Environment Waikato will continue to promote and maintain implementation of the harbour plan with the various interested groups and organisations.
- The Wentworth River Flood Assessment Report 2007 will also be used to address sedimentation and flooding issues in the Wentworth Valley and Moanaanuanu Estuary areas.
- The Moanaanuanu Estuary Rehabilitation Concept currently under consideration by Thames-Coromandel District Council will be useful in guiding restoration efforts in this area.
- If any changes are required to Environment Waikato's statutory plans (for example, the Regional Coastal Plan) arising from the issues and actions noted in this harbour plan and its associated documents, these will be addressed through council and statutory processes as required.

Table showing issues that need addressing, the required actions and who could be responsible

Issue: Sedimentation		
Relevant community visions and goals as outlined in Section 2.1. • The harbour will be a clean, ecologically healthy, sandy playground in which human activity is in balance with nature. • The harbour will have productive pipi and cockle beds. • Catchment management through the Whangamata Catchment Management Plan will minimise any harmful environmental effects. • Discharges to the waters of Whangamata will be managed to protect the wairua (spirit) of the estuaries and restore the health of the ecosystems. • Riparian planting and sediment trapping strategies for improving harbour water clarity and the sandiness of intertidal sea beds will be carried out. • Land use in the catchment will minimise erosion.		
Key concerns/risks	**Proposed actions**	**Who**
Sediment entering the harbour	Identify slopes of high erosion risk.	Environment Waikato
	Ensure the land use or land management of high risk steeper areas is appropriate for the slope.	Environment Waikato Land owners
	Investigate the option of using created or natural sediment retention areas to trap the sediment before it enters the harbour.	Environment Waikato
Stream bank erosion	Fence and plant waterways and eroding areas like hill slopes on farm land.	Environment Waikato Whangamata Golf Club Care groups Farmers
	Explore ways to manage bank erosion along the Wentworth River, including the option of reshaping the banks to prevent their collapse.	Environment Waikato Care groups
Erosion from forested areas	Continue to monitor existing consents to ensure forestry activities (particularly earthworks and forest harvesting in high risk locations) follow 'best practice' and comply with the appropriate standards.	Environment Waikato
	Monitor the annual rate of forestry harvest in each catchment to avoid removing significant areas in short timeframes.	Environment Waikato
Erosion from urban development	Continue to require consents for earthworks in high risk areas and to promote the use of existing guidelines through consents, advocacy and training.	Environment Waikato
	Establish ongoing ownership of consents for when developers have moved.	Environment Waikato
	Use a sediment model as part of the consenting process to estimate the	Environment Waikato

	risk of large amounts of sediment being produced at one time (sediment 'slugs') during the proposed development. If the risk is considered to be too high, the developer could be required to alter the plans.	
Mangroves retaining sediment	Carry out consultation on mangrove management to determine how mangroves will be managed.	Environment Waikato
	Develop a habitat restoration plan to manage mangroves in key locations.	Environment Waikato Whangamata Harbour Care Care groups Department of Conservation Iwi Forest & Bird
Sedimentation caused by causeway	Report on the sediment effects of replacing the causeway with culverts or a bridge.	Environment Waikato
	Carry out the recommendations in the Wentworth River Flood Hazard Assessment Report 2007.	Environment Waikato

Issue: Flooding

Relevant community visions and goals as outlined in Section 2.1.

- Riparian areas of the catchment are protected from harmful effects.
- Land use in the catchment will minimise erosion.
- People, property and essential services will be better protected from flooding.
- Sedimentation will be reduced in rivers, harbours and estuaries.

Key concerns/risks	Proposed actions	Who
Flooding caused by mangroves blocking stream mouths and drainage outlets to the harbour.	Establish and maintain a clear channel for water to flow to the sea. This includes clearing obstructing mangroves and removing any surplus build up of silt that is affecting drainage and impacting on upstream properties.	Environment Waikato
Flooding in low lying area (for example, near the Wentworth River)	Investigate options for managing the river and floodway as part of the Peninsula Project and the Whangamata Catchment Management Plan.	Environment Waikato
	Carry out the recommendations in the Wentworth River Flood Hazard Assessment Report 2007.	Environment Waikato
Animal pests contributing to erosion	Carry out further animal pest control work where animal pests are impacting on erosion and soil run-off (for example, in the forested areas of the upper catchment) as part of the	Environment Waikato

	Peninsula Project's pest control operations.	

Issue: Habitat restoration

Relevant community visions and goals as outlined in Section 2.1.

- The harbour will be a clean, ecologically healthy, sandy playground in which human activity is in balance with nature.
- The harbour will have productive pipi and cockle beds
- There will be greater understanding of coastal values by communities.
- There will no longer be any contaminants polluting the waterways or harbour, and many more wetlands exist because of community activities.
- The protection of a range of diverse, healthy life in the harbour including birds, fish, shellfish and plants and ensure people will be able to harvest kaimoana ('food from the sea') with confidence from productive and accessible beds.
- The protection and restoration of estuarine habitats and ecosystems.
- Planning will be carried out to address how mangroves will be protected in identified areas, but kept out of areas where other ecosystem values and uses would be adversely affected by their presence.
- A community education programme will be developed to foster awareness of our coastal environments and their values.
- Birds will be reintroduced into restored forest and wetland habitats.
- Inanga (whitebait) numbers and their spawning habitat will be increased.

Key concerns/risks	**Proposed actions**	**Who**
Marine and saltmarsh habitat management and restoration	Assess saltmarsh areas, identify key locations fro restoration and develop individual restoration plans for these locations. Set up Care Groups and apply for funding. Carry out the recommendations in the Moanaanuanu Estuary Rehabilitation Concept report.	Thames-Coromandel District Council Community Care groups Whangamata Harbour Care Department of Conservation Iwi Forest & Bird
Bush and wetland habitat management and restoration	Identify key locations for restoration and develop individual restoration plans for these locations. Set up care groups and apply for funding. Carry out the recommendations in the Moanaanuanu Estuary Rehabilitation Concept report.	Community Care groups Department of Conservation Iwi Environment Waikato Thames-Coromandel District Council
	Follow up and rectify any infilling or dumping activities.	Environment Waikato Thames-Coromandel District Council Farmers Urban population
Invasive weeds and pests (land, freshwater	Set up local weed and pest control schemes and projects in key	Environment Waikato

and marine)	locations.	Department of Conservation Local community members
	Carry out further animal pest control work through the Peninsula Project.	Environment Waikato
	Inform householders about the dangers of planting potentially invasive exotic plants on the harbour's edge. Manage and replant existing areas.	Thames-Coromandel District Council Environment Waikato
	Routinely inspect key locations for invasive marine organisms.	Environment Waikato Department of Conservation
	Spread material removed from stormwater drains in the Wentworth instead of piling it along the bank.	Thames-Coromandel District Council
	Control saltwater *Paspalum* in the harbour.	Environment Waikato Department of Conservation
Mangrove expansion	Continue to remove seedlings in consented areas.	Whangamata Harbour Care Inc.
	Continue monitoring areas where consented mangrove removal has already been carried out to ensure harmful or unwanted effects are prevented or reduced.	Environment Waikato
	Carry out ongoing consultation on mangrove management to resolve the issue of mature mangroves in the harbour.	Environment Waikato
	Prepare a consent for removal of mature mangroves in selected areas, if required.	Environment Waikato
More whitebait and eels	Exclude stock from riparian and wetland areas, particularly those with a tidal influence as these stream banks are whitebait spawning sites. Modify culverts blocking fish passage.	Environment Waikato Farmers
Ecological corridors connecting the different ecosystems	Fence and plant areas that connect habitats. Ensure corridors are included in pest control programmes.	Environment Waikato Farmers Department of Conservation
	Seek advice from specialist wildlife experts to determine suitable ecological corridor design and location.	Environment Waikato Department of Conservation
Harvesting pressures on shellfish	Continue to police and enforce shellfish gathering regulations. Continue to routinely assess the shellfish beds to ensure over-harvesting is not occurring.	Ministry of Fisheries Ngati Puu

Issue: Water quality

Relevant community visions and goals as outlined in Section 2.1.

- The load to the wastewater system is minimised and no pollutants enter the waters of Whangamata.
- The volume of run-off and pollutants entering the stormwater system is minimised.
- Discharges to the waters of Whangamata will be managed to protect the wairua (spirit) of the estuaries and restore the health of the ecosystems.
- Riparian planting and sediment trapping strategies for improving harbour water clarity and the sandiness of intertidal seabeds will be carried out.
- The riparian area of the catchment will be protected from harmful effects.

Key concerns/risks	Proposed actions	Who
Bacteria and nutrients	Options for removal of contaminants from stormwater are in place or being investigated.	Thames-Coromandel District Council
	Continue education to ensure people understand that chemicals and contaminants should not be poured down stormwater drains or onto surfaces draining to stormwater.	Urban population Environment Waikato
	Put in place processes to reduce high loads of contaminants coming from two permanent drains entering the Wentworth River.	Environment Waikato
	Identify properties with high rates of nutrient leaching and run-off and help owners put in place practices that will improve their nutrient efficiency and reduce contaminant run-off.	Environment Waikato
	Encourage more farmers to fence and plant the waterways on their properties (including wetland and seepage areas) and install bridges and culverts for stock crossings.	Farmers
	Carry out further animal pest control in forested areas.	Department of Conservation Forestry companies Environment Waikato
	Avoid excess or unnecessary fertiliser use.	Land owners
Accidental spills of oil or contaminants	Regularly inspect high risk industries.	Thames-Coromandel District Council
	Continue spill prevention and containment training.	Environment Waikato Thames-Coromandel District Council
	Ensure equipment for spills is readily available.	Thames-Coromandel District Council
	Boaties need to be aware of spill prevention procedures and the actions they should take if a spill occurs.	Boat owners Environment Waikato
The need for catchment-based planning to protect water quality.	Prioritise in regional and district planning documents the actions needed to improve water quality.	Environment Waikato Thames-Coromandel District Council

Issue: Recreation access and views

Relevant community visions and goals as outlined in Section 2.1.

- The harbour will have a stable, natural backdrop including forests, bush walks and appropriate land use.
- The harbour will be a clean, ecologically healthy, sandy playground in which human activity is in balance with nature.
- Public access will be provided around the harbour margins.

Key concerns/risks	Proposed actions	Who
Antifouling paints	Although the levels of diuron and irgarol in the water were safe, areas used for hull scraping and washing should be carefully managed to prevent contaminants entering the harbour.	Thames-Coromandel District Council
Public access	Continue to provide access to and around esplanade reserves. Provide suitable launching ramps. Start thinking about options for meeting boat trailer parking needs – this is an emerging issue.	Thames-Coromandel District Council
Views of the western slopes	Identify important views and landscapes for each settlement/catchment through Thames-Coromandel District Council's Coromandel Peninsula Blueprint Project.	Thames-Coromandel District Council Community representatives
Harbour views	Identify important views across the harbour and any related special building requirements, or need for protection from development, through the Coromandel Peninsula Blueprint Project. Note, this is not related to private household views of the harbour.	Thames-Coromandel District Council

Other

Relevant community visions and goals as outlined in Section 2.1.

- Catchment management will minimise any harmful environmental effects.
- There will be greater understanding of coastal values by communities.
- A community education programme will be developed to foster awareness of our coastal environments and their values.

Key concerns/risks	Proposed actions	Who
Public comment and formalising the Draft Whangamata Harbour Plan 2007	The Draft Whangamata Harbour Plan 2007 and a questionnaire will be distributed to Whangamata ratepayers and made available to residents and stakeholders.	Environment Waikato
Public comment and formalising the Draft Whangamata Catchment Management Plan 2007	The Draft Whangamata Catchment Management Plan 2007 and a questionnaire will be distributed to Whangamata ratepayers and made available to residents and stakeholders.	Environment Waikato

Mangrove management	The Whangamata Mangrove Management Options Report and a questionnaire will be distributed to Whangamata ratepayers and made available to residents and stakeholders. Some consented removal of mangroves has already been carried out in some areas within the 'eight hectares' initially selected as appropriate for proposed mature mangrove removal. These areas will be monitored to ensure any harmful or unwanted effects are prevented or reduced. Information gathered through this monitoring will be useful in decision-making and consultation on future mangrove removal and removal methods required in the Whangamata Harbour. The remaining sites from the 'eight hectare' areas now become part of the ongoing consultation process on managing mangroves. No further mangrove removal will take place until further consultation has been gathered and assessed following the distribution of the Whangamata Mangrove Management Options Report. During and after the consultation process, all proposals for mangrove removal will still need to go through a consent process.	Environment Waikato
Regional Coastal Plan	Update the Regional Coastal Plan in relation to issues and changes resulting from the Whangamata Harbour Plan and council's decision regarding mangrove management.	Environment Waikato
Monitoring progress	Provide timelines to review the achievements of actions and accountability is necessary to make sure that action and implementations occur.	Relevant organisations

4.1.3 Whangamata Harbour management area maps

Contained in this section are:

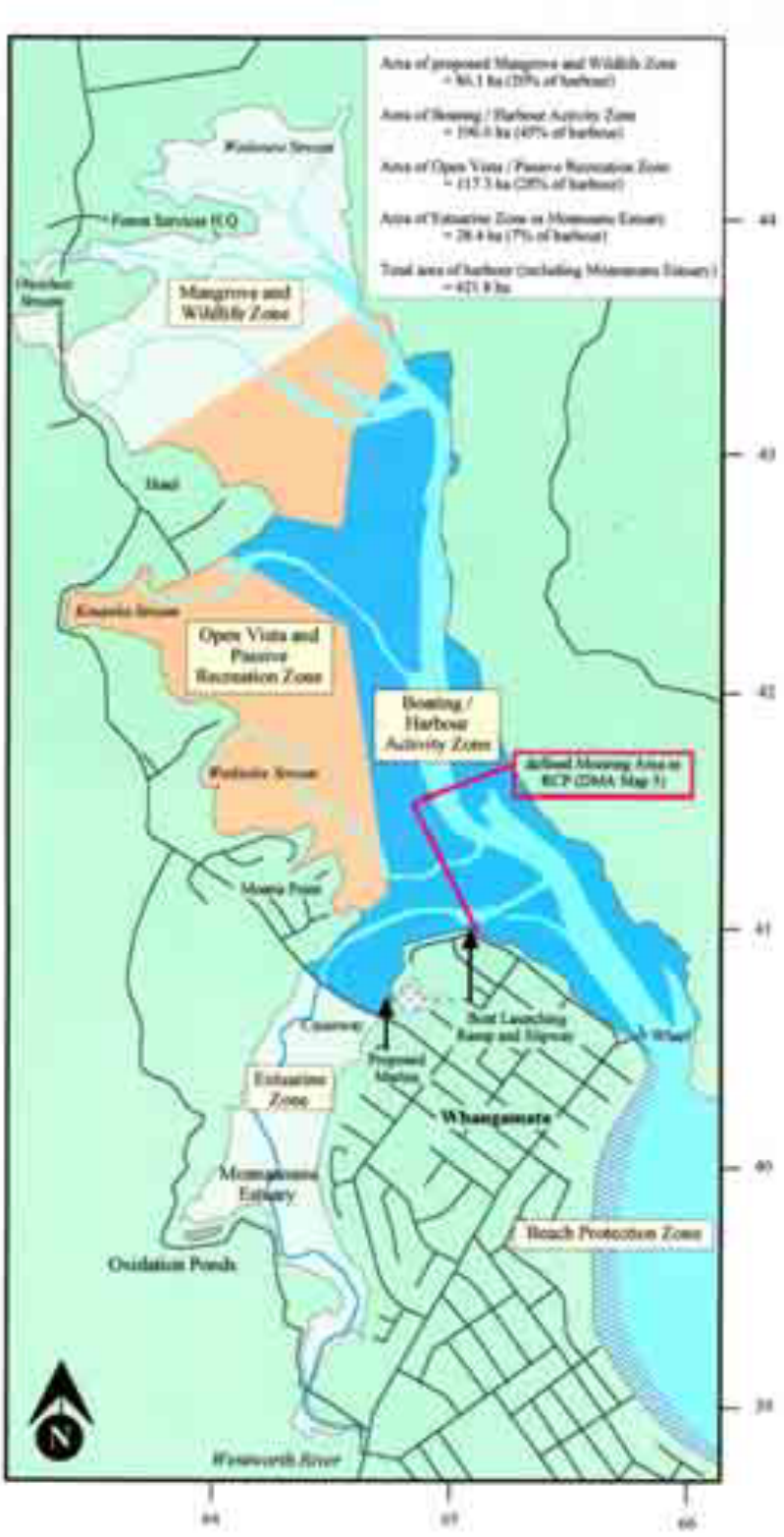
- Maps showing the different options preferred 2002 and 2005 by Whangamata Harbour Care Inc.
- Map showing the zones within the harbour as shown in the Regional Coastal Plan.

In addition, the following maps are included in Appendix I.

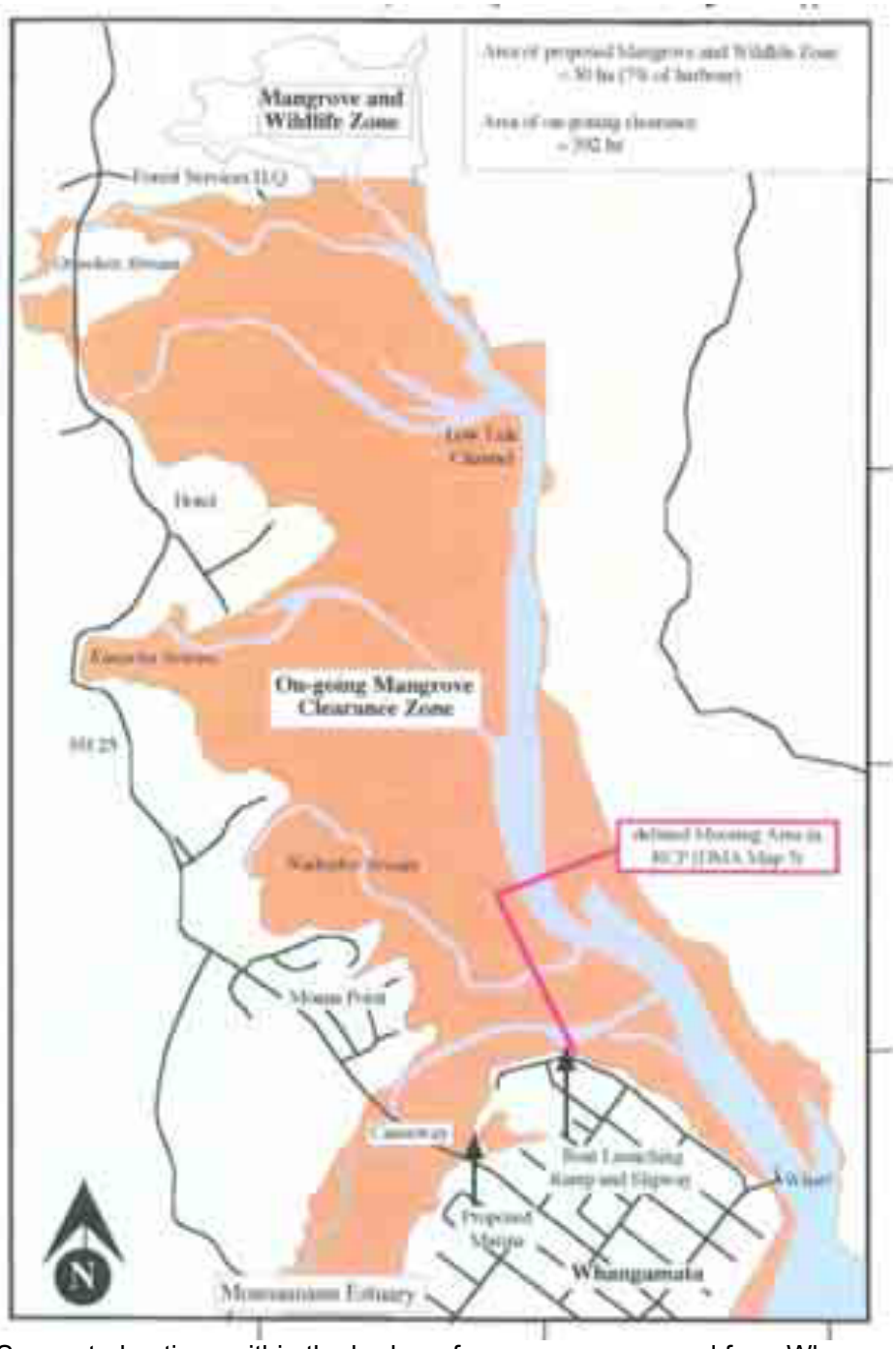
- Whangamata catchment map
- Whangamata locations map
- Whangamata catchment – Land clearance
- Whangamata catchment – Slope and flood hazards
- Whangamata catchment – Iwi heritage
- Whangamata catchment – Land cover

- Whangamata catchment – Targeted sites - the ‘eight hectares’ of initially selected mangrove removal sites identified by Environment Waikato in 2007.

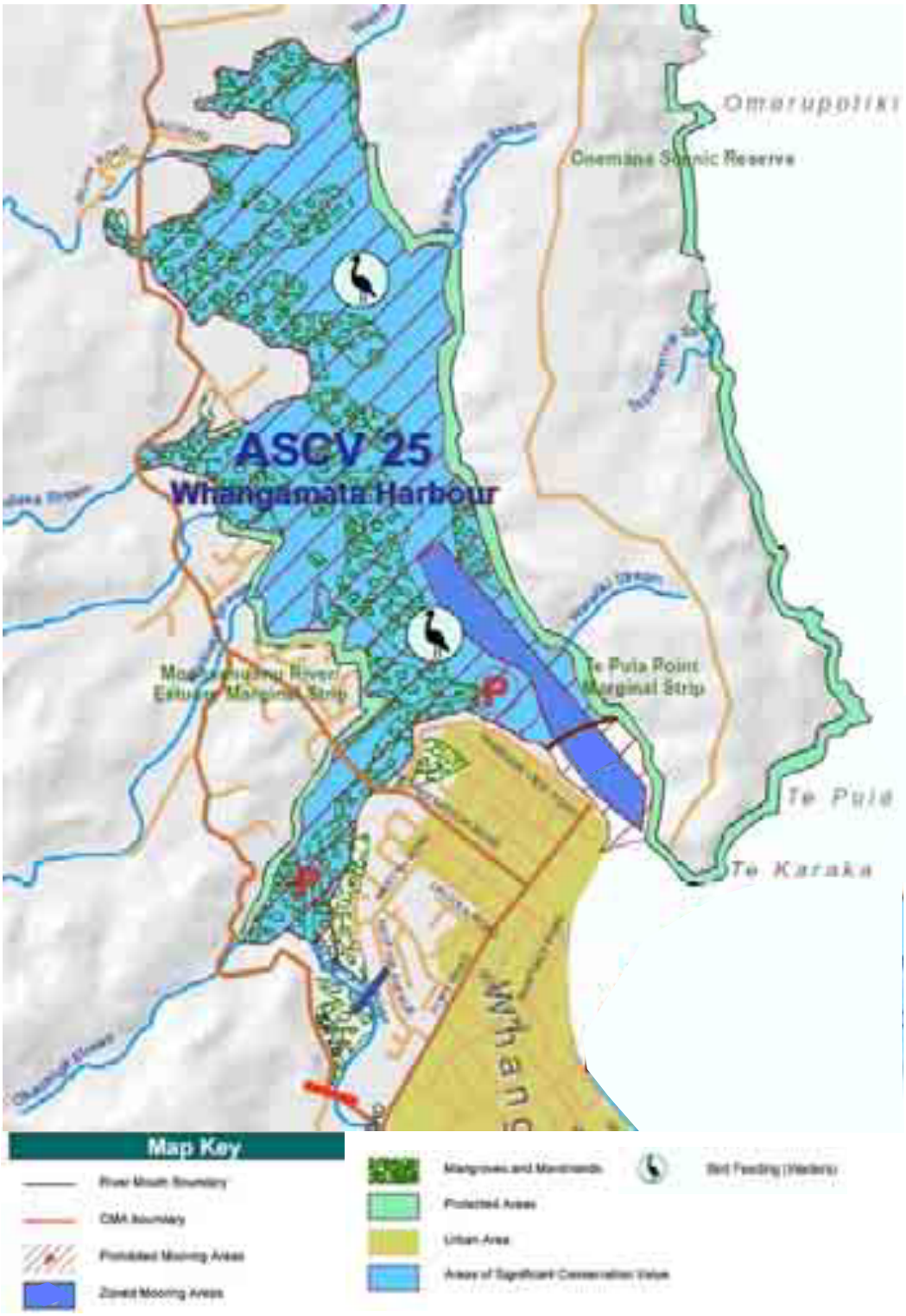
See also the Draft Whangamata Catchment Management Plan 2007 and Whangamata Mangrove Management Options Report. The options report contains another five mangrove maps showing historic mangrove distribution in Whangamata Harbour in 1994, 1965, 1978, 1993 and 2002 (‘current day’).



Suggested management options within the harbour presented in Whangamata Harbour Care Inc.’s Aspiration Plan in 2002.



Suggested options within the harbour for mangrove removal from Whangamata Harbour Care Inc., in 2005.



Zoning within Whangamata Harbour as shown in the Environment Waikato's Regional Coastal Plan.

5 Public participation

Purpose of public participation
The aim of this document is to produce an integrated harbour plan that identifies risks to the harbour and what needs to be done. Members of the public may wish to participate in this plan by:

- receiving information about the harbour plan, its associated documents and the questionnaire
- suggesting who needs to be involved in which parts of the actions planned and how they can be involved
- getting involved in other appropriate actions to improve the harbour and its habitats.

Reasons for public participation
The harbour is important to people who live in or visit the area. It is also important to people in many other ways. For example, people value the natural environment and like to know it will be protected for its own sake. Others have strong associations with the harbour through family and historical relationships. It is a food source, recreational resource and the focus of much of Whangamata's economic and social life.

There are many different people with an interest or stake in the future of the harbour who should have the opportunity to be involved in actions to improve it.

These people include (but are not limited to) the following.

- Whangamata residents.
- Visitors.
- Tangata Whenua.
- Environmental and community groups and organisations.
- Ratepayers and councils.
- Business.
- Recreational groups.
- Schools.

The table below sets how you can participate in the implementation of this plan.

Public participation in the Whangamata harbour pan process		
What you can do	**How**	**Who or Where**
1. You can receive information about the plan and its associated documents	Information in local papers about the Draft Whangamata Harbour Plan and its associated documents, how people can get involved, decisions about the plan, projects and progress reports. The Draft Whangamata Harbour Plan will be distributed to the community and placed on Environment Waikato's website along with the Draft Whangamata Catchment Management Plan, an overview document and questionnaire. The Whangamata Mangrove Management Options Report will also be made available for feedback. This report contains information on six mangrove management scenarios (including 'no removal'). Feedback on this report can been provided using the questionnaire mentioned above. Your feedback will be used in decision-making for future activities related to managing Whangamata's mangroves.	Media releases and direct communication from Environment Waikato. Environment Waikato's website www.ew.govt.nz. Environment Waikato will also make copies of these documents available at local libraries in Thames, Whangamata, Tairua and Hamilton.
2. You can give feedback about the plans and the mangrove management options report - suggesting who needs to be involved - saying how best to involve them	1. You can fill in Environment Waikato's questionnaire to give us feedback on any or all of the above documents (the questionnaire will be provided with the plans and the mangrove management report). 2. You can talk to experts who will visit Whangamata to hear community feedback in person and answer questions. 3. You can attend council meetings during decision-making about actions in the plans. 4. You can receive additional information about decisions on the plans and the reasons for the decisions.	Environment Waikato will provide the opportunity for experts to speak with interested groups. Information on the submission process and progress will be made available by Environment Waikato through media releases, direct communication from Environment Waikato and through Environment Waikato's website www.ew.govt.nz.
3. You can get involved in appropriate actions to improve the harbour	There are many ways that members of the public can be involved in the shared responsibility of managing the harbour. For example, managing pests and weeds, restoring wetland areas, attending relevant meetings. Environment Waikato will seek to support and resource initiatives in Whangamata on an ongoing basis through its Long-term Council Community Planning processes. You and/or your group can also apply to	The relevant agency will advertise events and initiatives they would like to start. Individuals can contact Environment Waikato or the Department of

	various sources for funds which are available for community conservation and habitat projects management. The Department of Conservation (DOC) can assist with these.	Conservation (DOC) with suggestions.
Habitat restoration		
What you can do	**How**	**Who or Where**
You can get involved in the establishment of wetland restoration groups, pest and weed control, riparian planting	Get in touch with Environment Waikato and Forest & Bird. They can help with the establishment of various care groups who have an interest in riparian planting and habitat management including pest control and restoration and planting programmes.	Forest and Bird, Department of Conservation, Environment Waikato, Landcare Trust
Managing run-off and erosion	Get in touch with Environment Waikato staff. They can give you advice on erosion and run-off management. Funding may also be available for planting to control erosion. Farm advisors can advise on nutrient management.	Environment Waikato
Reporting on progress		
What you can do	**How**	**Who or Where**
Be aware and actively watch for information and updates	You can find out information about the Draft Whangamata Harbour Plan's progress on Environment Waikato's website. You can request information from Environment Waikato if you cannot find what you're looking for.	Environment Waikato

How decisions about the plan were made

There were a number of steps in the decision-making process:

Step 1: Identifying the issues affecting the health of Whangamata Harbour and ways to address these issues.

The draft plan was prepared by Environment Waikato staff using existing information and knowledge about the harbour. Ideas and feedback have been sought by sending several versions of the plan to Thames-Coromandel District Council and various groups listed below.

- Whangamata Harbour Committee (a division of the Whangamata Community Board)
- Whangamata Ratepayers Association
- Clean Water Whangamata
- Whangamata Harbour Care
- Whangamata Màori Committee
- Ngati Pu Kaukainga
- Te Runanga o Ngati Pu
- Te Kupenga o Ngati Hako Inc.
- Te Rununga a Iwi o Ngati Tamatara
- Ngati Whanaunga Inc.
- Nga Uri o te Ngahere Trust
- Hauraki Màori Trust Board
- Royal Forest and Bird Protection Society Inc.
- Department of Conservation.

There is agreement on many of the actions suggested by the plan, however, the issue of mature mangrove removal is yet to be resolved.

Step 2: Getting further feedback from community groups.
The Draft Whangamata Harbour Plan 2007, the Draft Whangamata Catchment Management Plan 2007 and a questionnaire requesting feedback will be distributed to community groups for their comment and any further feedback about the issues or gaps in the plans. In recognition of the unresolved mangrove removal issue, the questionnaire will also be used to gather feedback on Environment Waikato's Whangamata Mangrove Management Options Report. The options report will provide a first step in providing Whangamata ratepayers and other relevant stakeholders with additional opportunities to comment on the mangrove management issue.

Step 3: Environment Waikato and Thames-Coromandel District Council will consider feedback and decide to adopt or amend the Draft Whangamata Harbour Plan and the Draft Whangamata Catchment Management Plan.
Once feedback on these plans has been received the councils will make a decision about whether the plans are to be supported or amended and then include their relevant parts within their Long-Term Council Community Plans and operational budgets.

The criteria they are likely to consider when making decisions about these plans includes:

- whether or not the action needs to go through a formal consent process
- the ease of the work
- its likelihood of success
- how it fits with current and planned work
- the level of interest from the public who want to be involved in actions (for example, Care groups)
- the degree of community support and stakeholder support
- contributions to costs
- urgency
- the risks of not doing the work.

Step 4: Environment Waikato will consider feedback on the Whangamata Mangrove Management Options Report and communicate any further decisions about mangrove management in Whangamata.
Before any decisions can be made we will need to:

- have the appropriate experts assess the feedback
- determine whether our decision on mangrove management requires further consultation through a formal process – if so, this would be through public notification and a submissions and hearings process
- take the feasible scenario(s) through the resource consent process
- follow the processes of the Environment Court where required.

6 Milestones

- Completion and distribution of the harbour and catchment plans, mangrove management options report and questionnaire.
- Agreement to undertake the actions in the harbour plan and the catchment plan by Thames-Coromandel District Council and Environment Waikato and relevant actions included in work programmes.
- Harbour and habitat management actions needing community involvement are selected and planned.
- Mangrove control options and actions are selected, planned and communicated once available.
- Actions begin under the guidance of the appropriate organisation such as Whangamata Community Board, Harbour Care, Iwi, Department of Conservation and Forest & Bird.
- Reporting back of progress by the various organisations and groups via council newsletters, newspaper articles, other media and Environment Waikato's website.

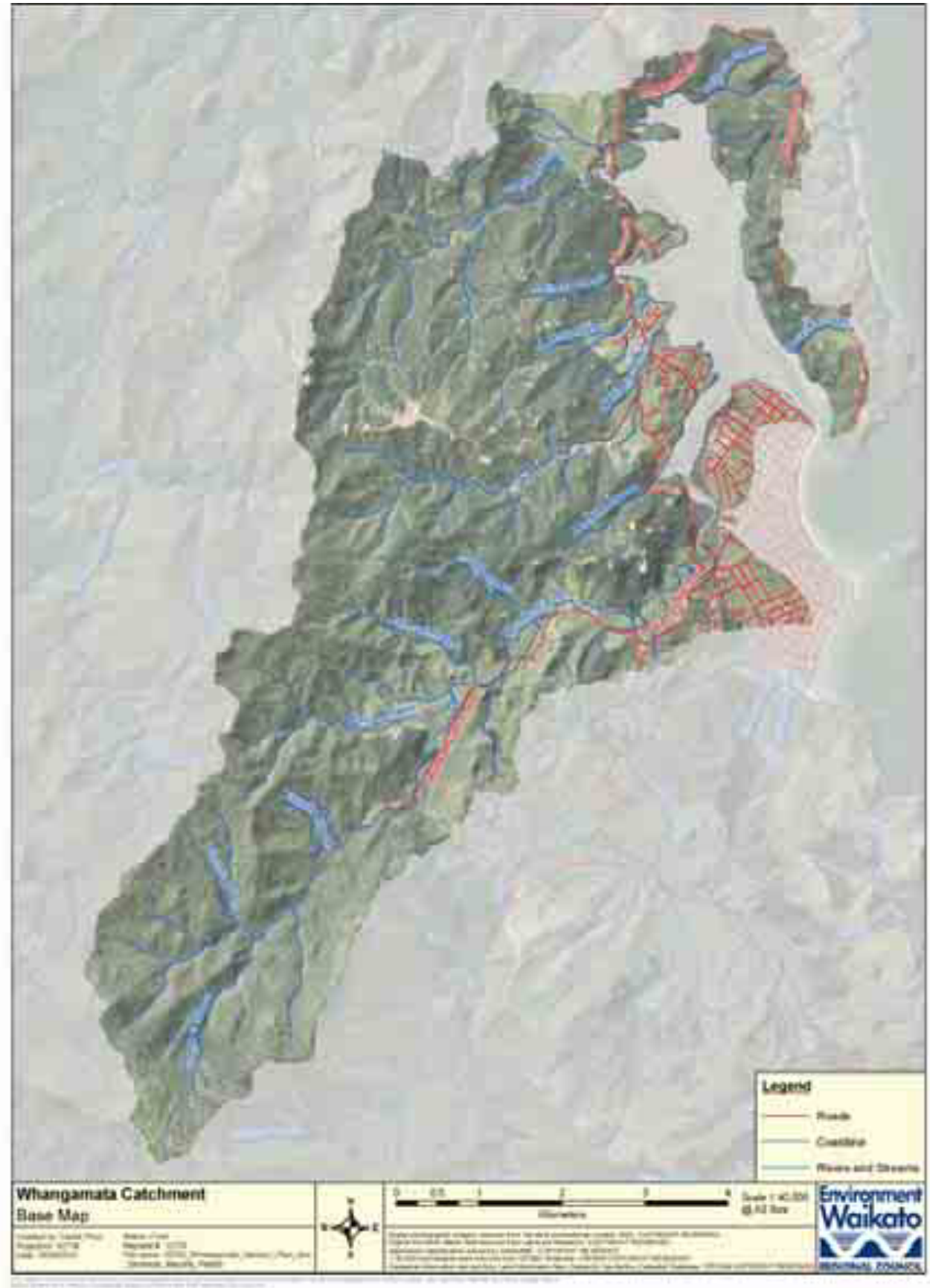
Appendix I

The following maps are provided in this section.

- Whangamata catchment map.
- Whangamata locations map.
- Whangamata catchment – Land clearance.
- Whangamata catchment – Slope and flood hazards.
- Whangamata catchment – Iwi heritage.
- Whangamata catchment – Land cover.
- Whangamata catchment – Targeted sites - the ‘eight hectares’ of initially selected mangrove removal sites identified by Environment Waikato in 2007.

See also the Whangamata Catchment Management Plan 2007. In addition, the Whangamata Mangrove Management Options Report contains another five mangrove maps showing historic mangrove distribution in Whangamata Harbour in 1994, 1965, 1978, 1993 and 2002 (‘current day’).

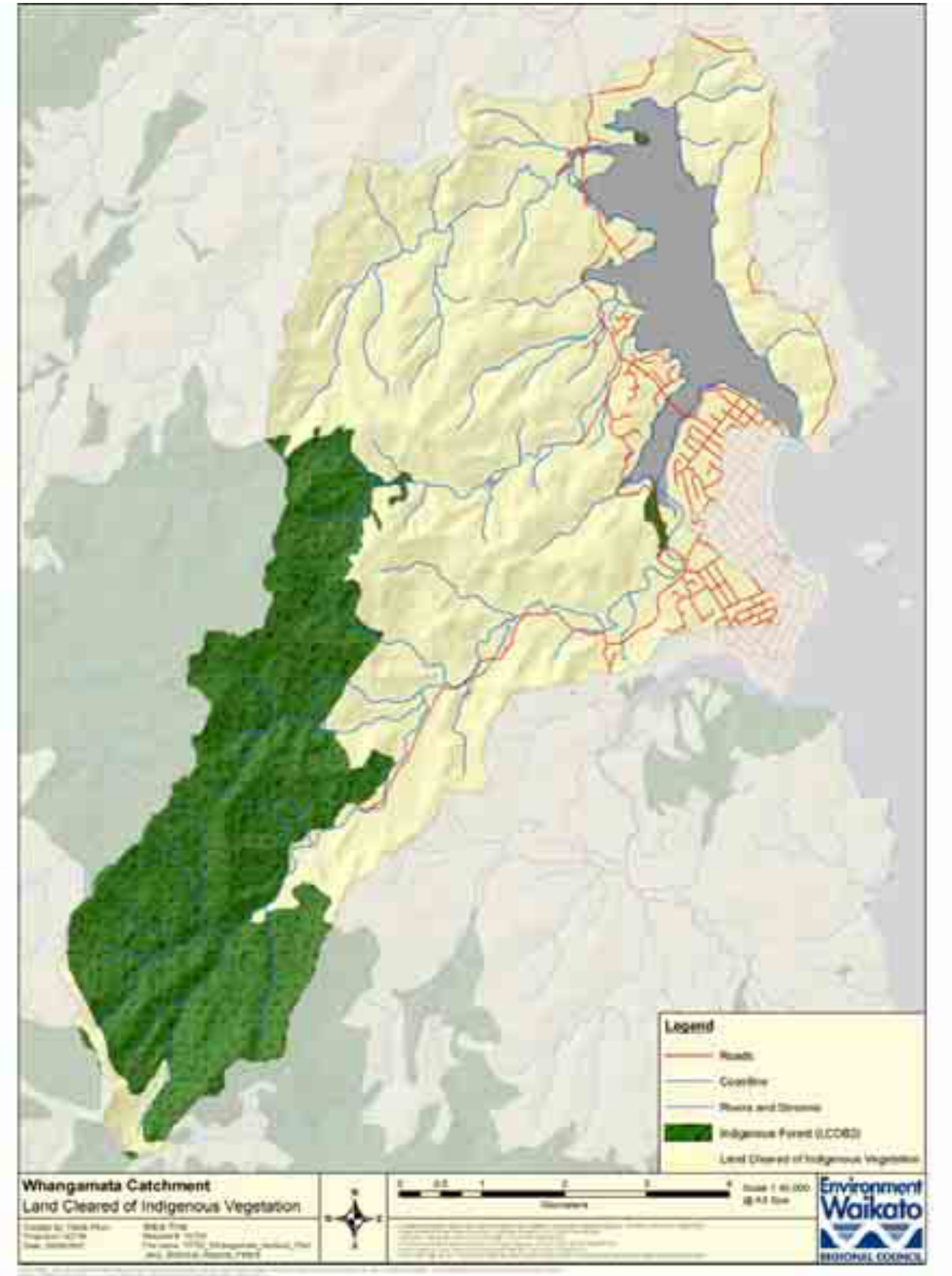
Whangamata catchment map



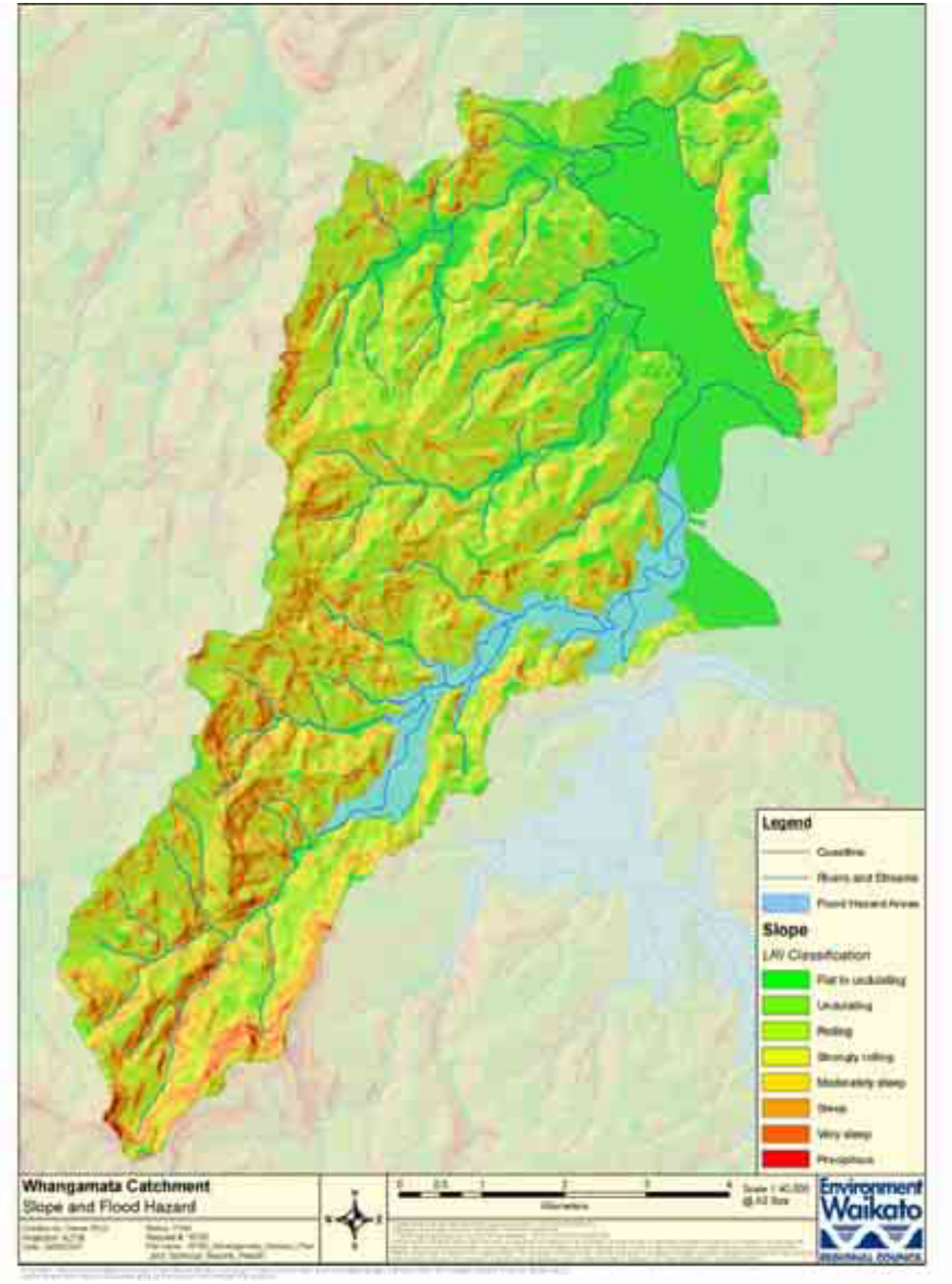
Whangamata locations map



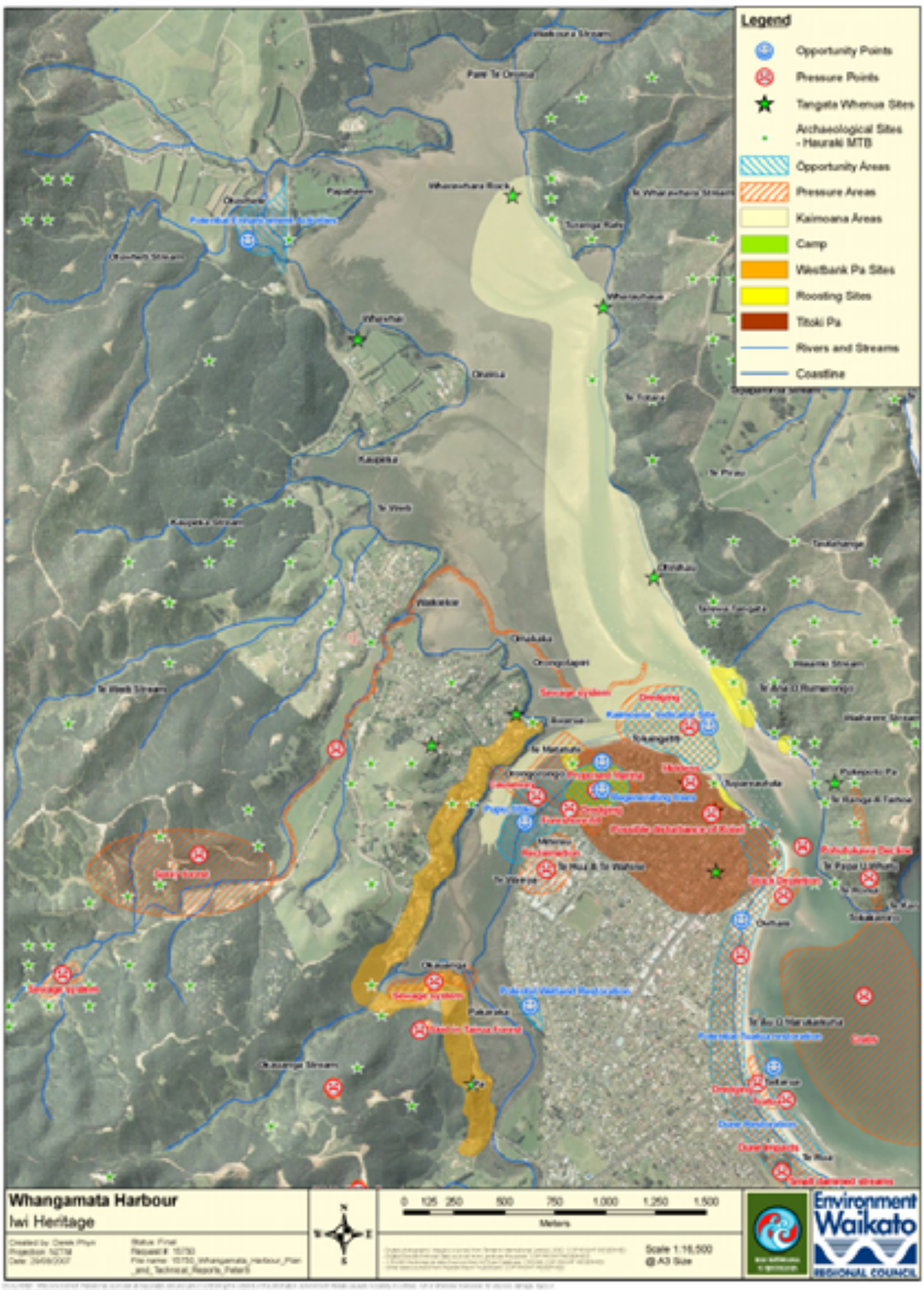
Whangamata catchment – Land clearance



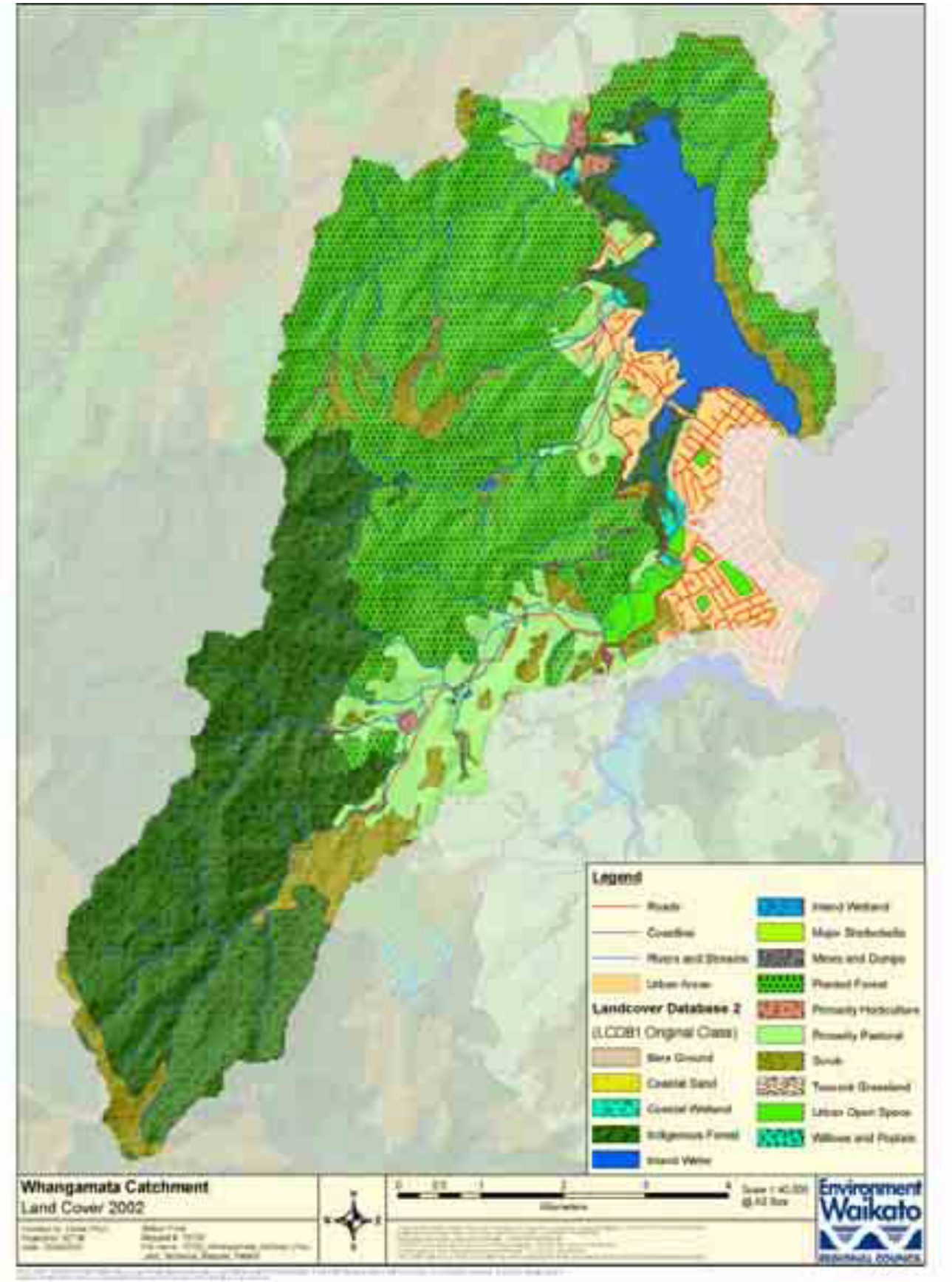
Whangamata catchment – Slope and flood hazards



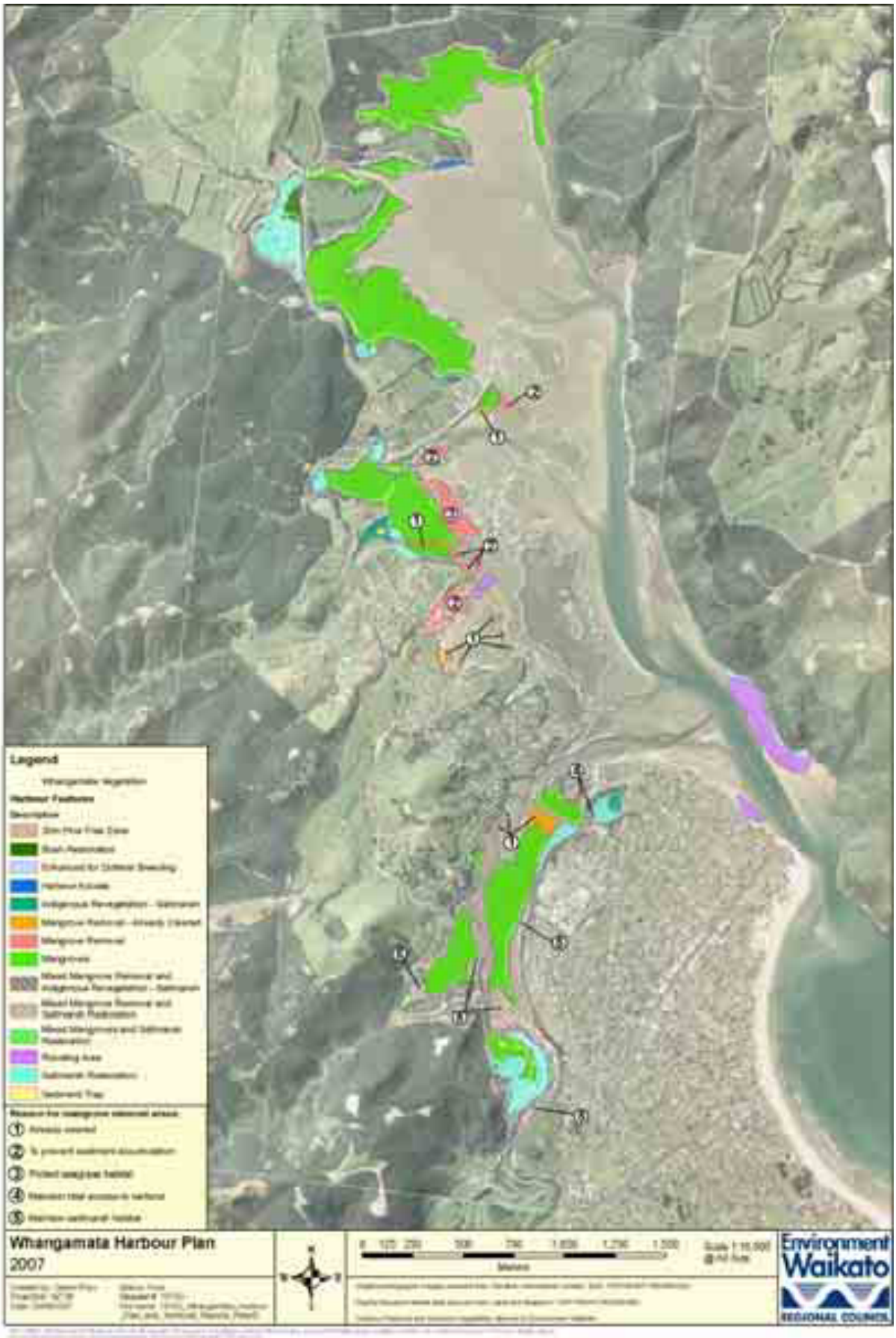
Whangamata catchment – Iwi heritage



Whangamata catchment – Land cover



Whangamata catchment – Targeted sites – the 'eight hectares' of initially selected mangrove removal sites identified by Environment Waikato in 2007



Appendix II Regulatory context

Regulatory context

The main legislative tools governing the management of Whangamata Harbour are the Resource Management Act 1991 and the Local Government Act 2002, administered by both the regional and district councils. A number of other agencies operate under a range of statutes.[112]

Resource Management Act 1991 (RMA)

The main environmental management mechanism is the RMA. Upon its commencement in 1991, the RMA replaced 78 statutes and regulations and amended numerous others. At the time of its passing it was considered to reform the management of environmental issues into one integrated statute. While the RMA provides a vastly more integrated structure for environmental management, there are a number of exceptions, most notably the area of Fisheries Management. See section 1.4 of this appendix for more information about the other regulatory management mechanisms which directly relate to our coastal environment.

As there are several agencies carrying out functions under the RMA there are inevitably issues with functional boundaries and with jurisdictional boundaries, discussed later in the report. These boundaries make integrated management more challenging and the RMA places an obligation on the relevant organisations to efficiently and effectively deal with them.

Statutory RMA policy documents affecting the management of Whangamata Harbour

In addition to the Part II matters set out in the RMA 1991, the two high order documents that govern the regulatory framework are the New Zealand Coastal Policy Statement (NZCPS) and the Waikato Regional Policy Statement (RPS).

These are given effect to via the following regional and district plans by way of policies and rules:

- Waikato Regional Coastal Plan.
- Proposed Waikato Regional Plan.
- Thames Coromandel District Plan.

A number of Guidelines documents also exist as well as non-statutory strategies.

Progression of resource management planning

The last 15 years have seen the progressive development of a planning framework shown in the diagram below. In 1991 the RMA set up the regulatory environment but operation was very much in transitional mode until new plans were developed. Over time the district and regional plans were developed through a detailed process in consultation with the community. Now that the planning framework is in place, focus is turning to implementation.

Other agency roles

A number of other agencies have roles under the RMA. The Minister of Conservation is responsible for producing New Zealand Coastal Policy Statements, approving Regional Coastal Plans and any changes as well as for approving applications for resource

[112] This section is largely based on Lawrie, A. 2005: Tauranga Harbour Integrated Management review. *Environment Bay of Plenty Environmental Publication* 2005/22, October 2005.

consents for Restricted Coastal Activities. These roles allow the Minister to give effect to the Crown's interests in the coastal marine area. The Ministry for the Enviroment (MfE) is responsible for drafting national standards, non-coastal national policy statements and can direct councils to make plan changes.

Local Government Act 2002

The purpose of the Local Government Act 2002 is "…to provide for democratic and effective local government". The Act provides a framework for the operation of local government and provides for councils to create and administer bylaws.

Navigation and Safety Bylaws

An important regulatory tool for Whangamata Harbour is the Navigation Safety Bylaw. The Bylaw covers all navigable waterways in the Waikato region and is aimed at ensuring the safety of users on these waterways. It sets out safe practices for people using lakes, rivers and harbours for water skiing, swimming, boating, kayaking or other water activities, by seeking to reduce the conflicts between different activities. There are also specific rules in the Bylaw for Whangamata Harbour as defined in the schedule at the back of the Bylaw. These specific rules relate to where waterskiing can occur, a prohibited powered vessels area and identifies access lanes and a prohibited anchorage area.

Bylaws

Thames-Coromandel District Council has district bylaws that govern the use of the foreshore and the adjacent coastal environment. The bylaws control many uses for the purposes of:

- protecting the public from nuisance
- protecting, promoting and maintaining public health and safety
- minimising the potential for offensive behaviour in public places.

Spatial jurisdictions for regulation

Under the RMA, territorial authorities have jurisdiction down to mean high water springs (the coastal marine area boundary) and regional councils have jurisdiction to the seaward side of this zone.

Other management mechanisms

There are a number of other mechanisms that directly regulate Whangamata Harbour's coastal environment. Some of these mechanisms have quite different purposes and principles to the RMA, making integration challenging.

Act	Administration	Purpose
Fisheries Act 1996	Ministry of Fisheries	To manage the sustainability of fisheries resources through allocation of quota as well managing the activity of fishing.
Reserves Act 1977	Department of Conservation and Territorial Authorities	The acquisition, control, management, maintenance, preservation (including the protection of the natural environment), development, and use of public reserves, and to make provision for public access to the coastline and the countryside.
Conservation Act 1987	Department of Conservation, Fish and Game New Zealand	To promote the conservation of New Zealand's natural and historic resources.
Wildlife Act 1953	Department of Conservation	The protection and control of wild animals and birds and the management of game.
Biosecurity Act 1993	MAF Biosecurity, DOC, Mfish, Ministry of Health, regional councils, territorial authorities	Preventing the introduction of unwanted organisms not yet established in New Zealand; and Managing unwanted organisms and pests already established in New Zealand.
Health Act 1956	Local Authorities, Ministry of Health,	Improving, promoting, and protecting public health.
Hazardous Substances and New Organisms Act 1996	Environmental Risk Management Authority	To protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms.