Environment Waikato Internal Series 2007/13

Draft Whangamata Catchment Management Plan

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Environment Waikato
REGIONAL COUNCIL

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1 Introduction

The Whangamata catchment sits on the lower east coast of the Coromandel Peninsula. The catchment supports a range of activities including multiple land use, pastoral and forestry activities and hosts a small sea-side community. The catchment's diversity and the value many people place on this area create a situation where there are a number of pressures and conflicts of interest.

In 2006-7, a Draft Whangamata Harbour Management Plan was developed with community groups and agencies in an attempt to identify and address some of the issues around the harbour - particularly in terms of managing increasing sediment levels and mangrove expansion.

A key component of the harbour plan was the identification of the need for a catchment management plan. This recognised the importance of taking a 'whole of catchment' approach to sedimentation issues and other issues such as biodiversity protection,[1] flood management and riparian protection to enhance water quality.

The intention of the Draft Whangamata Catchment Management Plan is to provide an assessment of the river and catchment issues in the Whangamata catchment and an implementation strategy for the works it needs. At this stage it is intended to be a guide only and a detailed works plan will be finalised once discussion has been carried out with land owners within the catchment. The catchment management plan will complement targets set out in the harbour plan.

This catchment management plan should also be read in conjunction with the two other key documents related to managing issues in Whangamata Harbour and its catchment: the Draft Whangamata Harbour Plan 2007[2] and the Whangamata Mangrove Management Options Report.[3]

1.1 Vision

A stable and healthy catchment supported by the community, land owners and iwi with:

- reduced erosion
- improved water quality
- enhanced biodiversity
- reduced sedimentation of the harbour and estuary
- reduced flooding.

This will support the vision of the Whangamata Harbour Plan which is:

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.

[1] Biodiversity a term used to describe the variety of plants and animals living in an area.
[2] Environment Waikato. 2007: *Draft Whangamata Harbour Plan*. Environment Waikato Internal Series 2007/14, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm.
[3] Environment Waikato. 2007: *Draft Whangamata Mangrove Management Options Report*. Environment Waikato Internal Series 2007/15, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm.

1.2 Objectives and outcomes

Key objectives are to:

- provide an integrated approach to river and catchment management
- provide a guide for improving the stability of the catchment and the health of the environment
- promote 'best practice' techniques while ensuring social, economic, cultural and environmental well-being
- work with and encourage the participation of tangata whenua, interest groups and the residents and ratepayers of the Whangamata area.

Key outcomes of the plan will be:

- reduced sediment and nutrient input into waterways
- improved water quality and biodiversity
- improved flood management
- identification of appropriate measures for works and restoration
- integration of existing works and initiatives
- links between groups and organisations in the catchment.

2 Background

2.1 The Peninsula Project

The Coromandel Peninsula is known for its beautiful environment. However, river bank erosion, debris blocking rivers and streams, the effect of animal pests on forest health and storms have caused widespread problems for communities.

The Peninsula Project aims to improve these issues. It is a collaborative project between Environment Waikato, Thames Coromandel District Council, the Department of Conservation and Hauraki Māori Trust Board established in 2004.
http://www.ew.govt.nz/regionalservices/rivercatchment/peninsula/peninsulapopup.htm
Over the next 20 years, the project will have far-reaching benefits for both the environment and the people who live and holiday on the peninsula. It will:

- better protect people, property and essential services from flooding
- reduce sedimentation in rivers, harbours and estuaries
- improve water quality
- reduce pests such as possums and goats
- improve the diversity of flora and fauna
- improve and stabilise catchments
- sustain the mauri[4] of the peninsula from the mountain ranges to the sea.

The Draft Whangamata Catchment Management Plan will be implemented predominantly through the Peninsula Project.

2.2 An integrated approach

'Catchment management' has become a catch phrase in recent years, with agencies and communities keen to take a holistic approach to issues and to get involved in work to improve their area. The premise is that there is a need to be aware of the implications land use actions have, upstream, downstream and in the surrounding catchment.

[4] 'Life force'.

Catchment management plans aim to link environmental issues and functions as well as engaging the communities that live and work within catchments. Catchment management works with the support of four key principles in mind. They are the consideration and support of economic; social; environmental and cultural outcomes.

The guiding factor behind catchment management planning is the involvement of communities. Environment Waikato, under its Regional Plan, recognises the need for communities to actively participate in preserving our environment and communities.

Community based management initiatives are generally more successful than those imposed by an external agency. This is mainly due to the fact that there is local ownership and connection to the environment.

This catchment plan is a supporting document to the wider integrated management document, the Draft Whangamata Harbour Plan 2007, which provides the strategic context for managing the harbour and its catchment across four main issue areas: water quality; habitat; sedimentation and flooding; and recreation, boating, access and views.

2.3 Community process

In most cases it is preferable that a catchment management plan's community process works from a grass roots level up, to ensure community ownership and support of the initiative. This process also assists in setting the tone and direction of a catchment management plan and drives the desired outcomes.

In the case of this plan, it is intended that it be developed as a means for further community consultation. This is on the basis that significant consultation has already been undertaken as part of the Draft Whangamata Harbour Plan development and the Draft Whangamata Catchment Management Plan supports that document.

Any proposed works on private land will only be undertaken upon agreement with the land owner on a case by case basis. A public consultation process will confirm both the Harbour and Catchment Plans.

3 Legislative and planning framework

This section is a summary of the legislative framework that guides and directs Environment Waikato, in particular its River and Catchment Services Group, in its various roles and functions.

Environment Waikato is responsible for the overall management of rivers and catchments in the Waikato region. This work is carried out under the soil conservation, river management and flood protection schemes

3.1 Soil Conservation and Rivers Control Act (1941)

The Soil Conservation and Rivers Control (SCRC) Act (1941) has been replaced in part by the Resource Management Act (RMA) (1991), but sections of the SCRC Act are still operative and are relevant to this management plan in respect of the responsibilities on regional councils (previously catchment authorities) in regard to flooding and soil erosion.

The objects of the SCRC Act are listed below.

a) The promotion of soil conservation.
b) The prevention and mitigation of soil erosion.
c) The prevention of damage by floods.
d) The utilisation of lands in such a manner as will tend towards the attainment of the objectives of the Act.

3.2 Resource Management Act (1991)

Part II of the Resource Management Act 1991 (and Amendments) outlines the purpose and principles of the RMA as defined in sections 5, 6, 7, 8.

- Section 5 outlines the purpose of the Act to promote sustainable management of natural and physical resources.
- Section 6 deals with Matters of National Importance.
- Section 7 addresses Other Matters.
- Section 8 relates to the Principles of the Treaty of Waitangi.

In particular it requires regional councils to develop policy statements and regional plans which detail how the environment will be managed.

3.3 Regional Policy Statement

The Waikato Regional Policy Statement (WRPS) provides a framework for resource use, which enables the regional community to achieve its social and economic aspirations, within the capacity of the environment. Where resource quality is high, it is the intention of objectives and policies to retain high resource quality. Where resource quality has been degraded through inappropriate use, the quality of such resources is intended to be improved over time.

Under the WRPS, Environment Waikato has a primary role for river and hazard risk management.

The key sections of the Regional Policy Statement that apply to this management plan relate to are listed below.

- Land and soil.
- Water.
- Indigenous biodiversity.
- Natural hazards.

3.4 Waikato Regional Plan

The Regional Plan implements the Regional Policy Statement. It contains policy and methods to manage the natural and physical resources of the Waikato region. The plan applies across the whole of the Waikato region, although some objectives, policies and rules apply only in specific parts of the region. The plan does not apply below 'mean high water springs'.[5]

[5] Mean high water springs: The place on the shore where spring high tides reach on average over a period of time. It can often be recognised by the upper line of debris on the beach.

4 Catchment description

4.1 Location

The Whangamata Catchment is located on the east coast of the Coromandel Peninsula in the southern part of the Coromandel Zone (see Figure 1). The catchment contains 81 kilometres of stream. The main contributor to Whangamata's harbour is the Wentworth River. Streams flow from south-west to north-east.

For the purpose of this catchment management plan, the area of concern is some 5,376 hectares of land. This area is consistent with the catchment zones identified for management purposes under the Peninsula Project.



Figure 1. Location of Whangamata Catchment

4.2 Physical characteristics

4.2.1 Geological

The Whangamata catchment is part of the Hauraki volcanic area with some influence from eruptions on Mayor Island. In geological terms this area is relatively young (Miocene area <25 million years) compared to the rest of the Waikato region. Some pockets of Jurassic (130 million year old) greywacke[6] exist throughout the peninsula.

[6] Greywacke: Coarse usually dark gray sandstone or fine-grained rock containing firmly cemented fragments (as of quartz or feldspar)

Both Coromandel andesites[7] and Whitianga rhyolites[8] make up the parent material of the Whangamata catchment. Most of the andesites have been altered due to hydrothermal activity, but fresh andesite can be found, and is quarried just north of Whangamata on McBeth's Road.

The Whangamata catchment was included in the 1975 Land Inventory Survey as part of the Coromandel Thames Counties area. The classification of soils was carried out by the then Department of Lands and Survey. This information is still relevant throughout New Zealand and is still the most complete record of soils and land use capabilities. The information in Table 1 below is sourced form this data set.

Table 1: Soil classification – Whangamata catchment

Soil Name	Topography location	Soil classification	Limitations for use	Area (%)
Pinaki sand	Dunes inland from coast	Yellow to brown sands	Low nutrient status seasonally droughty.	7
Whangamata hill soils	Easy rolling and rolling land	Yellow to brown loams	Soils of low nutrient status and impeded drainage.	52
Tangatera step land soils	Steep and very steep	Yellow to brown earth	Low nutrient status liable to severe sheet and slip erosion.	13
Te Kie and Aroha step land soils	Steep and very steep	Brown granular clays	Weekly developed structure, medium to low nutrient status liable to erosion.	14
Mangonui hill soils	Easy to rolling land	Brown granular clays	Low nutrient status and poor drainage.	11
Ohinemuri loamy sand	Flood plains and river beds	Recent soils	Weakly developed soil structure. High nutrient status, subject to flooding.	3

4.2.2 Land use

There is land suitable for production farming (and not prone to erosion) in the Whangamata catchment but the use of most of these areas is limited by poor soil fertility. This is reflected by the majority of land in the catchment with farming potential being used for production forests. Like so many of the catchments on the east coast of the Coromandel Peninsula, land surrounding the headwaters of the Whangamata catchment is managed as production forests. Between harvesting events the forest provides for water and soil conservation as well as regulating run-off during flood events in the lower catchment. This benefit is diminished after harvesting for a term of approximately seven years, until a new crop is established.

Unlike its neighbouring catchments (Otahu and Wharekawa) the Whangamata catchment has little floodplain. This makes the already poor soil fertility worse and limits intensive farming potential. Only 10 per cent of the catchment area is still managed for pastoral farming and there are no dairy farms. Agriculture is largely drystock or run-off blocks with less than one per cent in horticulture.

Impacts from historical tree felling, gold mining and land clearance are still being felt in the middle and upper catchment areas with poor forest canopy structure and unstable

[7] Andesite: Fine grained brown or greyish volcanic rock.
[8] Rhyolite domes: Granite-like land forms created through a build up of fine grained volcanic rock.

hill sides. Land use data shows that more than 40 per cent of the catchment area is under plantation forest. A further 36 per cent is covered by indigenous forest or scrub (refer to Figures 2 and 3). These areas have relatively high erosion potential. Most of the land is steep or mountain country with unstable landforms. The Department of Conservation manages 31 per cent of the catchment area.

4.3 Social

Like so many communities on the Coromandel Peninsula, Whangamata is home to a fairly small permanent population. This population increases from 4,000 to 50,000 over the Christmas period, putting pressure on infrastructure[9] and local resources. Support for projects and community initiatives is hard to come by. Permanent residents and land owners absent for most of the year have distinctly different perspectives in terms of priorities related to the area.

Whangamata is identified as one of the seven main serviced settlements and as such is an area where future growth should be concentrated. The 2006 Census[10] results show that Whangamata dropped 10.3 per cent of its usually resident population to go from 3855 to 3567. When you lay the population figures over the housing statistics it becomes apparent that the non-resident population is increasing. This is supported by the numbers of unoccupied dwellings on census night. In 2001 55 per cent of dwellings were unoccupied and in 2006 this increased to 60 per cent unoccupied.

Dwelling numbers increased from 4026 (2001) to 4182 (2006). In 2016 it is projected that there will be 5017 dwellings and 4846 usual residents. By 2026 it is projected that there will be 5664 dwellings and 5709 usual residents. These growth projections are being re-done as a result of the 2006 Census data and the new projections should be available at the end of July 2007.

4.3.1 The Coromandel Peninsula Blueprint Project

The Coromandel Peninsula Blueprint project is all about planning where, what and how people can do things in and on the land and waters of the Coromandel Peninsula. The project, lead by Environment Waikato and Thames Coromandel District Council, is about determining what is 'appropriate growth' particularly in light of the projected growth for the district. A significant challenge is managing the growth demands and pressures whilst still protecting important community values. The district's communities have already told Thames Coromandel District Council what they want through initiatives such as community plans and community outcomes. The Coromandel Peninsula Blueprint Project will build on these community visions.

4.4 Tangata whenua

There are four iwi with direct interests in the Whangamata catchment. They are Ngati Pu, Ngati Whanaunga, Ngati Hako and Ngati Tamatera. A statement of significance was prepared by representatives of Hauraki iwi for the Draft Whangamata Harbour Plan which identifies the Whangamata Harbour as being of cultural, spiritual and historical significance to Hauraki iwi. 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 with the environment.
- To make informed decisions about the Whangamata Harbour, its surrounding environment and heritage.

[9] Examples of infrastructure include roads, powerlines, sewage systems, water services and other organisational structures and services.
[10] Source: Statistics New Zealand website: http://www.stats.govt.nz/census/2006-census-data/default.htm.

- 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.[11]

A heritage map of the harbour and part of the catchment was compiled by the Hauraki Māori Trust Board in 2005. This identified sites of significance to Māori. Areas used for recreation, kaimoana, ancient pa sites and archaeological sites were identified along with locations suitable for habitat restoration. Locations of environmental concern were also identified.

4.5 Ecological

Under Environment Waikato's Key Ecological Site (KES) survey, no land areas of significant ecological value were identified in the catchment. The closest KES is the Otahu Estuary.

The Otahu Estuary is regarded as one of the most significant estuarine environments for protection on the Coromandel Peninsula by both the Department of Conservation and Environment Waikato. This estuary and Whangamata Harbour are identified in the Waikato Regional Coastal Plan as areas of significant conservation value.

New Zealand has been divided into 268 different ecological districts based on geological, topographical, climatic and biological features that together define a characteristic landscape. Similar districts combine to form an "Ecological Region".

The Coromandel Ecological Region is divided into eight ecological districts. For ease these have been reduced to four districts, largely based on topography. The Whangamata catchment sits in the Tairua Ecological District. Recognising and working within the parameters of an ecological region is important especially in relation to plant species.

From a biodiversity protection viewpoint, the Whangamata catchment is not a priority for animal pest control work on Department of Conservation-administered land when compared to high value sites like Moehau in the northern Coromandel. However, as a result, animal pests have led to a decline in forest health and a collapse of the forest canopy in areas in the southern part of the catchment.

While most of the biodiversity value in the catchment is around the saltmarsh and wetland areas, a post breeding season dotterel flock site is located in the harbour and is home to an estimated 30 to 40 birds. Populations of the threatened Fern bird and the Moko skink can also be found in the lower reach of the Wentworth River system.

4.6 Key stakeholders

- Iwi:
  - Ngati Pu
  - Ngati Whanaunga
  - Ngati Hako
  - Ngati Tamatera.
- Hauraki Māori Trust Board.
- Thames Coromandel District Council.

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

- Department of Conservation.
- Land owners and residents.
- Forestry – Rayonier.
- Care groups.
- Local community interest groups.

Other Māori interest groups have expressed an interest in the catchment and collectively, they along with the named iwi (above) have formed a kaitiaki group. A nominated spokesman has been appointed for this group.

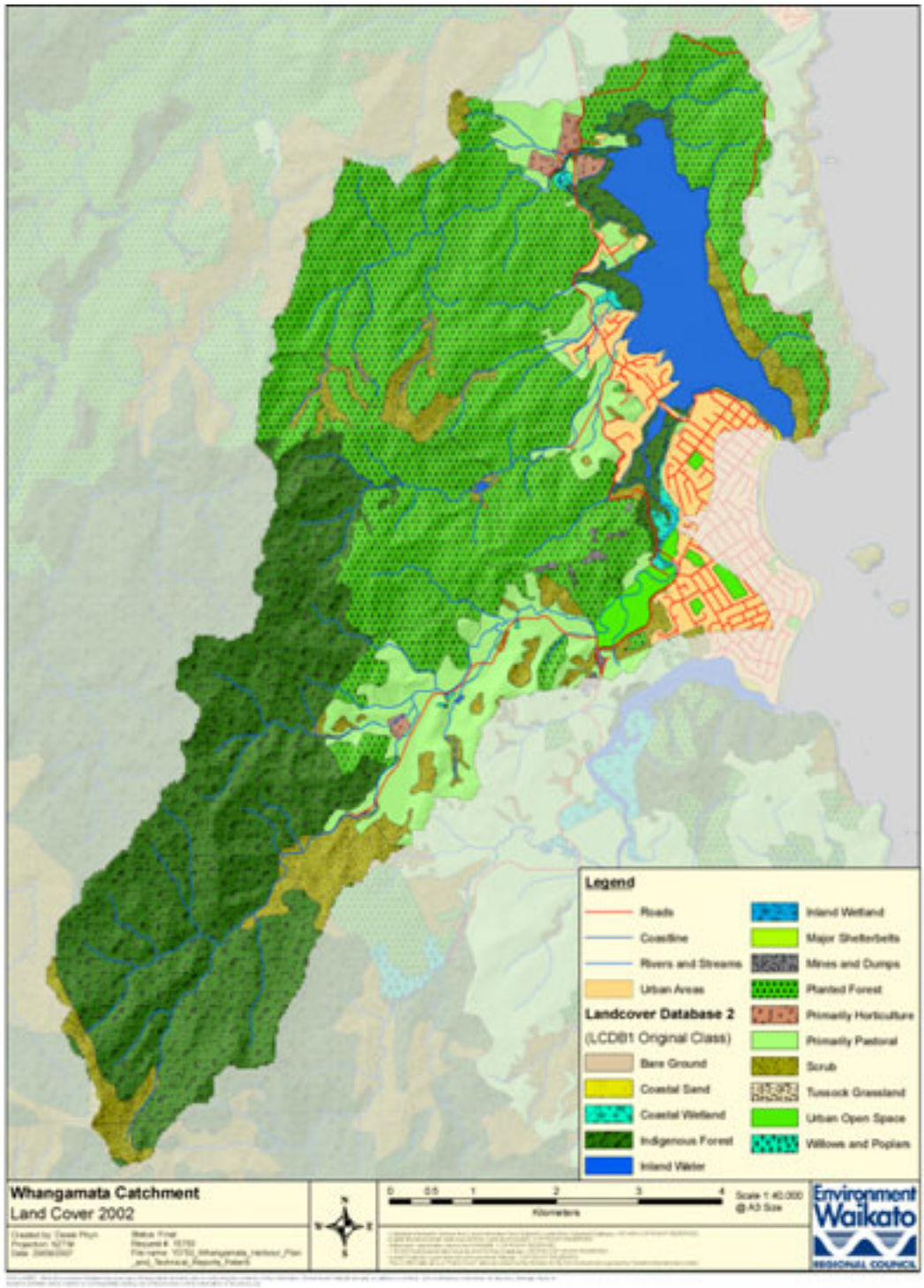

Figure 2. Land use in Whangamata catchment

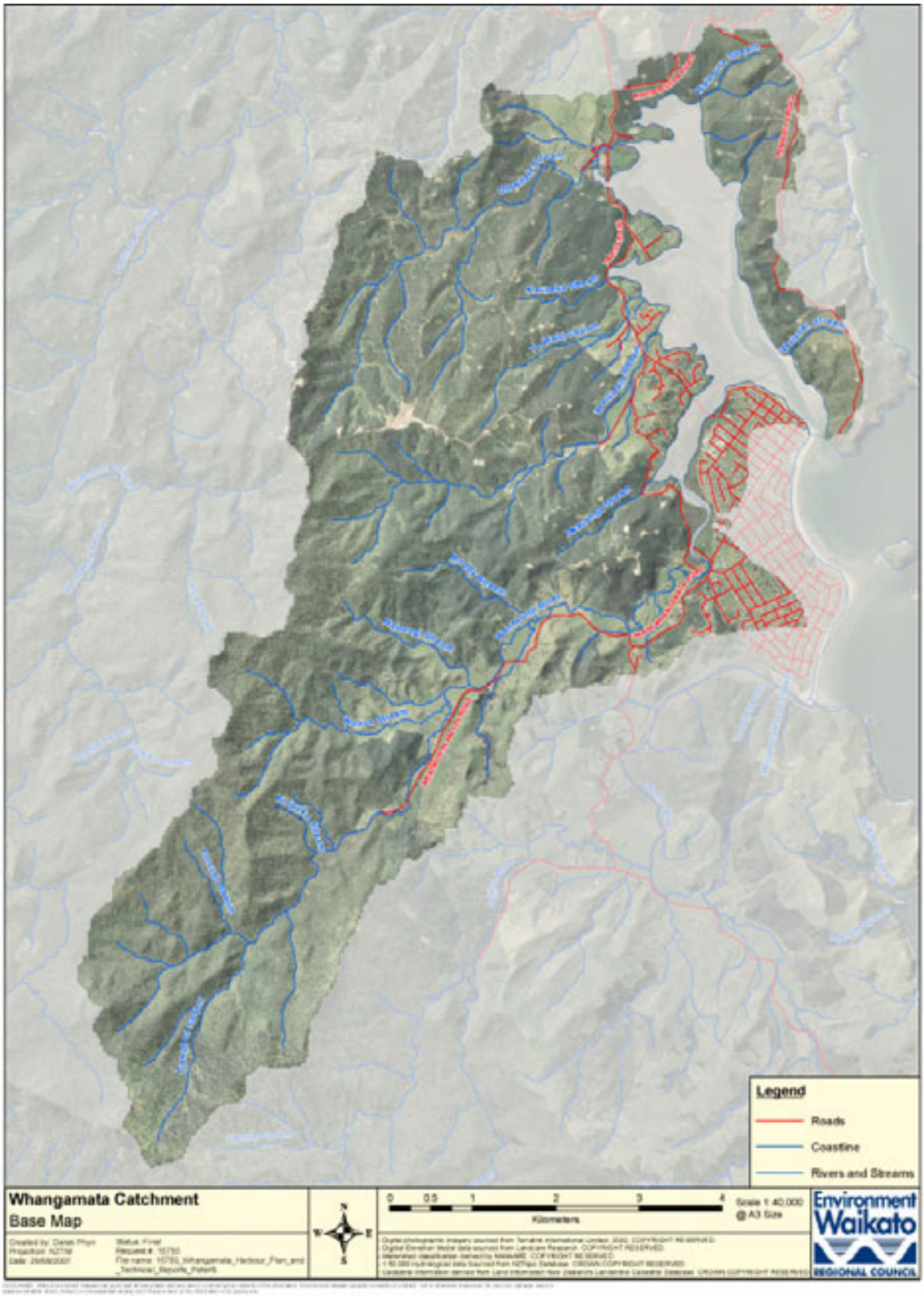

Figure 3. Aerial view of Whangamata catchment

5 Catchment assessment

An inspection of the physical characteristics of the Whangamata catchment was carried out by Environment Waikato staff in April 2007. A detailed account of the condition of the catchment and potential works required can be found in Appendix 1.

Three main sub-catchments and one minor tributary make up the Whangamata catchment. For the purpose of the inspection the main catchments of focus were:

- Wentworth River
- Waikiekie Stream
- Te Weiti Stream
- Otuwhete Stream (minor tributary).

Due to time constraints, the field and desktop assessments focused mainly on the stream channel and surrounding land. While there are benefits to be gained within the wider catchment, it is considered these are less significant and that the greatest gains will be made by focusing on streams and surrounding land. These gains can be made in a relatively short timeframe by getting land owners actively involved in soil conservation and farm plans. Consideration of land use in the catchment area and associated issues/benefits has been noted. Further investigation and consultation with land owners is needed to assess these further.

5.1 Values

A number of biodiversity and cultural values were identified through discussions with groups and individuals as part of the Draft Whangamata Harbour Plan 2007. The key values identified are listed below.

- Estuarine habitat.
- Kaimoana (seafood) gathering grounds in the harbour.
- Cultural and historical sites.
- Recreational use and amenity value of the harbour and catchment.
- Native bush in the headwaters and Department of Conservation lands.
- Rare animals including the Moko skink, the Fern bird and the New Zealand Dotterel.

Further discussion on these and other values will be had with the community as part of the consultation process.

5.2 Key issues

The key issues in the Whangamata catchment are listed below.

- Stream bank erosion.
- Sedimentation of the estuary.
- Degraded water quality.
- Some harmful impacts on biodiversity values.
- 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).

Harvesting of production forestry and resulting sediment run-off has also been raised as an issue through consultation on the Draft Whangamata Harbour Plan 2007. 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. This issue has been addressed under the sub-catchment sections that follow.

Environment Waikato's ongoing efforts on this issue will also ensure that forestry activities are aligned with existing and emerging 'best practice'.

5.3 Wentworth River

The Wentworth River Catchment is the largest water flow contributor to the Whangamata Harbour and the largest concentrated area of pastoral land. Approximately 50 per cent of the catchment is administered by the Department of Conservation, and a further 25 per cent is under production forest (mainly the northern slope of the catchment). The main stem of the Wentworth River channel flows for more than 10 kilometres.

Approximately 70 per cent of the main Wentworth channel is fenced to stock class standard and prevents stock from accessing the stream bed. Of the seven tributaries in this catchment area only the Wairoa Stream has any significant riparian protection (90 per cent fenced, good riparian (stream bank or river bank) cover 90 per cent).



Figure 4. Cattle next to the Wentworth River

Considerable effort has been made by the Wentworth Rivercare Group (supported by Environment Waikato) over the last 10 years to engage and support land owners in the catchment to fence and plant the river banks. Where land owners have taken up works, good riparian vegetation exists and is protecting the banks. This was demonstrated in 2006 when an isolated 'weather bomb' struck the catchment. Areas fenced and planted received minimal to no damage, areas unfenced with little or no vegetation were badly eroded.

Unfortunately not all land owners in the catchment took up the assistance offered by this group. The outcomes achieved by Wentworth Rivercare are testimony to what can be achieved by community initiatives.

The lower reach of the Wentworth River has been a key area for the Whangamata community in the mangrove management debate and is affected by the Hetherington Road causeway. The presence of mangroves in the Moanaanuanu Estuary and the associated sedimentation is likely to be reducing the hydraulic capacity[12] of the river/estuarine system. Sediment is currently accumulating in the estuary and the extent of mangroves is expanding as a result (refer Technical Report 2007/16 Wentworth River Flood Hazard Assessment Environment Waikato document number 1183283).[13]

[12] Hydraulic capacity: combined water volume and flow rate.

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

5.3.1 Lower reach (from the causeway upstream to old quarry)

The old quarry referred to is located right next to Wentworth Valley Road approximately 2.25 kilometres in from State Highway 25. This reach is generally well fenced and planting of native species has been carried out by the Wentworth Rivercare Group. Proposed works in this section are relatively minor as most of the issues relate to the stream channel or wetland areas.

5.3.1.1 Issues

- Large possum numbers in the upper catchment degrading the forest.
- Pampas growth on stream margins (less than 10 per cent).
- Lack of riparian vegetation (present, but needs in-fill planting).
- Isolated blockages within the stream need to be removed.
- Silting up of the stream reducing channel capacity and increasing water temperature.
- Flooding between the causeway and the golf course (refer below for summary of assessment).
- Hetherington Road causeway causing a dam effect at the mouth of the river
- Increased sedimentation of the estuary.
- Unauthorised stopbank and infilling next to the upstream side of the bridge.

Flooding

As part of the development of this catchment management plan a technical investigation has been carried out of lower Wentworth River flooding (refer Environment Waikato Technical Report 2007/16 'Wentworth River Flood Hazard Assessment').

Modelling was undertaken assessing three scenarios – the existing channel and estuary, the future situation with mangroves retained and the future situation with mangroves removed. The results indicate that there could be flood hazard potential in built up areas northwest of Martyn Road for both future scenarios, although the extent of this is greater if the mangroves are retained.

Given that there is little historical information about the channel dimensions of the Wentworth River and Moanaanuanu Estuary it is recommended that five yearly channel surveys be undertaken. Once sufficient site specific information is available, over say 10 years, it will be possible to reassess flood hazards and develop appropriate flood mitigation options. This timeframe will also allow for other catchment management initiatives to be implemented.

5.3.1.2 Proposed actions

- Rock work or willow layering on badly eroding corners.
- Stream bank fencing.
- Clearance of pampas (spray or mechanical removal) to reduce seed source and spread.
- Willow and/or poplar pole planting in highly eroding areas.
- Planting of native riparian species.
- Removal of mangrove seedlings on an annual or as needed basis.
- Initiation of channel surveys with consequent adaptive management practices.



Figure 5. Blockage in Wentworth River channel

5.3.2 Mid section (old quarry to approximately 1.5 kilometres upstream)

5.3.2.1 Issues

- Stream is virtually unfenced along this reach.
- Stream banks are eroding badly with no vegetation cover and full stock access to the bank and stream bed.

5.3.2.2 Proposed actions

- Fencing is needed on both sides of the stream.
- Appropriate planting to shade the stream and stabilise the banks is required.
- Removal of debris and blockages.
- Re-shaping of channel sides in key areas.
- Poplar and/or willow pole planting for erosion protection.

This section is the most degraded in the catchment area and probably the greatest contributor of sediment within the Whangamata catchment.

5.3.3 Upper reach (to the ford)

5.3.3.1 Issues

This reach is generally well vegetated.

- There are some exotic species present such as wattle.
- Some existing fencing is in place along the stream bank.
- Forest health is poor due to possums and goats.
- Potential issues with production forestry. For example, wood unsuitable for sale is left on harvested land and then mobilised during flood events causing debris dams; sediment run-off during harvesting.

5.3.3.2 Proposed actions

- Possible digger work to carry out minor repairs and to remove some in stream vegetation.
- Upgrade fencing to cattle class standard.
- Undertake plant pest control (pampas and wattle).
- Undertake possum and goat control in the upper catchment.

- Monitor the annual rate of harvest in each catchment to avoid removing significant catchment areas in short time frames.
- Liaison with Environment Waikato's Resource Use Group to ensure appropriate conditions relating to managing the harmful effects of run-off and sedimentation during forestry harvesting are implemented and monitored. For example, use of management methods on production forest land specific to the site to decrease impact of debris dams; increased silt traps during harvesting.



Figure 6. Slumping of the riverbank and stock access

5.3.4 Tributaries

5.3.4.1 Issues

- Majority are unfenced and poorly managed.
- Potential issues with production forestry. For example, wood unsuitable for sale is left on harvested land and then mobilised during flood events causing debris dams; sediment run-off during harvesting.

5.3.4.2 Proposed actions

- It is recommended that the stream be fenced to stock class standard and planted appropriately.
- The first tributary on the left when entering into Wentworth Valley Road flows from the now capped landfill. This area if full of pussy willow and is unfenced; some native vegetation exists. Cattle have access to this site. This arm of the catchment is a prime location for wetland restoration works. Not only would the area's appearance and biodiversity improve, appropriate planting would also assist in the uptake of nutrients or leachate[14] (if it occurs) from the site.
- Liaison with Environment Waikato's Resource Use Group to ensure appropriate conditions relating to managing the harmful effects of run-off and sedimentation during forestry harvesting are implemented and monitored. For example, use of management methods on production forest land specific to the site to decrease impact of debris dams; increased silt traps during harvesting.

[14] Leachate is rainwater that seeps through the landfill and becomes contaminated. If not contained and managed properly, leachate can get into our waterways, coastal areas and groundwater, polluting them.

5.4 Waikiekie

Close to two thirds of the Waikiekie sub-catchment is under production forest management. Of the 5.8 kilometres of the main stream channel, only 1.4 kilometres runs through farmland. The bulk of the catchment is owned or managed by forestry companies with only one other significant land owner. Environment Waikato undertook some minor river works in the form of vegetation clearance in the lower reach of this catchment in 2006 and is supporting land owners in the middle reach with fencing and planting of the stream. The land in the lower reach is owned by Thames-Coromandel District Council and Land Information New Zealand.

5.4.1 Lower reach (below state highway bridge)

5.4.1.1 Issues

- Floodplain blocked and storage capacity limited due to weeds.
- Council boardwalk trapping debris.
- Floodplain is slowly rising due to silt deposition after each flood causing flooding to properties next to it.

5.4.1.2 Proposed actions

- Floodplain may need to be reshaped to remedy flooding.
- Continued maintenance needed to maintain channel capacity.
- Consider deepening the stream bed to act as a sediment trap where practicable and effective.

5.4.2 Middle reach (above state highway to tributary confluence)

5.4.2.1 Issues

- Isolated blockages in the stream channel.
- Parts of the reach are fenced and additional planting is needed.
- Watt's Road wetland area is currently over-run with willow.
- Some minor weed control is needed.

5.4.2.2 Proposed actions

- Wetland area fenced to cattle class standard with appropriate planting.
- Upgrade existing stream fences.
- Weed removal on key sites.

5.4.3 Mid reach to forestry boundary

5.4.3.1 Issues

- Weeds (mainly pampas).
- Existing fences are degraded and stock have access to the stream in places.
- Eroding stream banks in places.
- Forest health is poor due to possums and goats.
- Potential issues with production forestry. For example, wood unsuitable for sale is left on harvested land and then mobilised during flood events causing debris dams; sediment run-off during harvesting.

5.4.3.2 Proposed actions

- Undertake weed control.
- Re-shaping of channel sides in key areas.
- A thread of native exists on both the left and right banks where infill planting could be undertaken to gain maximum benefit from these margins.
- Undertake possum and goat control in the upper catchment.
- Liaison with Environment Waikato's Resource Use Group to ensure appropriate conditions relating to managing the harmful effects of run-off and sedimentation during forestry harvesting are implemented and monitored. For example, use of

management methods on production forest land specific to the site to decrease impact of debris dams; increased silt traps during harvesting

5.5 Te Weiti

As with the Waikiekie sub catchment, the upper reaches of the Te Weiti Stream are largely covered by plantation forest with some native riparian vegetation. Of the 2.8 kilometres of main channel only one kilometre runs through pasture land or residential reserve. In 2006 work began to increase the channel capacity in the lower reach below the state highway bridge and where the stream enters the harbour, and to stabilise the stream banks by removing cattle access and planting appropriate species.

5.5.1 Lower reach (below the state highway)

5.5.1.1 Issues

- Sedimentation of the stream and bed build-up which worsens flooding of properties (mainly paddocks, lawns with some risk to houses).
- Poor fencing which allows stock access to the stream and bank erosion.

5.5.1.2 Proposed actions

- Regular maintenance of the stream channel through the mangroves into the harbour.
- Upgrade the stream fence and plant with appropriate natives.
- Maintain existing silt traps.
- Investigate potential in this area to carry out coastal wetland enhancement for biodiversity purposes.



Figure 7. Planting on coastal margin of Te Weiti Stream

5.5.2 Upper reach (above the state highway)

There is only one land owner in this reach before it enters production forest lands.

5.5.2.1 Issues

- Possum browse on poplar poles risking poplar survival rate and erosion reduction potential.
- Weed species are present such as pampas and pussy willow causing stream channel blockage.

- Potential issues with production forestry. For example, wood unsuitable for sale is left on harvested land and then mobilised during flood events causing debris dams; sediment run-off during harvesting.

5.5.2.2 Proposed actions

- Replace poles that have been lost due to possum browsing.
- Undertake possum control.
- Remove pampas and pussy willow in and on channel.
- Complete stream fencing and upgrade boundary fence.
- Liaison with Environment Waikato's Resource Use Group to ensure appropriate conditions relating to managing the harmful effects of run-off and sedimentation during forestry harvesting are implemented and monitored. For example, use of management methods on production forest land specific to the site to decrease impact of debris dams; increased silt traps during harvesting

5.5.3 Tributary

This tributary requires fencing of its upper end and maintenance of existing silt traps.

5.6 Otuwhete Stream/Julian Drive

The majority of the land draining into this area is in horticulture (citrus fruit) and small lifestyle blocks. Investigation into fertiliser use and nutrient budgets would be worthwhile to assess if nutrient run-off is an issue here.

5.6.1.1 Issues

- Excessive gravel deposition in the stream channel causing bank erosion and loss of channel capacity during high flows.
- Cattle access to the waterway causing bank erosion and sediment contribution to the stream.
- Poor stream shading which increases temperature and reduces biodiversity potential.

5.6.1.2 Proposed actions

- Remove gravel deposition below Julian Drive.
- Undertake riparian fencing and planting.
- Investigate potential in this area to carry out coastal wetland enhancement for biodiversity purposes.

6 Methods and outcomes

This section provides an overview of what would be involved in each component of work, the benefits and the expected outcomes.

6.1 Land management protection

Land management protection in this instance means enhancement work not associated with streams or wetlands. This work is essential in ensuring the big picture approach is taken and that the focus does not fall solely on stream works.

6.1.1 Methods

- Retire bush areas from stock access.
- Carry out pest control operations in pine and native bush on both public and private land.
- Encourage further forest fragment and riparian retirement.
- Encourage change to appropriate land use or management methods in some of the steeper terrain with a focus on Tangatera step land soils initially.
- Rat control project around the harbour fringes and coastal wetlands.

6.1.2 Benefits

Land management protection works have the potential to have the greatest overall benefit to biodiversity by reducing animal pest numbers and allowing native species to successfully reproduce.

The focus on land cover and pest reduction would see improved forest structure with the ability to provide greater stability during rain events and consequently less erosion, downstream sedimentation and harbour infilling.



Figure 8. Setting a rat trap

6.2 Riparian enhancement

For the purpose of this document riparian enhancement includes stream and wetland fencing, planting (both native and exotic species) and weed control.

6.2.1 Methods

- Native planting – planting of eco-sourced, site specific natives at 1.5 metre spacings (refer Appendix 2).
- Pole planting – Poplar and matsudana willow pole planting. Used for their quick rowing dense root structure that binds soil. Species used do not form dense thickets and are a sterile variety.
- Fence out all waterways where stock have access, including tributaries and drains, to stock class standard.
- Wetland fencing to cattle class standard.
- Weed control – removal of weeds such as pampas and woolly nightshade either by chemical application or mechanical means.
- In areas where erosion is active, it is better to use willow stakes, or whole trees (layering). In such cases, there needs to be enough channel width to retain adequate flood capacity within the channel.

6.2.2 Benefits

- Decreased water temperature through shading.
- Creation of fish spawning habitat by retiring stream margins and planting.
- Decreased stream bank erosion by removing stock pressure and by planting appropriate plant species.

- Fencing:
  - increased water quality, by reducing the direct (cows defecating in the stream) and indirect (run off) inputs of faecal matter and nutrients
  - reduced stream bank erosion and surface erosion
  - stream bed health and stability improved – stock crossing/walking in the stream bed impacts on the structure within the channel and decreases aquatic invertebrate habitat.
- Increased biodiversity by planting eco-sourced natives and creating new habitat.

6.2.3 Outcomes

- Improved water quality.
- Enhanced biodiversity.
- Stabilised stream banks.
- Reduced sedimentation.

6.3 River and flood management

6.3.1 Methods

- Removal of silt / mud that settles in the channel to maintain adequate channel capacity for each stream outlet on the harbour fringes. This will be done mainly by hydraulic excavator, and in some areas, the material will require complete removal from the Coastal Marine Area (CMA) where there is deemed a significant impact on the marine ecosystem.
- Repair eroding areas through site specific works and soil conservation planting and fencing.
- Removal or re-alignment of isolated whole trees, stumps or limbs that have fallen into the channel and which are likely to create an obstruction to flow or increase erosion.
- Removal of obstructive vegetation from the floodplain that may cause localised flooding. This includes species such as pampas, flaxes, willows and even mangroves.[15]
- Undertaking simple erosion control work within channels.
- Spraying vegetation.

6.3.2 Benefits

- Increased channel capacity.
- Reduced risk of stream bank erosion.

6.3.3 Outcomes

- Adequate flow path in heavy rainfall events.
- Property and infrastructure protected.
- Improved water quality.

[15] 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 more information on the pros and cons of mangrove management, see the full harbour plan document and the Whangamata Mangrove Management Options Report available from Environment Waikato or online at www.ew.govt.nz/projects/iwhangamata/index.htm. The report also contains a copy of the short publication, *'For and Against Mangrove Control'*, produced by the National Institute for Water and Atmospheric Research (NIWA).



Figure 9. Stream bank erosion in the Wentworth River

7 Implementation

On the basis that the community and Environment Waikato consider that addressing the sedimentation issues in the Whangamata catchment is a priority, it is proposed that the implementation of works be undertaken within a short to medium term time frame (10 years). The priorities for the first year in order of significance are identified below and are provided as guidance only – a works programme will only be confirmed once consultation with the community has been completed. It should be noted that the implementation of works will be dependent upon land owner participation and funding.

7.1 Community process

The first step in confirming this plan will be to consult with and engage the community. That process will take place in association with the informal consultation process for the Draft Whangamata Harbour Plan between September and December 2007 (refer Environment Waikato document number 1187143). The community within this catchment is fragmented and diverse with a high percentage of non-resident ratepayers.

Steps in gaining community and land owner involvement in the catchment management plan specifically will include:

- Kitchen meetings (small semi-formal meetings) with land owners and interest groups to identify their key issues and discuss proposals identified in this plan.
- Meeting with iwi to hear their key concerns about the catchment and how they feel the mauri of the catchment can be sustained and enhanced.
- Holding a community information day.
- Use of local media to keep the community up to date with progress and developments.

Currently, **mangrove seedlings only** can be removed under the conditions of the current resource consent granted to Whangamata Harbour Care Inc. earlier in 2007. Further consultation on mangrove management will be gathered and assessed

following the distribution of Environment Waikato's Whangamata Mangrove Management Options Report[16] and a questionnaire.

7.2 Work programme

The initial priority for work is the Wentworth River sub-catchment. This is the largest river system in the Whangamata Catchment and has the highest silt loading. Environment Waikato has already commenced some works on the Waikiekie and Te Weiti streams and this work will continue at a low level at present.[17]

The key steps in implementation for the Wentworth are as follows.

1. Reduce soil erosion and the amount of silt and sediment entering the harbour from the Wentworth River sub-catchment by:
   - fencing and stabilisation planting the river banks, targeting areas of active erosion (main channel first, tributaries second)
   - removing debris and blockages from the river and re-shaping incised banks where needed.

2. Initiate a river survey of the lower Wentworth River for the purpose of monitoring changes which may have an impact on flooding.

3. Establish an animal pest control programme in the upper catchment.

4. Undertake restoration planting of riparian, wetland and bush areas for the purpose of improving biodiversity and reducing erosion.

The time frame for implementation will be dependent upon funding and the level of participation that can be gained from land owners.

8 Costs

A detailed breakdown of expected cost is attached as Appendix 1. All recommended works costs are an estimate only, based on today's costs for materials and works. Actual price will vary depending on uptake of work, land owner contribution, industry price increases and availability of materials.

Below is a summary of the anticipated costs for each programme of works. These figures do not allow for annual maintenance.

Table 2 Land management protection

Work/Materials	Cost/Item	No. required	Total cost
Fencing – forest fragments (8 wire post and batten)	$16.00/metre	5000 metres	$30,000.00
Animal pest control – aerial	$26.00/ hectare	3600 hectares	$93,600.00
Ground based animal pest control	$52.00/hectare	300 hectares	$15,600.00
Total cost	**$139,200.00**		

[16] Environment Waikato. 2007: *Draft Whangamata Mangrove Management Options report*. Environment Waikato Internal Series 2007/15, Environment Waikato, Hamilton. Available online at www.ew.govt.nz/projects/iwhangamata/index.htm.

[17] In terms of the relationship between mangroves and flood risk in this area, it should be noted that a number of commercial and residential properties near the Wentworth River and surrounding areas will still be vulnerable to flooding in the future whether mangroves are removed or not (hence the need for the river and catchment works as outlined in this Draft Whangamata Catchment Management Plan 2007).

Table 3 Riparian enhancement

Work/Materials	Cost/Item	No. required	Total cost
Native plants (inc labour)	$5.00 per plant	14,500 plants	$72,500.00
Riparian fencing	$5.00/metre	24,000 metres	$120,000.00
Spraying of weeds	$25.00/hour	240 hours	$7,000.00
Pole planting including labour			$22,500.00
Total cost	**$222,000.00**		

Table 4 River and flood management

Work/Materials	Cost/Item	No. required	Total Cost
Remove blockages			$18,000.00
Repair corners			$28,000.00
Willow removal			$13,000.00
Mangrove removal and coastal excavation	TBA	TBA	$100,000.00
Silt traps			$3,000.00
Floodplain reshape/open			$7,000.00
Total cost	**$169,000.00**		

Table 5 Survey and design costs

Work/Materials	Cost/Item	No. required	Total Cost
Survey*	$15,000.00	2	$30,000.00
Flood modelling	$1,500.00	6	$9,000.00
Total cost	**$39,000.00**		

Table 6 Total cost – tables 2-5

Sub-total (tables 2-5)	**$570,000.00**
Plus supervisory and liaison costs	**$100,000.00**
Total cost	**$670,000.00**

* Note three surveys to be carried out over a 10 year period, including one at the beginning of the works programme and two within the following 10 years.

9 Funding

Environment Waikato funds river and catchment services on the Coromandel Peninsula under the Peninsula Project Funding Policy (Environment Waikato document number 924353). This policy provides for a Peninsula, Regional General Rate and land owner or community contribution to soil conservation, river management and flood protection works. At this stage, proposed costs for the catchment management programme total $670,000 (this figure does not include ongoing annual maintenance costs).

The Peninsula Project Funding Policy also provides for targeted rates to be applied where there is significant local community benefit from works. This typically applies to flood protection programmes, but could equally apply to a harbour and catchment management programme where the community supported significant works being undertaken in a short-term time frame. The proportion of funds to be recovered from the particular community would be determined on a case by case basis.

The Peninsula Project is already significantly committed to existing projects in other communities and catchments. Under existing funding the implementation of the Whangamata Catchment Management Plan would be carried out over the next 10 years or so. In order to reduce this time frame, targeted funding would be required.

Consultation with the community on funding, rating and costs of future works, services and activities related to carrying out the harbour plan's wider recommendations will also take place at each relevant stage as appropriate.

10 Monitoring and reporting

The implementation of this plan will be overseen by the Coromandel Zone Manager and progress will be reported to Council via the Coromandel Liaison Subcommittee.

Updates will be provided to the community of Whangamata via existing community networks and local media.

Contact will be maintained with local iwi through out this process.

An outcome monitoring programme is being implemented in the neighbouring Wharekawa Catchment. This catchment is similar in size, land use and issues to Whangamata and will provide useful information as works progress in both catchments.

Appendix 1 Assessment of individual streams

Ground inspections of the streams flowing into the Whangamata Harbour were carried out on 2 and 17 April 2007 by Emily O'Donnell and Roger Spooner. Results of those inspections are summarised as follows:

1. Wentworth River

a) Causeway to Old Tairua Road bridge
- Mangroves and general vegetation appear to be engulfing the floodway area
- Pampas has infested banks below Old Tairua Rd bridge (350m)
- This whole reach appears to be silting up. The Golf Course has complained about the increased incidence of flooding.

b) Old Tairua Road to Wentworth Valley Road (through Golf Course) - 2.2 km
- Isolated blockages in channel need removing

c) Golf Course to Water supply access bridge - 1.3 km
- Areas on LB need fencing
- RB is fenced with natives
- Isolated blockages need removing
- Eroding corners need to be repaired
- Pole planting required on outside of bends
- Isolated clumps of pampas need spraying [minor]

d) Access bridge to old quarry site - 2.30 km
- Both sides generally well fenced with natives
- Need to upgrade nominal fencing and complete fencing
- Isolated blockages need to be removed
- Willows growing in channel
- Eroding corners that need repairing
- Pole planting required
- Pampas and small willows need to be sprayed out
- Couple of bad corners to rock/layer etc.

e) Old Quarry to logged area - 1.50 km
- Virtually unfenced and eroding badly in places through this area – very open
- Fencing needed on both sides
- Pole planting needed both sides
- Allow repairs to say 6 corners

- Machine tidy some corners
- Piles of pine slash are lying in the floodplain as result of the recent logging operation

f) Logged area to Ford - 0.7 km
- Established riparian vegetation on both banks
- Fenced (fairly old and messy) but effective
- Some dead willows will need to be removed
- Allow for some machine time to carry out repairs

g) Above Ford
- Stream fringes are in native and/or retired, with virtually no fencing required.

- Needs a tidy up to remove blockages/debris in channel
- Pampas on fringes needs to be sprayed

h) Tributaries

i) Swamp near rubbish dump RB
   - this stream drains the old dump area, and is likely to contain leachate.
   - generally unfenced
   - pussy willows should be cleared and followed up with planting and fencing

ii) Tributary through Dairy farm RB
   - unfenced, needs to be fenced and planted [500m]

iii) Muddy stream LB
   - unfenced, needs to be fenced and planted over lower 450 metres [min]

iv) Large drain immediately U/S of Muddy LB
   - unfenced (500m)

v) Unnamed tributary through farm D/S quarry RB
   - both banks unfenced (500m)
   - runs through pasture up to old quarry

vi) Unnamed tributary at old quarry RB
   - fenced on one side by quarry
   - unsure about channel above quarry (700m)

vii) Wairangi Stream LB
   - unfenced (200m on 2 sides; 700m on 1 side)
   - fringes plantation in upper reaches

viii) Unnamed tributary D/S Connells
   - unfenced and eroding (700m)

ix) Wairoa Stream (Connells)
   - fenced at bottom end
   - not fenced in mid reaches (300m)
   - requires pole planting

x) Stream by McNelly property
   - needs some fencing and planting (500m)

2. Waikiekie Stream

a) Below State Highway
- Need to continue with maintenance
- Ensure open floodway to harbour – control mangroves, vegetation etc.
- Council boardwalk is obviously trapping debris and silt
- Look at reshaping floodplain.
- It appears that the floodplain is slowly rising due to silt deposition after each flood

b) Above State Highway to confluence with Tributary – 400m
- Isolated blockages in channel
- Some of this reach is fenced
- Pole planting needed on both sides

c) Tributary Confluence to Forestry – 900m
- Established thread type riparian vegetation on both banks
- Existing fencing on both sides could do with an upgrade
- Pampas needs to be sprayed
- Repair isolated erosion

d) Tributary through Watts Road – 900m
- Tributary generally unfenced
- Remove willows?
- Enhance wetland vegetation especially above road

3. Te Weiti Stream

a) Below State Highway
- Need to maintain channel through mangroves
- Need to maintain silt traps
- Ineffective fencing through grazed areas (McGregors, Thames Coromandel District Council)
- Need to plant poles in McGregors
- Plant natives (Paice and McGregor)

b) Above State Highway – 750m
- Need to maintain silt trap near road
- Replace poles (8 poplar, 2 willow)
- Plant extra poles
- Fence western side of cross stream
- Upgrade fencing and forestry fringes
- Some possum damage to last years plantings
- Pampas and pussy willow in channel needs to be removed

c) Major Tributary
- Fence out top end
- Maintain silt through Dickinsons

4. Other Tributaries

a) Julian Drive (Otuwhete Stream)
- Gravel deposition below Julian Drive culvert (approx. 100m³)
- Nominal fencing required on various tributaries

Overview of required works

In order to effectively manage the inflow into the harbour, I recommend the following actions need to be undertaken on this catchment.

1. Channel Management
- Maintain adequate channel capacity on the harbour fringes for each stream outlet
- Clear channels of obstructions or blockages
- Fence out all main waterways where stock have access [includes tributaries and drains]
- Manage/remove unwanted vegetation in channel and floodway areas
- Repair eroding areas through specific site works; and soil conservation planting and fencing

2. Riparian Enhancement
- Retire and plant fringe areas in native species

3. Upper Catchment Protection
- Retire all bush areas from stock access
- Carry out pest control operations in pine and native bush
- Adequately manage forestry operations
- Encourage further retirement
- Encourage change to appropriate land use in some of the steeper terrain

Proposed works and cost estimates

River and flood management

1. Wentworth River

a) Causeway to Old Tairua Road bridge — ?

- Survey this reach
- Assess hydraulic capability including minimum floodway width — ?
- Consider desilting exercise — ?
- Spray out pampas — 3,000

b) Old Tairua Road to Wentworth Valley Road (2.2km)

• Remove isolated blockages	-	remove	3,000
	-	dispose	1,000

c) Golf course to water supply access bridge (1.3km)

• Fenced areas on LB (700m)	-	materials		1,200
	-	labour		1,200
• Remove blockages	-	remove		1,000
	-	dispose		500
• Repair 3 corners				2,000
• Pole plant	-	materials	150 @ $10	1,500
	-	labour	150 @ $4	600
• Spray pampas and willows				500

d) Access bridge to Old Quarry site (2.30km)

• Upgrade and complete fencing	-	materials		2,000
	-	labour		2,000
• Remove blockages	-	remove		3,000
	-	dispose		1,000
• Remove willows	-	remove		1,500
	-	dispose		500
• Repair corners				4,000
• Pole plant	-	materials	250 @ $10	2,500
	-	labour	230 @ $4	1,000
• Spray pampas and small willows				1,000
• Allow for repairs to 2 bad corners				5,000

e) Old Quarry to logged area (1.5km)

• Fence both sides	-	materials		5,000
	-	labour		5,000
• Pole plant	-	materials	200 @ $10	2,000
	-	labour	200 @ $4	800
• Repairs to 6 bad corners				15,000
• Tidy corners with machine				1,000

f) Logged area to ford (0.7km)

• Upgrade fences	-	materials		300
	-	labour		300
• Remove dead willows	-	remove		1,000
	-	dispose		500
• Allow some poles	-	materials	50 @ $10	500
	-	labour	50 @ $4	200
• Minor works in channel				2,000

g) Above ford

- Remove blockages in channel - 2,000
- Spray pampas - 1,000

h) Tributaries

i. Swamp near dump RB (500m)

-	fence		materials	2,000
			labour	2,000
-	clear willows		remove	4,000
			dispose	1,000

ii. Tributary through dairy farm RB (500m)

-	fence		materials	2,000
			labour	2,000
-	pole plant	- materials	70 @ $10	700
		- labour	70 @ $4	300

iii. Muddy Stream LB (450m)

-	fence		materials	2,000
			labour	2,000
-	pole plant	- materials	60 @ $10	600
		- labour	60 @ $4	200

iv. Large drain U/S of Muddy LB (500m)

-	fence		materials	2,000
			labour	2,000
-	pole plant	- materials	70 @ $10	700
		- labour	70 @ $4	300

v. Unnamed tributary through farm RB (500m)

-	fence		materials	2,000
			labour	2,000
-	pole plant	- materials	70 @ $10	700
		- labour	70 @ $4	300

vi. Unnamed tributary at Old Quarry RB

-	fence		materials	2,000
			labour	2,000
-	pole plant	- materials	100 @ $10	1,000
		- labour	100 @$4	400

vii. Wairangi Stream LB

-	fence		materials	2,200
			labour	2,200
-	pole plant	- materials	50 @ $10	500
		- labour	50 @ $4	200

viii. Unnamed tributary d/s Connells LB (700)

-	fence		materials	3,000
			labour	3,000
-	pole plant	- materials	100 @ $10	1,000
		- labour	100 @ $4	400

ix. Wairoa Stream (Connell)

-	fence midreach (300)		materials	1,200
			labour	1,200
-	pole plant	- materials	100 @ $10	1,000
		- labour	100 @ $4	400

x. Stream by McNelly property

-	fence	say	materials	1,000
			labour	1,000
-	planting	say	materials	500
			labour	200

2 Waikiekie Stream

a) Below State Highway

• Open floodway to harbour			2,000
• Reshape floodplain			5,000
• Continue with annual maintenance			?

b) Above SH to confluence with tributary (400m)

• Remove isolated blockages	-	removal	1,000
	-	disposal	500
• Fence say	-	materials	500
	-	labour	500
• Plant poles - materials		50 @ $10	500
- labour		50 @ $4	200

c) Tributary to Forestry (900m)

• Upgrade fencing say	-	materials	2,000
	-	labour	2,000
• Remove isolated blockages and repair erosion			2,000
• Spray out pampas			1,000
• Planting say	-	materials	500
	-	labour	500

d) Tributary through Watts Road (900)

• Fence	-	materials	3,000
	-	labour	3,000
• Remove willows	-	remove	3,000
	-	dispose	1,000
• Plant poles below road	-	materials	300
	-	labour	200

3 Te Weiti Stream

a) Below State Highway

• Dig silt traps			2,000
• Fence 200m	-	materials	400
	-	labour	400
• Plant poles	-	materials (20)	200
	-	labour	100

b) Above State Highway (750m)

• Dig silt trap			1,000
• Plant poles	-	materials (30)	300
	-	labour	100
• Fencing say 300m	-	materials	500
	-	labour	500
• Spray pampas and willows	-		500
• Remove willows	-		500

c) Major Tributary

• Fence top end	-	materials	500
	-	labour	500

4 Other tributaries

a) Julian Drive

• Remove gravel			2,000
• Fence (say 1 km)	-	materials	2,000
	-	labour	2,000
• Plant poles	-	materials (100)	1,000
	-	labour	400

Total estimate of works $173,000

(Note – items in red represent activities that the land owners could carry out as their contribution and totals $52,100 for Channel Management).

Riparian enhancement

1. Wentworth

Currently the main Wentworth Channel has the following riparian plantings.

Golf Course	to water supply bridge	-	1.3km	planted 1 side
	to Old Quarry	-	2.3km	planted both sides
	to logged area	-	1.5km	no planting
	to ford	-	0.7km	established riparian

Allow to plant natives on 4.3km of new bank plus 20% infill on existing block (equivalent to 1.2km).

Total 5.5 of wide planting (1400 plants/km).

Cost to plant 7700 plants	-	supply ($3.50)	27,000
	-	labour to plant ($1.50)	11,600

Wentworth Tributaries

Allow to realistically plant 4 km of channel or 8 km of bank (narrow planting of 660 plants/km).

Also allow say 1000 plants in swamp below rubbish dump.

Cost to plant 6300 plants	-	supply	6,000
	-	labour	9,500

2. Waikiekie

Allow say 500m of channel planting (1km of bank) plus 1000 plants in wetland tributary

Cost to plant 1700 plants	-	supply	6,000
	-	labour	2,600

3. Te Weiti

Channel is quite entrenched, so planting of a native riparian zone may hinder access for maintenance. Perhaps allow for a token area of enhancement (500 plants).

Cost to plant 500 plants	-	supply	1,800
	-	labour	800

Total Estimate of Riparian Enhancement **$81,300**

Note that $24,500 can be done by the land owners as their contribution.

Land management protection

Fencing - allow to fence a nominal 5 km of bush retirement

Fence 5 km	-	materials	10,000
	-	labour	10,000

Pest Control - allow to treat 3000 ha with 1080 bait

Cost	-	3000 @ $26/ha	$78,000

Total Estimate for Upper Catchment Protection **$98,000**

Note that $10,000 can be done by the land owners as their contribution.

Summary of proposed work details

	Length of Channel Works (km)	Length of New Fencing to be Done (km)
Wentworth River	9.0	5.0
Wentworth Tributaries	6.0	10.0
Waikiekie Stream	2.0	nom
Waikiekie Tributary	0.9	1.8
Te Weiti Stream	1.0	0.5
Te Weiti Tributary	nom	nom
Other Tributaries	1.0	1.0
Upper Catchment	-	5.0
Totals	**19.9km**	**23.3km**
Say	**20km**	**24km**

Summary of estimate of costs

Channel Management	173,000
Riparian Enhancement	81,000
Upper Catchment Protection	98,000
	$352,000

Note that some $87,000 can be done by the land owners as their contribution.

Also need to allow for:

- consultation
- supervision
- design/survey
- channel works below Golf Course on Wentworth
- annual maintenance of key reaches.

Appendix 2 List of recommended native plants

Species	Location	Benefits
Kanuka *Kunzea ericoides*	Stream banks (>3m back from bank) and hill sides	Good for re-vegetating bare erosion areas.
Manuka *Leptospernum scoparium*	Stream banks (>3m back from bank) and hill sides	Good for stream bank planting and erosion areas, more hardy that Kanuka and grows larger. Manuka slash can be used as a cheap alternative to planting. Also acts as a weed mat.
Kowhai - *Sophora microphylla*	Stream banks (>3m back from bank) and hill sides	Good for controlling stream bank erosion, plant on stream edges where erosion control is needed. Also provides a food source for native birds.
Five finger	Forest fragments, hillsides gullies	Good second stage plant for re-vegetating sites.
Lemonwood	3m> stream margin	Provides good shelter and is hardy.
Mahoe Whiteywood *Melicytus ramiflous*	5m back form stream margin or wetland	Best suited for riparian planting not gully erosion plant a good distance back form the stream. Has a berry.
Koromiko - *Hebe stricta*	Stream banks and hillsides	Hardy and very great for re vegetating areas. Good on stream banks and hill slopes. Good cover for smaller bird species.
Toetoe *Cortaderia fulvia*	Wetland fringes, stream banks, hill sides	Great for use in re-vegetating slips or freshly exposed soil. Will tolerate wet. Not to be confused with Pampas.
Carex virgata	Plant close to wetland or stream at 1m spacing	Good cover, fast growing. Prefers dryer areas than *C. secta* and will tolerate the shade.
Purei *Carex secta*	Plant close to wetland or stream at 1m spacing	Buffers the stream bank is flood tolerant and provides good fish spawning habitat. Plant in exposed sites not where it will be shaded.
Karo – P*ittosporum Crassifolium*	Stream banks (>3m back from bank) and hill sides	Excellent shelter plant very wind resistant, good near the coast. Fast growing species often confused with pohutukawa during early stages of growth.
Wineberry (Makomako) *Aristotelia serrata*	Stream banks (>4m back from bank) and hill sides	Colonising species in secondary succession. Good for planting in gully erosion control and slip face re-vegetation.
Karamu *Coprosma Robusta*,	Stream banks (>3m back from bank) and hill sides	Suitable for soil erosion control and bank stability. They are also tolerant of dry and frost conditions. Has a dense fibrous root system. Good food source for birds.
Akeake *Dodomaea viscosa*	Forest fragment restoration and hill sides	Useful in controlling gully erosion. Fibrous root system. Rapid growth. Only this species is found on the Coromandel. The purple variety is not endemic to the region
Flax *Phoriuim cookianum*	Hill sides banks, fragments and retired areas	Useful in a dryer area, not as large as the river flax. Flowers earlier than Harakeke prolonging the availability of nectar for birds.
Flax - *Phoriuim tenax*	Wetland fringes, stream banks, bit only if 3m or more back form streams	Flood tolerant and very hardy. Don't plant too close to bank.
Coastal Ribbon wood Plagianthus divaricartus		Saline tolerant, Shrubby species. Not very common.

Species	Location	Benefits
Rewarewa Knightia excelsa	Forest fragment restoration and hill sides. More than 5m back form stream bank	30m tree. Slender tapering tree with long narrow serrated leaves. Rusty red flowers in spring and summer attract tui.
Taupata Coprosma repens	Stream banks , forest fragments or retired areas	Large shrub with dark green, glossy, rounded leaves. Very hardy, excellent wind and sea spray shelter. Orange berries attract birds
Cabbage tree/Ti kouka Cordyline australis	Pant in conjunction with Harakeke	17m tree. Requires some protection when young. Moderate tolerance to salt and wind. Good colonising species - grows happily on bare ground. Tolerate the wet
Pukatea Laurelia novae-zelandiae	River banks or banks of wetlands	30m tree. Slow growing. Tolerates wet sites and periodic flooding.
Kahikatea Dacrycarpus dacrydiodes	Wetlands and river margins that are periodically inundated	60 m tree. New Zealand's tallest tree. Plant with shelter in a moist site. Protect from wind in early years