Table of content

Introduction

The Whangawehi Community (represented by tangata whenua of Mahia, landowners, Department of Conservation and the district and regional councils) shares a desire to *maintain or improve the different cultural, ecological, recreational and economical values of the Whangawehi Catchment.*

Central to this aim is the need to address water quality issues and the loss of habitat for important freshwater and estuarine species. Erosion, land use, loss and fragmentation of aquatic and terrestrial habitat have led to the current degraded state of the Whangawehi Stream, its tributaries and the estuary. The protection and enhancement of remaining biodiversity values such as threatened habitat (forest and wetland) and threatened species (e.g. tuna / long fin eel, red fin bully, and Inunga) is of key concern.

The proposed Whangawehi Catchment Protection and Enhancement Project aims to address these issues by working with landowners to protect and enhance water quality, threatened habitat, and threatened species and to bring about long-term behaviour change. Enhancement works undertaken as part of this project will contribute to the National Priorities for Biodiversity Protection on Private Land.

Why a Whangawehi Cathment Management Group ?

The WCM group was born in 2011 when the consultation process undertaken in relation to the resource consent applications for the waste water treatment plant which identified deep concerns from the local community about the potential effects of the scheme on the cultural, historical, recreational and ecological values of the Whangawehi catchment. At the same time, the different parties involved also identified a shared desire to create a better management of the natural, physical, cultural and spiritual resources of the catchment as a whole and resolved to enter into a Memorandum of Understanding.
At the moment, the group encompasses a number of landowners in the catchment, Tangata Whenua with strong agency support (Wairoa District Council, Hawkes Bay Regional Council and Department of Conservation).

A community driven project formalised under a Memorandum of Understanding

A Memorandum of Understanding between the Wairoa District Council, the Hawkes Bay Regional Council, Tangata Whenua of Mahia, represented by Kaiuku Marare Trustees, Tuahuru Marae Trustees, Ruawharo Marae Trustees, Mahanga Marae Trustees, Mahia Maori Committe and Landowners in the Catchment was signed in July 2011.
This document outlines the importance Tangata Whenua place on the Waste water treatment scheme and the wish for the parties to engage in a respectful, meaningful, balanced and mutually beneficial decision making process.

The MoU identifies that the Wairoa District Council and the Hawkes bay Regional Council will consult with Tangata Whenua and landowners for the development of a Catchment Management Plan.

What is a Catchment Management Plan?

A catchment management plan (CMP) is a document encompassing all the information available on the catchment relating mainly to land use, water quality and a range of actions in order to improve water quality and to protect endangered habitats.
The core objective of the document as defined at the September 2011 Hui is to :
" maintain or improve the different cultural, ecological, recreational and economic values of the Whangawehi catchment identified by the community, in short, maintain or improve a healthy Awa"
The development of a CMP is seen as an opportunity to involve the whole of the community and provide extra knowledge, education, and funding. It is also clear to all that both the landowners and Tangata Whenua must be willing to fully participate if concrete management actions are to occur on the ground.
A Catchment Management Plan (stage one) was commissioned by the group and released in July 2012. This document which is an inventory is available to the public and was used as a base to develop this Catchment Management Plan (Stage two).

Key milestones:

Mission statement:

"Ki te ora te wai, kai ora ai te katoa " "If the water way is healthy then everything will survive"(Kathleen Mato Chairperson, Tuahuru Marae).

1- Improvement of the water quality of the Whangawehi Catchment

Restoring the integrity of the water has been identified as a priority by the community during the development of the catchment management plan. Three key objectives have been identified in this implementation plan and will be developed to give guidelines and recommendations for future work.

From previous work and studies carried out by HBRC, the main focus points identified in for the Whangawehi streams are :

- Sedimentation (priority 1)

- Coliform contamination (priority 1)

- Nutrient levels (priority 2)

1-1 Reduction in sedimentation levels

1-1-1 Presentation of the Whangawehi catchment

To address this issue, it is really important to understand at catchment scale the different land uses and soil types as they will influence the level and rate of sedimentation. The information provided comes from the Soils of part Tiniroto Wairoa area, North island NZ (WC Rijkse) and was completed by field assessment. The field assessment was made from September 2014 to March 2015.

- **Land use in the catchment:**

-1000 ha of commercial forestry

-370 ha of bush reserve

- 2130 ha of farming operations

- **Soil types in the catchment**

The soils can be broken into two main groups; the sedimentary soils (Recent and Pallic) originating predominantly from mudstone and the volcanic influenced soils (Pumice). The types of soils vary with location and slope within those broad groups. However the broad groups provide a good perspective as to which soils require what management.

- The volcanic soils are going to be of low natural fertility due to low nutrient reserves (naturally) due to their physical make-up and leaching ability. However the soils have been farmed for a long time now and will have built a solid foundation of organic matter and nutrients, even with annual leaching. If there are major nutrient reserves lacking they will be **potassium, magnesium, sulphur, nitrogen, phosphorous, and calcium**. They have a moderate to high P retention capability (particularly if there is substantial levels of allophane clay), and a low bulk density (which is excellent for reducing compaction and pugging during winter). Although this is dependent on the depth of topsoil and Waimihia layer, and the location within a paddock. They have a relatively good water holding capacity depending on ash layers present, therefore porosity and slope angle, but they

are well to moderately well drained and will get droughty over periods of long moisture deficit. **They are very prone to erosion though**, and require soil conservation measures in place to prevent soil loss. One concern is cultivation – these soils have taken a long time to develop a top soil with a reasonable level of organic material and any disruption to that development could reduce the soils ability to be as productive as it may have been. Fertiliser plus trace elements are the key ingredients with these soils at the appropriate quantities and in the right places. They are likely to be deficient in the trace elements of **copper, cobalt, boron, molybdenum, iodine, and selenium.**

- The Recent order is naturally fertile, as the soil has developed from weathering of the underlying bedrock. Their location on steeper slopes limits there potential and versatility to land use options. They are more droughty – although in this case their aspect is variable suggesting they are will vary accordingly, they are potentially highly erodable and prone to invasive weed species if left unfertilised and grazed inefficiently. Soil conservation measures are required to maintain the soils health and reduce loss and this may be managing pasture swards and fertiliser requirements. They generally have a low P retention capability and are imperfectly drained, with good levels of clay for soil activity.

- The Pallic soils originating from weathered mudstone are going to be naturally fertile, with a low P retention (or anion retention capacity). They have the potential to grow reasonably high quantities of pasture – at least 10,000kgsDM/ha on the less steeper country, however the level of growth or the quantity of dry matter will fluctuate in response to erosion levels, moisture content, stock grazing efficiency and to a lesser degree damage, and aspect.

Under the new New Zealand Soil Classification, the catchments' soils would fall into four Order's :
- The Pumice order, comprising mostly yellow brown pumice soils including steepland yellow brown pumice soils, and some yellow brown loams with a high glass content and moderate P retention.
- The Pallic soils, comprising mostly yellow grey earths, associated steepland soils, intergrades between yellow grey earths and yellow brown earths and intergrades between yellow grey earths and brown grey earths.
- The Recent soils, comprising recent soils from the previous categories.
- The Organic soils, comprising organic soils.

Table 1 : soil series present in the Whangawehi cathment

Pallic soils	Taihape, Mangatea
Pumice	Mahia, Kopuawhara series
Recent:	Recent steepland soils
Organic:	Okepuha/Taharoa

Kopuawhara sandy loam in Top little 1 paddock (Okepuha Station)

Mangatea silt loam in Big 3 paddock. Note there is no ash layer present. (Hokepuha Station)

- **Geology**

Geological data is based on the geology of the Raukumara area. The bedrock is formed from one main marine deposit split by a small variation during its deposition. It is dipping at 20-24 degrees west south west. Following this, the youngest and overlying layers are from aerial deposition and colluvium. They are in order of oldest to youngest:

- The Tolaga group provides the massive mudstone and bedded mudstone/sandstone bedrock originating from the Miocene period of the Tertiary epoch about 11.2 to 5.3 million years ago. The great depositional phase of the Miocene was coming to an end when this sediment occurred. During this period, a sediment phase altered to being predominantly sandstone and tuff (volcanic).

- During the following tectonic activity the Tolaga group sediments were up lifted above the sea and have subsequently eroded to form the hill country we see today. The uplift happened in phases with remnant marine terraces left as the sea eroded old coastline, which was then uplifted for the sea to have a new coastline to erode.

- Across those terraces the hill country eroded and laid down colluvial and alluvial material, which is found at depth on the terraces as clays and silts.

- Roughly 30,000 – 15,000 years ago during the last ice age wind blown silt (loess) was deposited across the terraces which was subsequently followed by volcanic deposition form eruptions; Waiohau (circa 11,250yrs ago), Rotoma (circa 9530yrs ago), and the Waimihia (3470yrs ago). These are the well defined phases found in the soils but during this period there were a lot of eruptions and there may be other ash deposits present. There is little if none of the Taupo eruption found either because it never existed or was eroded off quickly.

- There is a faultline called the Mangatupae fault originating in the Urumatui stream, heading towards Table Cape. It is mapped as being intersected by a fault that traces along the front of the tilted block that forms a large component of the farms landscape. Essentially along the base of the cliff in behind the Okepuha houses.

- **Climate**

The Whangawehi Catchment has two bioclimatic zones, coastal and semi coastal with the entire Mahia District influenced by its close proximity to the coast. It has a moderate coastal climate with very warm windy dry summers. Day temperatures occasionally exceed 30 degrees during the summer, with dry foehn northwesterly winds. Annual rainfall ranges from 1000-2000 pa (av 1000 mm around the coast, rising to 1600-2000 mm at the DOC Reserve) with a marked decrease in the amount and reliability of rainfall in spring and summer. Winter temperature are moderate (av. Winter minimum of 6.3 -9 C) with maximum rainfall in this season.
Equinox winds are quite characteristic of the area and lead to extensive wind erosion affecting the pumice soils. This is reflected in the evapotranspiration rates (table 4) in October, November.

Table 2 : Rainfall at Pongaroa Station Meteorological Station from March 1953 to August 1996.

	Jan	Febr	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Mean	59	73.3	132	116.3	113.6	147.8	143.4	119.3	98	86.6	53.1	63.6	**1243.4**
Max.	223	200.2	1283.6	315.5	461.6	405.6	349.7	360.7	273	286.6	147.3	256.8	**2296.1**

The Min Mean and Max of Annual values are for complete years only.

Table 3 : Mean soil moisture deficit at Pongaroa Station Meteorological Station from March 1953 to August 1996.

	Jan	Febr	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Mean	114.1	105.1	76.0	53.2	12.3	2.3	2.2	5.1	15.3	33.5	78.2	108.4

Table 4 : Mean evapotranspiration from 1991 to 2014 at Pongaroa Station Meteorological Station.

	Jan	Febr	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Mean ETP	154.2	117.4	98.5	60.6	43.5	33.7	35.9	51.4	76.8	113.0	132.7	144.7	1067.3

Table 5 : Mean rainfall, maximum and minimum temperatures from 1981 to 2010 at the Mahia AWS site (see map)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall	57.2	86.4	84.2	126.1	108.9	137.4	139.1	103	64.9	78.6	75.7	68.8	1130.3
Mean max T	21.8	21.5	20.1	17.7	15.5	13.3	12.5	13	14.8	16.4	18.2	20.2	17.1
Mean min T	14.7	15.1	14.1	12	10.2	8.3	7.6	7.7	8.9	10.1	11.5	13.5	11.1

1-1-2 Erosion Modelling

A model was run on the Whangawehi Catchment by the Soil Science team (HBRC) in January 2015 to identify the main contributing areas in terms of sediment. The model used is the New Zealand Empirical Erosion Model developed by Landcare research. NZeem® is an empirical model that predicts mean annual sediment yield from a given catchment, based on annual rainfall, type of terrain and percentage of woody vegetation cover.
The model is used to identify vulnerable land for soil conservation prioritisation, and to minimise erosion and flood damage.

Table 6 : Erosion modelling for the Whangawehi catchment

Soil loss (kg/ha/year)	Area (ha)	% in the catchment	Location	Priority
2-50	177	**5 %**	Flats on the marine terraces on Pongaroa Station, Taharoa Trust and Wairuhe Station	**3**
51-200	699	**19.7 %**	Rolling country on the marine terraces on Pongaroa Station, Taharoa Trust and Wairuhe Station.Some bush blocks on Grandy Lake Forest, on Pongaroa Station, Taharoa Trust and Wairuhe Station	**2**
201-500	687	**19.3 %**	Steep hill country slopes on the edge on the Marine terraces on Pongaroa Station, DOC Bush, Taharoa Trust, Wairuhe Station and Okepuha Station.	**2**
501-2000	1284	**36%**	Active gully systems and steep slopes on Grandy Lake Forest, Pongaroa Station,Taharoa Trust,Wairuhe Station and Okepuha Station	**1**

2001-5000	708	**20%**	Very steep slopes and gully systems actively eroding on Grandy Lake Forest and Okepuha Station	**1**
5001-20000	2.7	**0.08%**	Hot spot with high sediment loss mainly on Okepuha Station	**1**

Table x gives a general appreciation of the different parts of the catchment and their contribution in terms of sedimentation. A prioritisation is given as a general guideline but needs to be used with care. The following section gives more details on how some of these areas could be treated.

Key soil classes and general recommendations:

- Class 501-2000 : This class type is the most significant in the catchment (36%). This class unit offers a wide range of erosion ranging from 501 to 2000 kg of soil loss per ha. Giving general land management advice on such a large range of erosion magnitude is risky, specific advice is given in section 1-1-3 Land and environment plans. However this class is made of slopes that could be planted with trees especially in the gully systems. The general recommendation would be to establish soil conservation trees in the gully systems when suitable and possible.

- Class 2001-5000 : This is a highly erodible class mainly located on the western part of the catchment. These soil types are usually located on very steep contours where soil conservation trees may not be suitable. Alternative land use options may have to be envisaged (see section 1-1-3). However, gully control when possible will help stabilise the soils. Gully control should be the first initiative to undertake in order to reduce soil loss on these soil types.

1-1-3 Land and environment plans

- **Environmental programme for Okepuha Station**

The recommendations listed below come from the Environmental Plan done by Simon Stokes (HBRC) in July 2005.
The map "Land Resource Management Map Environmental Plan" attached in the annexes gives a summary of the environmental work proposed.

<u>Environmental plan summary :</u>

Table 7 : Okepuha environmental plan

Environmental plan recommendations	**Location**	**data**
Erosion Control Forestry	Bottom N2 Poplar and Top N2 Poplar Spring banks gully, Bottom big 1 gully	**38 ha**
Retirement Protection	Little bush, big bush	**8 ha**
Riparian fencing	See map	**4000 m**
Gully planting	See map	**6000 m** **910 trees**

Shade and slope planting	See map	**1200 trees**
Riparian Management stream	See map	**17632 m**
Shelter belts	See map	**6096 m**

Detailed land resource management plan :

The paddocks listed below require spaced tree planting or pair planting to control actual and potential erosion. The tree planting is split into three categories – slope, gully, and shade. The size of pole used is dependent on the pole protection provided from stock. For example, you can reduce the pole size by ring fencing or hot wires keeping cattle away. There may be other management techniques required such as subdivision fencing, debris dams or contour drainage that will be listed. **All trees are planted at approximately 12-15m spacing unless otherwise stated, or they are listed as shade trees. Willows are planted for root matting.**

Location or paddock(s)	**Site**	**Tree species**	**Quantity + other techniques**
Top terrace face,	Shade trees	Trees planted as individuals Pohutukawa, Quercus ilex v ballota, Lagunaria patersonii, Norfolk island and Bunya pine Trees/shrubs planted in clusters of individual species or mixed copses: Karo, Taupata, Ngaio, Karaka, Olearia paniculata/traversii, Cordyline australis, Ralph's pittosporum, Korokia, Phormium tenax, Griselinia littoralis, Puriri	More exposed sites to east and north in particular. 7 sites = 1 to many trees per symbol Require fenced protection from stock (initially for some trees)
Top little 1, No 1 north, No 1 south, Top big 1 gully, Bottom big 1 gully, Basin lane, Basin, and Lake	Shade trees	Trees planted as individuals Norfolk Island hibiscus *Lagunaria patersonii*, Norfolk island and Bunya pine *Araucaria heterophylla & A. bidwilli*, various Pinus species particularly Bishops pine *Pinus muricata*, Maritime pine *Pinus pinaster*, Trees/shrubs planted in clusters of individual species or mixed copses: Karo, Ngaio, Karaka, Olearia paniculata/traversii, Cordyline australis, Ralph's pittosporum, Korokia, Phormium tenax, Griselinia littoralis	Very exposed sites to west and northwest. 18 sites = 1 to many trees per symbol Require fenced protection from stock (initially for some trees)
Location or paddock(s)	**Site**	**Tree species**	**Quantity + other techniques**

Top Triangle, Bottom trig, Finns	Shade trees in mid slope in gullys	Poplars – Veronese, Crowsnest, Argyle; Willows - Salix matsudana – Tangoio, Moutere plus other sawfly resistant clones Or a selection from any of the above species listed previously	Sheltered but also drier planting sites generally so poplar and willow clones are selected for reliability in deep soil, moist sites. Willows can be planted higher up the slope 13 sites = 1 to many trees per symbol Require fenced protection from stock (initially for some trees
Back big 3, Front little 3, Big 3, Back corner big 3,	Shade trees in mid slope in gullys	Poplars – Veronese, Crowsnest, Argyle; Willows - Salix matsudana – Tangoio, Moutere plus other sawfly resistant clones Or a selection from any of the above species listed previously	Sheltered but also drier planting sites generally so poplar and willow clones are selected for reliability in deep soil, moist sites. Willows can be planted higher up the slope or a selection from any of the above species 12 sites = 1 to many trees per symbol Require fenced protection from stock (initially for some trees

Location or paddock(s)	**Site**	**Tree species**	**Quantity + other techniques**
Bottom big gully 1	Sub - division	Required for establishing riparian management and erosion control forestry; 800m fence	
Top No 2 poplar	Sub - division	Required to renew fenceline, shifting current fence for establishing riparian management and erosion control forestry; 500m fence	
Small No 1	Sub - division	Required for subdivision and establishing riparian management; 411m fence	

Total slope planting	**1060**
Total gully planting	**910**
Total new subdivision fence	**1711m**
Total shade planting	**71 or more**

Some of the hill country that needs some spaced planting – looking into Middle and Bottom valley paddocks- Okepuha Station

- **Environmental programme for Taharoa Trust**

The O'Briens are already carrying out soil conservation measures as part of their Erosion Control Plan developed in 2013 in partnership with the Hawkes Bay Regional Council. The following recommendations include:

- Reduction of sedimentation levels on the Hill country blocks including the stabilisation of the Mangatupapa gully and sub catchments.

- Soil conservation on the pastoral block.

- Track and infrastructure protection.

- Wind erosion control, shade and shelter for stock health.

- Retirement of native bush block for soil conservation and biodiversity.

Environmental plan summary :

Table 8 : Taharoa environmental summary

Environmental plan recommendations	Location	Area/length/tree number
Retirement Protection	Bush retirement (see maps)	12.5 ha 3500 m fencing required
Riparian fencing	Mangatupae if feasible	2000 m
Gully planting	See map	900 trees
Shade and slope planting	See map	1000 trees
Shelter belts	See map	4855 m

Detailed environmental plan :

1- Mangatupae Catchment

The Mangatupae catchment is a steep hill country catchment (approximatively 130 ha) eating back into the Marine terraces located at the front. Drainage lines from the rolling terrace above drop off sharply into this valley with the potential for these to cut back into the terrace. The waterway has many discontinuous gully heads working their way up the stream bed. Each lowers the stream base level making the valley sides more unstable. Erosion control measures are needed to reduce the rate of erosion.

Mangatupae catchment with class 7e in the back ground

Gully control : The Mangapae stream is 2 km long. The lower part of the stream bed presents a low slope (on 900m) while the upper part of the catchment is steep to very steep.

Gully erosion in the Mangatupae catchment where an active pole planting programme will take place soon

-The landowner is planning on fencing off the lower section of the stream on both sides (500 m) and establishing native trees. An alternative and cheaper option would be to pair plant willows every 20 meters in the lower part of the stream and every 10 meters in the steep parts. This will require a minimum of 500 trees as an initial operation. Side streams will have to be planted as well where not too steep (1000 m in total). This will require a minimum of 200 trees

- Debris dams : 6 sites for debris dams have been identified on the map and 3 will be built in January and February 2015 in order to build the stream bed up in the lower part of the stream.

Debris dams are structural controls that are built in the floors of eroding gullies. Their purpose is to stabilise the gully floor so that trees can be established to stabilise the gully sides. While trees are the main long term tool to control the Mangatupae gully system, they can be difficult to establish if water channels continually undermine the toes of the hill slopes.

Netting debris dam : note the back fill upstream of the structure, standards to tie the structure back, wings above flood level, weir board horizontal and tyres downstream.

Debris dams are normally built in series over time, with the base of the upstream debris dam level with the top of the debris dam below. However, locating a suitable site to commence debris dam construction is an important part of ensuring their success. It is important that the site is able to give sufficient support to the sides of the dam. The height of debris dams (where the water flows over the centre of the structure) should be approximately 600 mm on completion of construction.

Slip control : The upper part of the Mangatupapa stream (Bush paddock) offers some easier LUC classes (6 ha approx) where pole planting could be undertaken in order to reduce gully erosion and earth movement due to springs. This would require a minimum of 200 trees at a spacing ranging from 10 m (steep) to 20 m (easier).

Cutting and Fern paddocks are similar to the Bush paddock, poplars and willows would help hold the soil together where trees can grow (200 poplars and willows)

Obviously weed control will have to take place prior to any soil conservation measure is undertaken.

Bush paddock (class 6e10). Soil conservation trees can reduce soil erosion on this easier country

Table 9 : Soil Conservation programme for the Mangatupae catchment

Area/Paddock name	Purpose	What's required
Mangatupae stream and main tributaries gully control	Gully control all along the Mangatupae stream and main tributaries	Pair planting with 700 willows 10 to 15 m spacing
Bush paddock, Cutting and Fern paddock	Control the side slopes of the catchment	Space planted poplars and willows from 10 to 20 m spacing, 400 trees minimum
	Debris dams to build stream level up	3 debris dams as identified on map
Bottom basin, Bush	Retire already existing bush block for erosion control and biodiversity purposes.	2 bush blocks have been identified by the owner in the Bottom Bassin paddock and will be fenced off.
	Debris dams to build stream level up	3 debris dams as identified on map

2- Whangawehi northern terraces:

Gully and slip control :

-The landform is one of steep slopes down to the stream with a series of 4 steep valleys draining the western parts of the terrace. The drainage lines have steep sides covered in tephra and in places covered with scrub. This is the case on the last gully towards the boundary with Andrew Ormond. Soil conservation will have to be planted once the development phase is completed.

- The valley bottom and easier slopes are to be protected with soil conservation trees with a focus on protecting the different tracks and controlling the bottom part of the steep gullies. Trees have already been planted and this effort should be continued once black berry and shrub has been controlled.

Slip erosion on the terrace edge on class6e4 land. Soil conservation trees will reduce soil slips

Mill face : gully control is critical to protect the fertile flats located above the hills.

Mill face : track protection with poplars

Mill face : class 4e1 amongst class 6e1 country. This easier country is worth protecting with poplars once blackberry control has been undertaken

- New fence lines have been drawn on the soil conservation map in order to subdivide this large paddock in 3 more manageable units of respectively 15ha, 17.5ha and 17 ha (see map).

Table 10 : Soil Conservation programme for the Northern terraces

Area/Paddock name	Purpose	What's required
Mill face	Soil conservation, track and infrastructure protection	Gully control : 200 trees -10 m apart Slope control : 150 trees -15 to 20 apart Track protection : 50 trees-15 to 20 m apart

3- Southern paddocks:

These paddocks are the catchment heads of drainage lines to the coast in which severe and deep seated earth flow has reached the boundary and is difficult to control. Forestry is one way of reducing soil erosion as well as the establishment of soil conservation trees down slope on the adjacent property.

Nber 1,2,4,4,5 paddocks with gully erosion and soil slip

Nber 5 paddock : this gully head /system needs to be controlled with poplars

4- Marine terraces:

Bottom and top puia paddock and wetland

Horseshoe paddock and wetland

View from Bottom hay pad on class 3 and 4 country. Erosion occurs at the bottom part of the slope

Bottom hay paddock with erosion occurring along the wetland

- Erosion control

Wetlands have formed in the terrace drainage land forming a unique environment. 30 ha of wetland have been retired and include some steeper slopes colonised by native plants. The side slopes when unfenced become susceptible to sheet wash and slip erosion. The owner has been planting soil conservation trees (Top and Bottom Puia etc).

Scotts Gully 1 and 2 are the heads of 2 main gully systems and should be controlled by some sort of woody vegetation either Willows or native vegetation as they jeopardize the fertile land above.

Table 11 : Soil conservation programme for the marine terraces

Area/Paddock name	Purpose	What's required
Horseshoe2 and 3, Island Pd, Puia lane, Bowens	Soil conservation	Slope control, 50 poplars- 20 m apart
Scotts gully 1 and 2	Gully head control	- Soil conservation trees : 100 or retirement (Manuka for honey)

- Wind erosion, shade and shelter

Wind erosion is a real concern on the Peninsula, it affects the arable soil (Pumice) located on the marine terraces. The wind especially in the winter is quite a limiting factor to the sheep and beef enterprise. The landowners have agreed to develop several shelter belts in key areas of the farm.

The proposed sequence is based on a 2 rows shelter belts with native trees planted 2 m apart with a one meter gap between the rows.

Mill flats, intensive bull fattening unit quite vulnerable to wind erosion

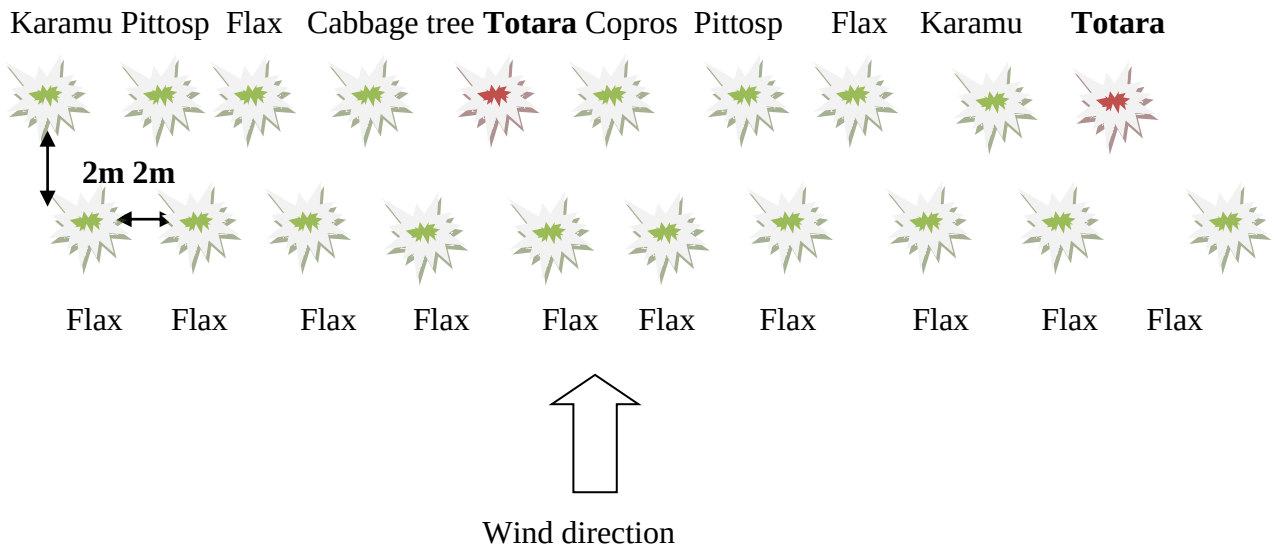


Table 12 : budget

Paddock Name	Length of shelter	Number of trees	Seedling Costs ($3.5/seedl)
Top Hay pd	1993 m	**2193**	**$ 7675**
Mill flat pd	1268 m	**1395**	**$ 4883**
Top Puia	70 m	**77**	**$ 270**
Bottom Puia	108 m	**120**	**$ 420**
Woolshed 3	200 m	**220**	**$ 770**
Loveys	262 m	**300**	**$ 1050**
Horseshoe pd	500 m	**550**	**$1925**
Total	4400 m	**4855**	**$ 16,993.00**

Planting costs are based around $0.75/tree

- Multi purpose shelterbelts

- Fire wood/timber blocks

The farm is extremely exposed to the wind which is a limiting factor for stock in the winter and at cropping time especially during the equinox period where wind can blow from September to November. The establishment of trees offering shade and shelter as well as other ecological services is something that needs to be taken in consideration before establishing these shelterbelts.

The establishment of trees providing shade and shelter as well as good quality wood for firewood or timber, close to the woodshed, is a simple project that could sustain firewood on the farm for a long period of time. Planning a firewood block makes a lot of sense and doesn't require a large area to be taken out of farming. It could be an opportunity to fence off an unproductive part of a paddock (wet area for example) or create a shelter belt against an existing fence. **Front hay paddock, Loveys and Bottom hay paddock** have got small areas unproductive (wet) that could be fenced off and planted with appropriate trees.

-Trees for bees :

The farm benefits from significant bush blocks within the property and surrounding properties which supply large numbers of native flowers for native and domestic bees. Honey production is becoming more and more popular especially for Manuka honey and could become a new income stream for the owners. As a rule of thumb the foraging area around a beehive extends for 3 km, although bees have been observed foraging twice and three times this distance from the hive.

- ✓ **Facts and figures :**

- The chart below demonstrates the strategic position of the farm for bee hives located either near the homestead or more inland around the hay barn. 107 ha of native bush are within close range for a bee (less than 2 km) and an other 1000 ha are within the 3 km optimal foraging range.

- Taharoa Trust and surrounding farm land offer large areas in clover.

- The restoration of the Mangatupae gully system will require a minimum of 500 willows which will provide early pollen from August to September.

- The large undeveloped coastal slopes are covered with native vegetation and Gorse which will provide winter feed for bees.

- The possibility for the farm to plant marginal land with specific bee /honey trees (Manuka) (Part of Scott Gully 1 and Scotts Gully 2, possible area 10 ha).

Table 13 : distance to key pollen and nectar sources.

Bush block name/location	**Distance from the Homestead**	**Distance from the hay**	**Area in bush**
Horseshoe bush block/Andrew's block	1.5 km	450 m	39 ha
Bush block paddock	1.3 km	600 m	4 ha
Bottom basin bush blocks	2.3 km	1 km	4.6 ha
Riparian strip/Grandy lake Forest	2.7 km	1.4 km	10 ha (plus 1000 ha of forest with natives)
A Ormond big bush block	1.9 km	1.3 km	50 ha
DOC Reserve	4.1 km	2.5 km	374 ha
Coastal steep slopes	1.5 km	2.9 km	200 ha plus
Roger Dicky's forest (with natives)	2.7 km	2.5 km	500 ha

Mahia peninsula seems to be lacking flowers and pollen in the autumn and winter.

Here are some trees species that could help bridge the gap (see documents included in the appendices for more details):

Table 14 : tree species for autumn and winter source of pollen .

Tree species for winter source of pollen and nectar	**Tree species for autumn source of pollen and nectar**
Silver wattle	Eucalyptus Fastigata
Green wattle	Coast Banksia
Cootamundra Wattle	Eucalyptus Regnans
Puriri	NZ Lacebark
Kowhai	Manuka

Manuka	Lancewood
Tree Lucerne	

5- Bush retirement for erosion control and biodiversity

The Mangatupae catchment offers good size bush blocks on steep slopes that are worth protecting for biodiversity and soil conservation purposes.

Table 15 : bush retirement information

	Area	**Fencing required**
Bottom basin (small bush block)	1.3 ha	600 m
Bottom basin (big bush plus riparian strip)	3.3 ha	1000 m
Bush paddock	4 ha plus	700m plus
Mill face bush	2 ha	1000 m
Bottom hay bush	0.2 ha	200 m
Pines bush	1.7 ha	Already fenced off
Total	**12.50 ha**	**3500 m**

-Bottom basin bush blocks: the big bush block includes a significant riparian strip that plays a key role in controlling the Mangatupae gully system. It could worth meeting with HBRC and a QE II officer and see if they would be willing to co fund this project. If a covenant is agreed to and signed, the fencing costs could be shared and only a third of the expenses are incurred to the landowner. By fencing off these 2 bush blocks, the landowner would subdivide this part of Bottom Basin paddock in 2 manageable size paddocks of 7 ha and 8 ha.

Bottom basin bush blocks on class 6 and 7e reducing erosion in the Mangatupapa catchment

-Bush paddock: the 4 ha bush block plays a key role in terms of erosion control in the Mangatupapa sub catchment. Fencing it off would be quite challenging and would have to be done once the main gully system has been stabilised with willows.

Bush block in Bush paddock controlling earth flow and gully erosion on class 7e2 land

-Mill face bush: this 2 ha bush block controls the gully head of a deep gully system, hence the importance of its protection. Gully control with soil conservation trees on the flood plane will be needed to stop the gully system from eroding.

Mill face bush controlling a gully system in the northern part of the farm

-Bottom hay bush : small block that could be retired against the southern boundary.

-Pines bush : this block was planted in Pines and harvested recently. The owner intends to retire it and establish native trees.

6- Subdivision programme

Taharoa Trust is currently undergoing development work on the Hill country block by spraying scattered scrub (happened over the past few years), spraying black berry and gorse. As part of this development programme, fencing is being erected. The Environmental programme map shows the potential subdivision that should occur. The following is a summary of fence length required to implement the recommendations.

Table 16 : Taharoa subdivision programme

Paddock name	**Current area (ha)**	**Fence length (m) required for subdivision**	**Potential paddock size**
Mill face	48.8	666m 574 m	17 ha 8.5 ha 22 ha
Bottom Basin	35	510 m 1000 m	20.6 ha 6.7 ha and 7.7 ha
Total		**2750 m**	

- **Environmental programme for the Homestead farm**

An erosion control plan was developed for the farm in November 2014. The Homestead farm has a limited area draining into the Whangawehi stream hence the limited environmental programme. However the steep slopes (Parakiwai) facing the Whangawehi stream need substantial input in terms of soil conservation trees in order to reduce soil erosion and protect tracks.

Table 17 : Homestead erosion control recommendations

Pd Name	Issue	Details	Numbers
Parakiwai	Gully control	3 major gullies are actively eroding this paddock	60 Willows, 15 m spacing
	Gully erosion and wet spots	A large number of small gullies and wet spots could be planted	A mixture of Willows and Poplars 100
	Slump erosion	The soil is slumping towards Pongaroa Station and against the forest	A minimum of 50 Crows Nests are required
Total			**210 trees**

- **Environmental programme for Grandy Lake Forest**

Grandy Lake Forest represents 1000 ha in the catchment and although most of the land is in Forestry, erosion is still occurring. Harvest is a critical time and some measures could be put in place now to mitigate erosion issues in the future. These recommendations are based on observation, field assessment and on the Forest Manager's knowledge of his forest and environmental issues he is facing.

Table 18 : Key issues identified in the Forestry

Issues	Measures
Trees planted too close to water ways	Best practise implemented during the next rotation with a buffer left between the trees and the water ways.
Absence of riparian margins	Identify sub catchments where suitable riparian margins could be established
Roading quite close to water ways	Identify key issues and put in place remediation measures when possible (sediment traps)
Debris and silt at harvest time	Put in place traps in key areas and establish willows to hold the slash in key areas where maintenance will be done easily.

Table 19: Work programme overview

Recommendations	Location	Data
Riparian buffer	The main Whangawehi stream, the Urumatui stream and the DOC stream could be planted with native trees that will withstand harvest and sylviculture practises. They would be damaged at harvest but would grow back	Species recommended ; Mahoe, Wine berry, Tutu ?, five fingers, Pittosporum, Coprosmas etc.
	Main Whangawehi	3 km
	DOC Stream	1.5 km
	Urumatui Stream	1.5 km
Debris structures	The three streams should have at least one individual structure above the confluence with the Whangawehi stream. One structure at least should be constructed below the confluence of the 3 streams.	These structures could be either made of metallic rails or willows poles planted across the stream bed. All structures should be accessible to a digger for maintenance purposes

- **Environmental programme for Pongaroa Station**

A full comprehensive farm plan is underway on Pongaroa Station and will be added at a later stage to this catchment management plan.

An earlier Erosion Control plan was drafted in order to protect the hills overlooking the Whangawehi stream. This data will be the base of the recommendations until a comprehensive farm plan is completed.

Table 20 : Pongaroa erosion control recommendations

Pd Name	Issue	Details	Numbers
Bottom Rupahau	Track protection Gully control slumping	Willows, 10 m spacing Kawas, 30 m spacing Willows 20 m spacing Crows Nest, 15 m spacing	**10** **20** **10** **20**
Bottom old woolshed	Track protection Gully control Slumping	Willows, 20 m spacing Kawas, 30 m spacing Crows nest, 15 m spacing	**40** **30** **50**
Ridges and flats	Gully control/crossing protection	Willows, 25 m spacing Crows nest, 15 m spacing Kawas, 30 m spacing	**35** **20** **15**
No smoke	Gully control/crossing protection	Willows, 10 m spacing	**50**
Total			**300 trees**

➢

1-2 Reduction of faecal contamination: restoration programme along the Whangawehi stream

1-2-1 Work programme overview:

The following tables offer technical information regarding the establishment of a riparian zone along the Whangawehi stream. The timeline is only given as a guideline as these projects will be subject to funding opportunities.

Table 21 : General work programme overview

Property name	Length of river	Area to be retired	Number of trees required	Fencing required	Note
Pongaroa Station	3 km	20 ha	Between 60 and 70 000 trees	3 km conventional new	
Grandy Lake Forest/Homestead	1.6 km	10 ha	Between 30 and 40000 trees	3.2 km new with potentially 1.6 km deer fence and 1.6 conventional	Willow removal (30 big trees) and alternative water supply for Homestead will have to be addressed
Taharoa Trust / Grandy lake	1.5 km	10 ha	Between 30 and 40000 trees	1.5 km new 1.5 repairs with 3 wire extension for deers	
Ormond /Grandy Lake Forest	850 m	4 ha	Between 12 and 15000 trees	850 m new 850 m repairs with 3 wire extension for deers	
Len Symes/WDC	750 m	4 ha	Between 12 and 15000 trees	750 m of new conventional fence	
Total	**13.8 km**	**48 ha**	**180,000**	**9.3km new** **4 km of repairs and extension with 3 wires for**	**30 willows to remove and alternative water supply**

				deer	

1-2-2 detailed work programme

- **Pongaroa Station**

Table 22 : Pongaroa Station work programme

Stage 1 : 10 ha – 30000 trees	**Date 2015**	**Status**
Aerial weed control Metsul 700 g/ha , Pulse : 2l/ha Application rate 400l/ha. Glyphosate was not applied	December 2014	Done
Fence establishment	January /February 2015	Done
Tree establishment (30000) Impact Forestry (166 hs on 2 days to establish 8000 trees)	June 2015	
Release spraying (30000) Gluphosinate (10 ml/l) – 1.5 drum required	October 2015	
Blackberry/Gorse control :5g/10l Knap sack, Pampas : Glyphosate 15ml/l.	November 2015	
Stage 2 : 10 ha – 30000 trees	**2016**	
Block 2 : Recommendations : aerial weed control Metsul 500 g/ha , Glyphosate 4l/ha. Pulse : 2l/ha Application rate 400l/ha	September 2015 (second application for this block)	
Block 1 and 2 : Blackberry/Gorse control :5g/10l Knap sack, Pampas : Glyphosate 15ml/l.	February 2016	
Block 2 : Aerial weed control Glyphosate (4l/ha), pulse ; 2l/ha 200l/ha	3 weeks before planting Mid to end of April 2015 weather dependent	

Block 1: Release spraying of trees planted in 2015 (30000) 1.5 drum required	March/April weather dependent	no
Block 2 : Tree establishment 30000 trees	May/June 2016	no
Block 1 and 2 : Release spraying (60000 trees) Gluphosinate (10 ml/l) – 3 drums required	October 2016	no
All blocks : Blackberry/Gorse control :5g/10l Knap sack, Pampas : Glyphosate 15ml/l.	November 2016 and February 2017	no
Tree maintenance		
Release spraying	April and October for the first 2 to 3 years	
Blackberry and weed control	Ongoing every year in February /March	

- **Grandy Lake Forest Homestead**

Table 23 : Grandy Lake Forest Homestead work programme

Stage 1 :	**Date ?**	**Status**
Engage with the landowner	November 2014	
Make a decision around extensions of the existing water supply system to the Whangawehi	June 2015	
Make a decision on willow management along the stream	June 2015	
Mechanical Willow removal /other option	November 2015	
Aerial weed control Metsul 700 g/ha , Glyphosate 5l/ha. Pulse : 2l/ha Application rate 400l/ha	December 2015	
Fence construction on true left side of the stream (1.6 km deer fence?)	January 2016	

Fence construction on true right side of the stream (1.6 km conventional)	**January 2016** or 2017 funding dependent	
Glyphosate 5l/ha. Pulse : 2l/ha Application rate 200l/ha	March 2016	
Tree establishment (40,000)	May 2016	Done
Release spraying (40000) Gluphosinate (10 ml/l) – 2 drums required	October 2016	Done
Blackberry control :5g/10l Knap sack	November 2016	Done
Tree maintenance		
Release spraying	April and October for the first 2 to 3 years	
Blackberry and weed control	Ongoing every year in February /March	

- **Taharoa Trust**

Table 24 : Taharoa Trust work programme

Stage 1 : 4 ha – 16000 trees	**Date**	**Status**
Aerial weed control Metsul 700 g/ha , Glyphosate 5l/ha. Pulse : 2l/ha Application rate 400l/ha	February 2014	Done
Fence establishment	March/April 2014	Done
Tree establishment (16000) Impact Forestry (166 hs on 2 days to establish 8000 trees)	June and September 2014	Done
Release spraying (16000) Gluphosinate (10 ml/l) – 0.75 drum required	November –December 2014	Done
Blackberry control :5g/10l Knap sack	November 2014	Done
Stage 2 : 4 ha – 12000 trees		**2015**

Block 2 : Aerial weed control Metsul 500 g/ha , Glyphosate 4l/ha. Pulse : 2l/ha Application rate 400l/ha	September 2014 (second application for this block)	Done
Block 1 and 2 : Blackberry control : 5g/10l Knap sack	February 2015	
Block 2 : Aerial weed control Glyphosate (4l/ha), pulse ; 2l/ha 200l/ha	3 weeks before planting Mid to end of April 2015 weather dependent	no
Block 1: Release spraying of trees planted in 2014 (16000) (0.75 drum required)	March/April weather dependent	no
Block 2 : Tree establishment 12000 trees	May/June 2015	no
Block 3 : Aerial weed control Metsul 500 g/ha , Glyphosate 4l/ha. Pulse : 2l/ha Application rate 400l/ha	September 2015	
Block 1 and 2 : Release spraying (12000+16000= 28000) Gluphosinate (10 ml/l) – 1.5 drums required	October 2015	no
All blocks : Blackberry control :5g/10l Knap sack	November 2015 and February 2016	no
Stage 3 : 2 ha – 6000 trees		**2016**
Block 3 : Aerial weed control Glyphosate (4l/ha), pulse ; 2l/ha 200l/ha	3 weeks before planting Mid to end of April 2016 weather dependent	
Block 1 and 2 : Release spraying (12000+16000= 28000) Gluphosinate (10 ml/l) – 1.5 drums required	April 2016	
Block 3 : Tree establishment 6000 trees	May/June 2016	
Block 1, 2 and 3 : Release spraying of all trees Gluphosinate (10 ml/l)	October 2016	

– 2 drums required		
Tree maintenance		
Release spraying	April and October for the first 2 to 3 years	
Blackberry and weed control	Ongoing every year in February /March	

- **Ormond / Grandy Lake Forest**

Table 25 : Ormond / Grandy Lake Forest work programme

Stage 1 :	**Date ? 2017**	**Status**
Engage with the landowner	January 2017	
Make a decision around alternative water supply options (Ram/dams etc.)	Winter 2017	
Put in place the alternative water supply	December 2017	
Aerial weed control Metsul 700 g/ha , Glyphosate 5l/ha. Pulse : 2l/ha Application rate 400l/ha	December 2017	
Fence construction on true left side of the stream (850 m deer fence?)	January 2018	
Fences repairs on true left side against the forest with 3 wires extension for deer.	January 2018	
Aerial weed control Glyphosate (4l/ha), pulse ; 2l/ha 200l/ha	3 weeks before planting.Mid to end of April 2018 weather dependent	
Tree establishment (15,000)	May 2018	
Release spraying (15000) Gluphosinate (10 ml/l) – 0.75 drums required	October 2018	
Blackberry control :5g/10l Knap sack	November 2018/Feb 2019	

Tree maintenance		
Release spraying	April and October for the first 2 to 3 years	
Blackberry and weed control	Ongoing every year in February /March	

- **Symes /WDC**

Table 26 : Symes/WDC

Stage 1 :	**Date ? 2016**	**Status**
Willow removal bellow the crossing	November 2015	
Aerial weed control Metsul 700 g/ha , Glyphosate 5l/ha. Pulse : 2l/ha. Application rate :400l/ha	December 2015	
Fence construction 750 m	January 2018	
Aerial weed control Glyphosate (4l/ha), pulse ; 2l/ha 200l/ha	3 weeks before planting. Mid to end of April 2018 weather dependent	
Tree establishment (15,000)	May 2018	
Release spraying (15000) Gluphosinate (10 ml/l) – 0.75 drums required	October 2018	
Blackberry control :5g/10l Knap sack	November 2019/ February 2020	
Tree maintenance		
Release spraying	April and October for the first 2 to 3 years	
Blackberry and weed control	Ongoing every year in February /March	

1-3 Reduction in nutrient contamination

1-3-1 Background

Dissolve Reactive Phosphorus (DRP-the phosphorus forms that are directly available to plants) concentrations were found to be low to moderate during the snap shot survey carried out by HBRC in 2011. The highest concentration was recorded in the bush stream which has most of its catchment in native vegetation. This indicates that there are probably natural sources of DRP in the catchment presumably from naturally phosphorus rich tertiary sedimentary geology which dominates the catchment leading to naturally moderately elevated DRP concentrations.Given the likely naturally moderately elevated DRP concentrations, sources of dissolved inorganic nitrogen (the sum of ammonia, nitrate and nitrite-nitrogen) are essential to controlling periphyton growth.Nitrate nitrogen concentrations were found to be low except at two sites in the upper Whangawehi stream at Leen's cattleyards and to a lesser extent above the confluence with the bush block.

The amount of sunlight reaching the stream bed is a key driver of periphyton growth and the absence of riparian vegetation probably contributes to the excessive periphyton growth. The riparian planting programme should provide shade overtime and reduce water temperatures to a more tolerable level for fish and macro invertebrates.

In 2014 a water monitoring programme was developed measuring nutrient levels in 6 sites on the Whangawehi river and tributaries. The data collected should help better understand the fluctuation of nutrient levels overtime.

1-3-2 Nutrient modelling

In December 2014, an overseer exercise was carried out on the Taharoa Trust. Overseer was developed by landcare and Reserach Massey University to model nutrient cycles and their impact on the water ways. The model takes into account the whole farming system including livestock enterprise, fertiliser regime, soil type, climate etc.

Results are available in the appendices but two main points were raised:

- The overall farming operation is within the leaching levels for a sheep and beef farm. However there is a big difference between the intensive block and the hill country.

- The intensification of land use on the marine terraces on pumice soils leach above average mainly phosphorus and nitrogen.

- The hill country, on steep and highly erodible siltstone, leaches moderate levels of phosphorus mainly due to soil erosion

- Wetlands play a role of sediment/nutrient trap but end up being emission point. Their impact in reducing nutrient leaching in the overseer model is minimal.

Recommendations :

All farms in the catchment could be inputted into overseer to have a better appreciation of nutrient leaching into the Whangawehi stream. These results will be correlated with the water monitoring data collected since December 2014.

2- Protection of significant and endangered habitats in the Whangawehi catchment

2-1 General information

Little information exists about the original vegetation cover of Mahia Peninsula. Prior to human habitation the Peninsula was largely forested (Philipps 1948). Coastal Forest of which little remains had a mixed canopy of titoki, tawa, kara, karaka,nikau and lemonwood.Kohekohe, wharangi and mahoe dominated sub canopy. Karaka, titoki and ngaio were more common on the slopes with the most direct coastal influence. This is still the case on Pongaroa Station, Homestead Farm, Taharoa.

The semi coastal forest in the interior of the peninsula was tawa dominated with kohekohe the major sub canopy species. Rimu, kahikatea, matai, northern rata and rewarewa were emergent.The sub canopy and understory was lush with abundant nikau, ferns, broadleaved trees and shrubs. These trees are still standing in the Mahia Scenic reserve managed by DOC (374 ha).

The Whangawehi estuary had saline wetland communities. Sea rush rushland dominated the tidal estuary edges with knobby clubrush, bands of jointed wire rush and sea primrose selliera-glasswort turffield. The inner margins that were completely submerged at high tide supported populations of salt tolerant three square and patches of raupo reedland. The dry outer edges of the lagoon had low patchy shrubland flaxland of saltmarsh ribbonwood, pohuehue, bracken, harakeke and cabbage trees. The Whangawehi estuary has changed a lot but the restoration programme is re establishing these wetland communities that used to thrive there.

Some in land wetlands are still preserved particularly on the Taharoa Trust where 30 ha of prime wetland habitats were fenced off in 2004. Most of these wetlands are recovering from decades of hard grazing, spraying and draining. They are starting to be recolonized by native vegetation and will offer prime habitats for wetland birds including bitterns, fern birds etc.

Threatened plants

Many plants within the Whanagwehi catchment can be considered locally threatened (Dianella nigra), hen and chicken fern, Libertia grandiflora, New Zealand Broom, northern rata, wharangi and whau. Hebe tairawhiti is a nationally threatened plant that survives in the Mahia scenic reserve.

2-2 Summary of rare habitats and their status (see maps in the annexes)

2-2-1 Recommended Areas for Protection (RAPs) (from Tiniroto, Waihua,Mahia and Matawai Ecological Districts – June 2001)

93 sites were identified and described in the Mahia Ecological District survey done in June 2001 by Department of Conservation. Only a few lies into the Whangawehi catchment but they are the most significant.

- **Grandy Lake Forest**

Table 27 : RAPs on Grandy Lake Forest

RAP MAH	Study site	Priority	Area	Location
8	475	2	20 ha	Grandy Lake Forest

Significance : This RAP is important because itis the largest and most intact piece of semi coastal forest remaining on the northern end of the peninsula. Although on slopes of very predominantly shady southeasterly aspect, the RAP includes a complete section from ridge crest to riparian margin.

- **Pongaroa Station**

Table 28 : RAPs on Pongaroa Station

RAP MAH	Study site	Priority	Area	Location
11	443	1	13 ha	Pongaroa

Significance : this RAP is the second largest area of primary forest surviving on the marine terrace surface of the northeastern plateau and contains one of the few examples of swamp forest left on the peninsula.

- **Ormond's block**

Table 29 : RAPs on Ormond's block

RAP MAH	Study site	Priority	Area	Location
13	611	2	33 ha	Ormond's against Taharoa

Significance: This RAP has a substantial area of primary forest- the least modified and most diverse primary forest in the incised stream gullies on the northeastern plateau. This RAP complements the values of RAP MAH 14 which lies 1 km south on the upper plateau. Its significance is enhanced by the inclusion of varied secondary vegetation on the ridges/terrace surface, contiguous with the primary forest.

RAP MAH	Study site	Priority	Area	Location
14	612	1	68 ha	Ormond's against Okepua

Significance : this RAP is significant as it contains the largest tract of forest left on Mahia's northeastern plateau and the second largest area of continuous primary forest remaining in the ecological district after Mahia Scenic Reserve.

- **Okepuha**

Table 30 : RAPs on Okepuha

RAP MAH	Study site	Priority	Area	Location
15	448	3	3.7 ha	Coop's

Significance : this RAP includes a notable area of primary forest on fertile slopes, together with a range of vegetation at earlier successional stages. It lies between two larger RAPs MAH 14 described above and 17, providing a link for wildlife and seed dispersal.

2-2-2 Other significant sites and habitats

- **Taharoa Trust**

Table 31 : significant habitats on Taharoa Trust

Paddock names	**Area**	**Status**	**Covenanted**	**Fencing required**
Bush N 2	3.9 ha	Fenced off	No	Already fenced off
Macrocarpa bush	0.8 ha	Fenced off	No	Already fenced off
Bottom basin (small bush block)	1.3 ha	Unfenced	No	600 m
Bottom basin (big bush plus riparian strip)	3.3 ha	Unfenced	No	1000 m
Bush paddock	4 ha plus	Unfenced	No	700m plus
Mill face bush	2 ha	Unfenced	No	1000 m
Bottom hay bush	0.2 ha	Unfenced	No	200 m
Pines bush	1.7 ha	Fenced off	No	Already fenced off
Wetlands	29 ha	Fenced off	No	none
Total	**12.50 ha**			**3500 m**

Detailed presentation :

-Bottom basin bush blocks: the big bush block includes a significant riparian strip that plays a key role in controlling the Mangatupae gully system. It could worth meeting with HBRC and a QE II officer and see if they would be willing to co fund this project. If a covenant is agreed to and signed, the fencing costs could be shared and only a third of the expenses are incurred to the landowner. By fencing off these 2 bush blocks, the landowner would subdivide this part of Bottom Basin paddock in 2 manageable size paddocks of 7 ha and 8 ha.

Bottom basin bush blocks on class 6 and 7e reducing erosion in the Mangatupapa

-Bush paddock: the 4 ha bush block plays a key role in terms of erosion control in the Mangatupapa sub catchment. Fencing it off would be quite challenging and would have to be done once the main gully system has been stabilised with willows.

Bush block in Bush paddock controlling earth flow and gully erosion on class 7e2

-Mill face bush: this 2 ha bush block controls the gully head of a deep gully system, hence the importance of its protection. Gully control with soil conservation trees on the flood plane will be needed to stop the gully system from eroding.

Mill face bush controlling a gully system in the northern part of the farm

-Bottom hay bush : small block that could be retired against the southern boundary.

-Pines bush : this block was planted with pines and was harvested not long ago. The owner intends to retire it and establish native trees.

- Wetlands : 29 ha of wetlands were fenced off in the early 2000 and are recovering from farming pressure. They offer fantastic potential for biodiversity if pest control is carried out intensively.

- **Pongaroa Station**

- Summary

Table 32 : significant habitats on Pongaroa Station

Paddock names	Area	Status	Covenant	Fencing required
Bottom old woolshed	2 blocks 5 ha in total	Unfenced	No	1600 m
No smoke	6.5 ha	Unfenced	No	1500 m
Parakiwai	5 ha plus in clusters 20 ha (face)	Unfenced	No	1000 plus 2500 m
Total	**16.50 ha or 31.5 ha**			**4.1km or 5.6 km**

- Detailed presentation :

Pockets of native bush on Pongaroa Station

- Bottom old woolshed offers two significant blocks of natives (2.5 ha each) located in gully systems.

- No smoke paddock : a 6.5 ha bush block that controls a gully system.

- A number of small pockets of native forest survive amongst gorse and black berry on the steep slopes of Parakiwai paddock. This face is quite steep with a large number of limestones outcrops. Grass growth is marginal in the summer and drainage is an issue in the winter (siltstone soils). Developing and maintaining this steep face would require old cows who would lead to more tracking and soil slip especially in the winter. The owner will have to make a decision but fencing off part (if not all) of this less productive part of the farm would make a lot of sense. A native cover on these steep slopes would have a positive impact on the flats which suffer from wetness especially in the winter.

2-3 Pest control programmes

2-3-1 Goat control strategy

In 2013, the WCMG developed a goat control strategy looking at protecting the future plantings along the Whangawehi stream, in partnership with Hawkes Bay Regional Council and Department of Conservation.

Past controls were carried out in the area by DOC, a Forestry Company (Grandy Lake Forest) and to a lesser extent by some landowners. These controls have been carried out through a variety of techniques; Heli shooting, ground shooting and mustering. Each of these stakeholder has been conducting their control independently of each other which reduced the scope and efficiency of the controls.

The aim of the Coordinated Management Area is to gain both more effective control and cost benefits from having a collective control programme being conducted by one contractor, working the control area systematically.

So far 1900 goats, 3 deers and 12 hares have been removed from the catchment.

2-3-2 Community based community predator control

The restoration of the Whangawehi stream will improve water quality overtime and increase biodiversity levels including birds, insects and small vertebrates that thrive under a forest canopy. However unless a strong effort is initiated in the area of pest control, the group may not reach the desired outcomes. Three landowners have mentioned their willingness to focus more on pest control hence the following proposal. A small scale pest control programme was initiated in January 2015 on Taharoa Trust and Grandy lake Forest. This programme is managed by the community and reporting is made using the Trap.org.nz application.

2-3-3 Pest control proposal

Summary :

Table 33 : pest control proposal

	Traps working in January 2015	**Potential for expansion**	**Trap requirement**
Taharoa Trust 385 ha	10 DOC 200 4 Timms traps 14 bait stations	Protect 30 ha of high value wetlands 10 ha bush blocks Good track network	**50 traps :** DOC 200 : 32 Timms traps : 18 Masters : 10
Grandy Lake Forest 1000 ha Homestead farm	9 DOC 200 15 bait stations	30 km of good ATV tracks 20 km of 4*4 tracks Possible extension on	**270 traps** (200 m spacing) DOC 200 : 170

430 ha		the Homestead farm.	Timms : 50 Masters : 50
Okepuha Station **758 ha**	0	20 km of good ATV track at the front and a main track at the back	**450 traps (200 m spacing)** DOC 200 : 250 Timms traps : 200 **Bait Station : 200**
Pongaroa Station 950 ha	0	Secure the whangawehi river on both sides initially	**30 traps :** - DOC 200 : 20 - Timms traps : 10
Total : 2765 ha	**23 traps 29 bait stations**		**800 traps** **200 Bait stations**

Detailed pest control proposal:

- **Pongaroa Station :**

The initial pest control effort needs to be focused on both sides of the Whangawehi stream. Track condition is very good on both sides of the river. A total of 6 km of riparian margins can be trapped cumulating a total number of 30 traps (10 Timms traps and 20 DOC 200). As the river is a high way for rats, some bait stations could be installed as well depending on funding opportunities. Based on 100 m spacing, the Pongaroa corridor would require 60 bait stations on top of the 30 traps.

Table 34 : Pongaroa Station pest control proposal

Trap type	Number	Targeted species
DOC 200	20	Stoats, weasels and rats
Timms trap	10	Feral cats and Possums
Bait stations	60	Possums and rats
Total	**56**	

- **Taharoa Trust**

The following recommendations are given to improve pest control pressure around the high value wetlands protected on the property. These recommendations are based on best practice and practicality. The advice given is only a general guideline. Table 14 offers the perimeter of all the

protected wetland. This data will be useful to tailor a more accurate pest control programme once funding has been allocated. Table 15 gives an idea of traps type and number required to initiate a wider pest control programme on the property. The budget is subject to price change but gives an idea of the costs involved. Maintenance costs are not taken in consideration in this budget. Assistance from HBRC will be critical in assisting with the review and implementation of this proposal.

Table 35 : Perimeter of main wetlands

Wetland name	Perimeter
Puia Wetland	1665 m
Top Puia Wetland	1452 m
Bottom Puia	1474 m
Horseshoe wetland	4158 m
Dam wetland	606 m
Water supply wetland	330 m
Total	9685 m

Table 36 : Taharoa pest control proposal

Trap type	**Number**	**Targeted species**
DOC 200	32	Stoats, weasels and rats
Timms trap	18	Feral cats and Possums
Bait stations	6	Possums and rats
Total	**56**	

- **Grandy Lake Forest and Okepuha Station**

Both landowners are supportive of the restoration programme and is willing to contribute to the pest control effort. The initial effort needs to be focused along the stream but good tracking infrastructures on both properties offer a wide range of options in terms of pest control.

GLF : Indeed, 50 km of tracks are currently maintained (30km are accessible in ATV while 20 km are accessible 4*4).

In January 2015, 9 DOC 200 and 15 Bait station where installed along the Whangawehi river as an initial initiative.

Okepuha Station : the front part of the farm is extremely well tracked with a large number of tributaries to the Whangawehi stream that will be fenced off in the near future. Landowners signed the group's Memorandum of Understanding in October 2015 and deployed 10 traps in early January.

Table 37 : Grandy Lake Forest and Okepuha pest control proposal

Trap type	Number	Targeted species
DOC 200	180	Stoats, weasels and rats
Timms trap	40	Feral cats and Possums
Master traps	40	Feral cats and Possums
Rat Bait station	400	Rats
DOC 200	250	Stoats, weasels and rats
Timms	200	Feral cats and Possums
Rat bait stations	200	Rats
Total	**1310**	

2-3-4 Landcare Research programme

In 2014, Landcare research initiated a social survey with a small number of landowners (report available in the annexes). This initial phase will be followed up by a more wider consultation with the Mahia community looking at identifying the values associated with pest control.

Background :

Pest management is vital to New Zealand because it is key to protecting our native biodiversity and our economy. Typically, pest management agencies decide when, where, and how to do pest management, and often local communities have little opportunity to contribute to the decision-making process. This lack of engagement opportunities sometimes results in community dissatisfaction with pest management plans and lack of support for their implementation. Consequently, there is a need to improve the public engagement processes so that community members can participate in pest control decision making, and help with developing management

plans that are more favourable to them. Landcare Research staff are conducting social research to better understand how communities want to contribute to pest control decision making through a series of case studies across New Zealand. One of these case studies is in the Mahia Peninsula; where the research team has conducted eleven semi-structured interviews with diverse community members to discuss people's values associated with the land and how pests and pest management in the area may affect those values. The outcome of this first step is to provide the Hawkes Bay Regional Council and the Mahia community with some options for initiating a more participatory process for discussing any potential future pest management on the peninsula.

3- Building community engagement and knowledge to stimulate economic development

3-1 Building community engagement

3-1-1 Development of an Environmental Education programme with Te Mahia school and Tangata Whenua (2013)

In 2013, the Whangawehi Community decided to take an active part in the transfer of local knowledge around Matauranga Maori to the younger generations. A core of kuia and kaumatua drafted a curriculum and committed to deliver 12 workshops in order to pass on their knowledge and understanding of the environment they want to protect. This project is generating intergenerational change in the way people think and manage their natural resources. The group hopes it will also help develop leadership in the community and prepare the next generation of kaitiaki for the Whangawehi Catchment Restoration project.

In January 2015, a coordinator was appointed to deliver and organise 11 workshops throughout the year (see programme in the annexes) cumulating a total of 60hs.

This programme is extremely important as it involves the community and reaches out to the student's family who can be disengaged with the restoration programme.

Background :

Te Mahia School is a vibrant small rural school situated 65 kilometres north-east of Wairoa. It provides education for 57 students in Years 1 to 8. The contributing community is mainly Māori, with two small groups of Cook Island Māori and New Zealand European/Pākehā residents. The school roll reflects this composition. The school is strongly supported by community members, many of whom have whānau connections. Parents, extended family and iwi provide support for students and their learning, and are a constant presence in the life of the school. 2 years ago the structure embraced the Enviro School Kaupapa and developed multiple activities around gardening, waste management and sustainability etc. A shade house was erected in 20011 as part of a HBRC and Genesis funding project. Native plants are grown by the students and planted in a nearby wetland in Opoutama managed by the NZ Native Forests Restoration trust. The school has demonstrated a real interest and commitment tosustainability.
1- Environmental issue that the project aims to address

The restoration project is aiming at improving the habitats for native fish species and water quality over time. There is a strong desire from the community to help the younger generations to be involved, understand and one day contribute to what they are trying to achieve.

- Learning outcomes for the project:

• To develop a new reflection on sustainable land management practice within their catchment, identify issues and search for solutions etc.
• To help the local students and their parents to be reconnected with their awa, their culture and traditional practises (customary fisheries etc.).
• To involve the locals (kaumatua and Kuia) in the transmission of local knowledge through the

school. The leaders of the group are expecting them to take an active part in the education programme.
• To develop practical activities (planting project, weaving workshop etc.) where the students can learn through real experience and participation.
• To create the link between students and professionals working in the management of the environment through several workshops organised over the year (DOC, Forestry Manager, Marine biologist etc.). This could help develop interest and maybe vocations for these young Tamariki looking for carrier opportunities in that industry.

- Hands on activities.

The learners are going to better understand the environment they live in, the environmental issues the catchment is facing and the possible methods of remediating these issues. They will carry out practical activities (water and fish monitoring, planting project, weaving workshop etc.) and learn through real experience and participation with strong involvement from the leaders of the community (local Kaitiaki, kui and Koroua).

- Integration with the school?

This project has been designed with a strong input from the Principal of Te Mahia School, looking at reaching out to the 3 classes over the year. This project started in January 2014 and is part of the school Kaupapa with 3 activities per term (15 workshops planned for the year).

- Project management and planning process in place.

•A detailed project plan is reviewed every year and is implemented by the Project Manager of the Whangawehi Catchment Management Group Incorporated. Decisions are made after consultation with the Principal of Te Mahia School and the Project Manager.
• This project is implemented following the guidelines for Environmental Education in NZ Schools as close as possible. The School is already involved with the Enviro School network and has followed its guidelines since 2011 with the support of a coordinator.

- Key people involved

• The Principal and teachers are very supportive and involved and are the driving force behind this project.
• Jennifer Scothern, local Enviro school Coordinator assists and supports the initiative.
• Iwi and Hapu are extremely supportive of the initiative and will contribute a lot through the different workshops planned. They will pass on the local knowledge and catalyse the chnage in the entire community.
• The Project Manager for the WCMG Incorporated is in charge of the implementation of the curriculum and report to funders.
• The Whangawehi Catchment group (including Iwi, local farmers and Agencies) is extremely proud to be able to engage with the younger generations and transmit its aspirations.

- Link with Agencies
• This unique template has already generated a lot of interest and the school has been offered the support from WWF- New Zealand, Department of Conservation, Fish and Game, Hawkes Bay Regional Council and the National Aquarium of NZ through the Fresh Water Education Programme.

3-1-2 Cultural survey

Tangata Whenua expressed a strong desire to have a cultural and archaeological survey done in the lower reaches of the Whangawehi river in order to :

- record and protect any sites of significance prior to the construction of fences and the establishment of trees.

- transfer the cultural knowledge to the younger generations.

Implementing some of the recommendations given by Mana Cracknell will always be a very good way of engaging with the Whangawehi community. Local involvement will be needed to implement some of the recommendations.

Back ground :

Archaeological survey: (see report in annexes)

The WCMG ordered in 2013 a physical assessment of the catchment done by an Archaeologist (Kevin Jones). Kevin Jones identified a number of sites and produced a report available in the annexes. The fence built on the true left side of the whangawehi stream in January 2015 on Pongaroa Station followed the archaeologist's recommendations. However some significant sites remain still unprotected on the true right end side of the whangawehi stream on Pongaroa Station. It could be a goal for the group to protect these sites if funding is made available. Working with the landowner will be a key to the success.

Cultural and spiritual assessment: (see report in annexes)

A cultural survey was done by Mana Cracknell and includes:

- a spiritual assessment (Mana Cracknell)

- a cultural report including a clear description of the sites and their significance. The report is available in the annexes and contains a large number of recommendations.

Some of the recommendations given were:

- to always work with the landowner

- to recreate a burial site for the human remains found during the restoration programme (culvert with a led)

- to create shelters along the river

Note : all contractors working along the Whangawehi stream are asked to follow the Accidental Discovery Protocol developed by the NZ Historic Places Trust.

3-1-3 Water monitoring - Cultural Health Index (project details in annexes)

In 2013, Tangata Whenua wanted to be involved in a water monitoring project that measures the improvements from community led work in the catchment over time. It looks at things from the cultural perspective of our two marae who leaders for the project. The WCMG applied for funding through Nga Whenua Rahui and in March 2013 put in place a community based water monitoring programme. A co-ordinator and 4 local field officers were appointed to do water and fish monitoring as well as engaging with the school and the community via workshops and community days. This project has proven to be an extremely successful way of monitoring our river and engaging with the community.

The recommendation is to continue this project and make sure it remain a community initiative involving locals.

3-1-4 Community engagement officer (see job description in annexes)

In March 2015, the WCMG recruited a part time contractor to assist the group in engaging with the local community. The main function of this role is to build relationships with the local community of Mahia with a clear focus being the three Marae signatories of the MoU, landowners of Mahia Peninsula and relevant organisations. The Community engagement officer will also develop and build partnerships via a cadet training programme that should allow our local workforce to be skilled and comply with Health and Safety requirements.

3-1-5 Community events

- Community planting days are very effective ways of engaging with both local and wider community. They have to be encouraged but need to be well prepared especially around Health and Safety. In 2015, the WCMG will be organising two major planting days with an overnight stay at a Marae including evening presentations.

- Advertising the work the WCMG does at the Mahia Market during the Christmas/New Year period is a very good way of connecting with batch owners, holiday makers and oversees tourists. In January 2015, the WCMG attended two market days which were successful.

- Focused workshops: via the Nga Whenua Rahui programme, the WCMG organised a number of successful workshops tailored around fresh water fisheries management. These types of events need to be continued.

- School planting days are a very effective way of engaging with the local community. At this stage the WCMG organises one school planting day a year but some relevant Wairoa schools could be invited and become involved as well.

- Outside District trips are effective as they allow people to see what other Hapu and Iwi are doing. These trips help develop and maintain the passion for the project. It is really important to keep the leaders of the WCMG and the community inspired. Targeted trips such as Cape to city and Gisborne Sting Ray attraction etc. could be highly beneficial.

- Participating in Environmental awards and conferences are key to promoting the work done by the WCMG outside the district. The awards bring pride and recognition to the Whangawehi

Community as well as recognition from funders. These events need to be part of the communication /engagement strategy of the WCMG.

3-2 Communication

Communicating plays a key role in engaging both at local, national and international level. The WCMG uses limited but an efficient strategy based around :

- a blog site (whangawehi.com) with a large number of posts that update both local and funders on what is happening.

- regular newsletters (two per year)

- A set of eight posters and several flyers are used during community days.

- Shorts films published on the blog and professional films such as the recent documentary produced by Scottie production for Maori TV are extremely powerful (Project Whenua).

Suggestions for the future:

It is very important for the WCMG to step up its communication strategy.

- The WCMG should develop a logo that could be used on letters heads, T shirts, jerseys etc.

- The WCMG should develop a number of banners, flags to use during community days. They give a professional impression and are easy to use.

- The WCMG could develop a wiki page

- Calendars, pens, block notes could be developed if budget is allocated

- The WCMG could use local radios to promote its work and engage more with the local community.

3-3 Economic development

- The WCMG is already stimulating economic development by employing local contractors as much as possible. However some of the work is still getting done by contractors from outside the District mainly for Health and Safety reasons or the inability from local contractors to meet the groups demand. This is the case for the native trees that WCMG needs to purchase.

- Some leading projects for the future could be :

- A training programme developed in Mahia which would allow for the local work force to benefit from jobs opportunities around:

    - Tree establishment and maintenance

- Development of small scale nurseries

- Environmental monitoring (water, fish monitoring etc.)

- Pest control

- Eco tourism (cultural walks, bike trails, bird watching, Marae experience etc.)

These training programmes will be delivered by local providers who will make sure students are under supervision during their field work.

- A branding initiative was discussed in 2014 with Mike Barton. The WCMG invited him to the Mahia Golf Club to talk about the "Taupo Beef" brand and product. There is a real opportunity to develop a brand acknowledging the environmental effort done by the landowners around water quality and pest control. This branding project could target meat products initially but could also encompass wool, wood, fruits or fish. It is the early days but certainly a good initiative that would draw interest from most landowners in the catchment.

- The little blue Penguin restoration project undertaken on Pongaroa station could (if successful) initiate some business ventures linked with other things (catchment guided walks, bird watching etc.)

- Developing a cycling track along the river connected to the kini kini road would create a loop that could attract cyclists from around the world. Funding is available for this type of project.

- The Whangawehi river flow into a Mataitai that could, if protected, be used to develop diving experiences etc.

4- Monitoring tools

In its initial development phase, the WCMG has been focusing on understanding the catchment and implementing robust scientific monitoring systems to ensure future work will make positive and **measurable** changes.

Five tools have been developed, four to monitor the physical impact of the restoration programme on the environment, one to monitor the governance structure of the organisation:

Environmental monitoring tools :

– a water monitoring programme.

– a bird monitoring programme.

– a stream bank monitoring programme.

– a pest control monitoring programme.

Governance monitoring tool :

- NZ Navigator

4-1 Environmental monitoring tools

4-1-1 Water monitoring programmes

The WCMG developed, in partnership with agencies, two water monitoring plans:

- a western science approach: The Whangawehi stream has been closely monitored since April 2011 when an extensive survey took place in order to prepare a catchment management plan. Annual monitorings have followed until 2014 when a more intensive monitoring plan was put in place. The programme developed by the WCMG in September 2014 was looking at developing a frame work that integrates and merges existing initiatives taking place in the catchment at different times of the year (HBRC recreational monitoring, State of the environment, WDC waste water sampling programme etc) in order to save time and money. The goal is also to share the different sources of information with the wider community in a single and simple format with clear limits and thresholds.

- a Maori and community approach using the **Cultural Health Index technique**. This programme funded by Nga Whenua Rahui for three years (from 2013 to December 2016) is carried out by Arthur Bowen (Coordinator) and a team of field officers.

It is really important to keep these two programmes going over time as they keep the momentum going within the community. There is a level of expectation from the community that they should know more about our river hence the wish to see ongoing community lead initiatives happening in the water sphere.

These two programmes will help demonstrate the environmental outcomes of the restoration programme.

Western science monitoring plan

- Community survey

A survey was done in August 2014 in order to re assess the community values and tailor a monitoring plan. These values are completely aligned with the values identified by Aquanet Consulting in April 2011 but are more specific. The main points raised during the August survey include:

- The community values very highly the need to have a robust and long term monitoring plan put in place.

- The in stream values that came back very strongly from the survey are around stream health, water quality and habitat, safe swimming, safe mahinga kai or food gathering both in the fresh and marine ecosystems. These values pivot on Bacterial contamination, nutrient enrichment, sediment loss and in stream habitat quality.

- The need to measure nutrient levels, E Coli, enterococci and sediments both in the fresh and saline environments.

- The need to monitor the in steam habitats

- The need to better understand what fish species are present in the catchment, their abundance, population structure and dynamics.

- The need to test key indicators in the estuary for heavy metals, hydrocarbons and pesticides.

- The need to do a Macro Invertebrate Community Index and periphyton assessment once a year.

- The need to fully disclose all the data collected by different organisations and present it in a form that is understood by everybody.

- Monitoring plan summary:

The proposed monitoring plan is hinged around the community's values identified previously. The proposal includes:

- Number of sites: The selection of 6 sites throughout the catchment. These sites are identical to the sites currently monitored by our Cultural Health Index programme since 2014. They include also all the sites monitored by HBRC since 2011.

- Frequency : Each sites will be monitored every second month

- Parameters measured:

- ✓ Flows (Flow and discharge will be measured with the assistance of HBRC via a permanent data logger installed at the Rapids on Pongaroa Station).
- ✓ Nutrients
- ✓ Faecal bacteria E Coli and Enterococci
- ✓ Turbidity, conductivity , Ph and T
- ✓ Dissolved oxygen (only during the summer period)

- Other monitoring:

- ✓ A riparian habitat assessment with photo points will be done
- ✓ A comprehensive fish survey will be done initially in 2015 and then repeated every 3 to 5 years once stream and catchment enhancement work have progressed.
- ✓ Periphyton and stream-bed sedimentation will be monitored on all sampling occasions.
- ✓ Annual tissue sampling of key indicators (Cockles or eels) for heavy metals, hydro carbons and pesticides. Because of the costs involved, these tissue samples will have to be readjusted after the first findings.

-Monitoring sites

The proposed sites include the sites already monitored during the 2011 survey and by the WCMG since March 2013. Landowners agreement will be required to undertake any monitoring.

Table 38 : monitoring sites

Site number	Site description	Purpose
1	Whangawehi bridge car park	Capture the bottom end of the catchment in an estuarine environment
2	Mamangu /rapids	The waterfalls mark the salinity wedge (out of tidal influence).Sampling site above the falls
3	Whangawehi at Pat's above the confluence with the Mangatupae stream (retired area)	Capture the state of the stream in a recently retired environment. This point is also half way through the catchment
4	Urumatui/Okepua Stream above confluence with Whangawehi stream	Capture the impact of farming operation
5	Bush stream above confluence with Whangawehi stream	Control/ afforested catchment
6	White Pine, Whangawehi stream above the confluence with the Bush stream	Capture the impact of the exotic forest on water quality

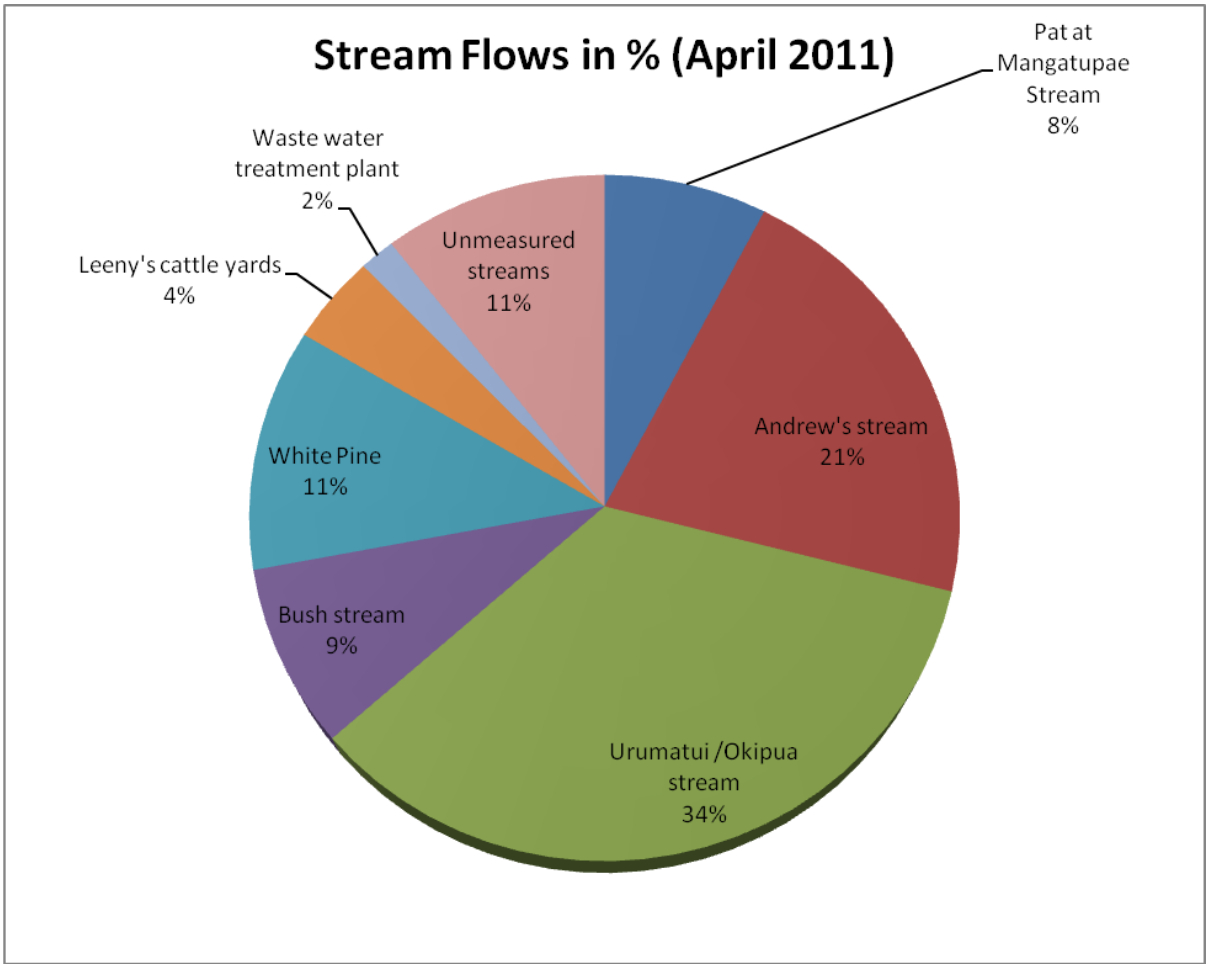
- Stream flow (from the survey done in April 2011)

The following data collected in 2011 gives an appreciation of the contribution of all tributaries of the Whangawehi stream in terms of water flow. Flow monitoring is a really important component of any water monitoring programme, the proposal will look at getting more information around this parameter.

Table 39 : stream flow

Site number	Site description	Flow (liters/s)	% contribution
1	Whangawehi bridge car park		?
2	Mamangu /rapids	234l/s	100%
3	Pongaroa side creek		
4	Tributary at Pat's Mangatupae Stream	18l/s	7.7%
5	Whangawehi at Pat's above the confluence with the Mangatupae stream (retired area)	238l/s	100%
6	Andrew's stream above confluence with	50l/s	21.4%

	Whangawehi stream		
7	Urumatui/Okipua Stream above confluence with Whangawehi stream	81l/s	36.6%
8	Bush stream above confluence with Whangawehi stream	19l/s	8.1%
9	White Pine, Whangawehi stream above the confluence with the Bush stream	27l/s	11.5%
10	Leeny's Cattle yard	10l/s	4.2%
11	Whangawehi stream where it leaves the waste water irrigation area	4l/s	1.7%



- Water monitoring indicators

The community expressed the wish to see a monitoring plan articulated around 8 key measures/indicators:

Microbiological water quality monitoring (on all sampling occasions):

fresh water monitoring:

The 2002 microbiological guidelines for recreational waters recommend the use of the indicator bacteria Escherichia Coli (E. Coli) as indicator of health risk in freshwaters (Mfe/MoH, 2002). The guidelines define a 3 mode management system for recreational freshwaters : Acceptable mode (E.Coli<260/100ml), Alert mode (E.Coli < 550/100ml) and Action mode (E.Coli > 550/100 ml) . We propose to monitor E Coli during on all sampling occasions.

Saline water monitoring:

The same guideline recommends the use of indicator bacteria enterococci as an indicator of the health risk in marine waters. Similarly the guidelines define a 3 mode management system : Acceptable mode (enterococci <140/100ml), Alert mode (enterococci<280/100 ml) and Action mode (enterococci> 280/100ml). We propose to monitor Enterococci on all sampling occasions.

The data will be collected through the HBRC Bathing Beach program with weekly samples being taken from early November to Mid March. The Whangawehi Catchment group won't have to carry the costs during this period.

Kaimoana gathering areas:

For shellfish gathering areas, the guidelines set a maximum median of 14/100ml and a maximum of 43/100 ml. For Kaimoana gathering areas, Norovirus, and Salmonella would have to be tested as well (once a year). This assessment will be done using the HBRC BB program data.

Box 3:
Recreational shellfish-gathering bacteriological guideline values

The median faecal coliform content of samples taken over a shellfish-gathering season shall not exceed a Most Probable Number (MPN) of 14/100 mL, and not more than 10% of samples should exceed an MPN of 43/100 mL (using a five-tube decimal dilution test).

These guidelines should be applied in conjunction with a sanitary survey. There may be situations where bacteriological levels suggest that waters are safe, but a sanitary survey may indicate that there is an unacceptable level of risk.

How : Hill Laboratories

Nutrient monitoring (on all sampling occasions)

The proposed monitoring plan includes the measurement of several main nutrients including :

- Total Nitrogen : There are four forms of nitrogen that are commonly measured in water bodies: ammonia, nitrates and nitrites and organically bonded nitrogen. Total Nitrogen (TN) is the sum of nitrate-nitrogen (NO3-N), nitrite-nitrogen (NO2-N), ammonia-nitrogen (NH3-N) and organically bonded nitrogen.(An acceptable range of total nitrogen is 2 mg/L to 6 mg/L). Total Nitrogen is an

essential nutrient for plants and animals. However, an excess amount of nitrogen in a waterway may lead to low levels of dissolved oxygen and negatively alter various plant life and organisms.

- Nitrite /Nitrate nitrogen : Nitrite, Nitrate Nitrogen is a nutrient and together with Phosphorus plays a major role in algal growth. Its presence can be the result of urine and dung from stock, fertilizer or effluent run off.

- Ammoniacal Nitrogen : The ammonia component of ammoniac nitrogen is toxic to aquatic life. The presence of Ammoniacal Nitrogen is indicative of effluent contamination.

- Total Phosphorus and Dissolved Reactive phosphorus:

Total Phosphorus and Phosphate

Phosphorus occurs naturally in rocks and other mineral deposits. During the natural process of weathering, the rocks gradually release the phosphorus as phosphate ions which are soluble in water and the mineralize phosphate compounds breakdown. Phosphates PO4-3 are formed from this element. Phosphates exist in three forms: orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate each compound contains phosphorous in a different chemical arrangement. These forms of phosphate occur in living and decaying plant and animal remains, as free ions or weakly chemically bounded in aqueous systems, chemically bounded to sediments and soils, or as mineralized compounds in soil, rocks, and sediments.

Dissolved Reactive phosphorus (DRP)

DRP is a nutrient and together with nitrogen plays a major role in algal growth. Its presence can be the result of dung from stock, fertilizer, soil sediment or effluent. We know from the 2011 study that there is a moderate level of P in the bush stream due to tertiary sedimentary rock naturally rich in Phosphate.

How : Hill Laboratories

Periphyton monitoring and stream-bed sedimentation

Periphyton is the brown or green slime or filaments coating stones or any stable surfaces in streams and rivers. Excessive periphyton can affect a number of values associated with stream and rivers including ecosystem health, recreational and aesthetic values.

The NZ periphyton guidelines define nuisance periphyton growth as a maximum periphyton cover of the visible river bed of 60% by mats more than 3 mm thick or 30% by filamentous algae more than 2 cm long (Biggs,2000).

Excessive sedimentation of the stream bed is an issue for the Whangawehi Stream. Stream substrate provides critical habitat for aquatic bugs and fish. The health of the substrate determines the ability of the stream to support a wide range of animals. Assessing the 'health' of the substrate in regards to sedimentation and smothering is useful in identifying threatening processes such as erosion that may be affecting the overall health of the stream.

The Whangawehi Stream could be assessed on all sampling occasions.

How : Visual assessment method (HBRC/NIWA protocol).

Macro invertebrate Community Index

Macro invertebrate communities (small animals, caddies etc.) are commonly used as an indicator of water quality and ecosystem health. A macro invertebrate community index (MCI) of 120 or more is considered excellent, a score of 100 to 120 is considered good, a score of 80 to 100 is considered moderate and a score below 80 is considered poor. Macro invertebrate communities are sampled by dislodging macro invertebrates from the stream bed and capturing them in a fine mesh net placed immediately downstream. The samples are collected and sent to a lab for identification and scoring.

A MCI was carried out during the April 2011 survey and scores were reported in the report. A second set of data was collected in 2013 and scorings will be made available to the group. It is proposed to have one MCI done in the catchment in 2015.

Note from HBRC : The bugs that score highly in the MCI are influenced significantly by high stream temperatures. So elevated temperatures may drive a low MCI independent of pollution. This means that the interpretation of these results needs to be put into context.

How : HBRC to sample using quantitative surber sampler. Samples to be sent to EOS ecology. Sample costs to be met by HBRC.

Riparian and in stream habitat (done once and then repeated at a later date)

- **A riparian and in stream habitat assessment** of the stream reach being studied, surrounding land use and aspects of the riparian (stream side) zone will be carried out as part of the monitoring program. Habitat assessments provide information on the immediate surrounding land use and how land use may affect the health of the stream. This will be done by following the HBRC assessment protocol. Photo points will be located at all sites and a series of upstream/downstream photos are to be collected at least once during the current survey to allow for future comparisons to be made.

- Stream sediment and substrate characterisation. Stream substrate provides critical habitat for aquatic bugs and fish. The health of the substrate determines the ability of the stream to support a wide range of animals. Assessing the 'health' of the substrate in regards to sedimentation and smothering is useful in identifying threatening processes such as erosion that may be affecting the overall health of the stream. This assessment will be carried out on all sampling occasions.

Fish survey

A comprehensive fish survey needs to be completed in March 2015 in order to better understand what fish species live in the catchment, their abundance and dynamic as well as their health. This assessment will be done via an electric fishing method and a night survey. Expertise from DOC or HBRC will be needed. The Whangawehi Catchment Management Group will undertake hinaki and spotlight surveys of eels at a number of key locations independent of DOC/HBRC as part of the Cultural Health Index programme. This will be done in a way that future comparisons can be made of the number of eels caught and spotted. Assessments of eel health can be made by members of the catchment group.

Turbidity- Conductivity

Turbidity and conductivity will be measured as part of our routine water monitoring programme.

- ***Turbidity*** measures the number of suspended particles in the water. Turbidity can be used as an indicator of the effects of runoff from farms, erosion, logging activity etc. Regular monitoring of turbidity can help detect trends that might indicate increasing erosion in specific watersheds. However, turbidity is closely related to stream flow and velocity and should be correlated with these factors. Turbidity is not a measurement of the amount of suspended solids present or the rate of sedimentation of a stream since it measures only the amount of light that is scattered by suspended particles. Measurement of total solids is a more direct measure of the amount of material suspended and dissolved in water.

- ***Conductivity*** is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, etc. Streams that run through areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Conductivity is useful as a general measure of stream water quality. Each stream tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements. Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered a stream.

How : Conductivity and turbidity will be measured by Hills laboratories on water samples submitted for nutrient analysis.

Tissues samples

The community is eager to know if the activities happening in the catchment (recreational, farming, forestry, waste water treatment plant) are impacting on the health of the key emblematic species. The proposal includes analysing tissue samples for heavy metals (Arsenic, Cadmium,Chromium, Copper, lead, Nickel, Zinc), hydrocarbons (16 Polycyclic Aromatic Hydrocarbons), pesticides (DDTs- Dieldrin- Chlordane). The analysis of tissue sample will be done once in 2015.

How : samples sent to Hill Laboratories and Assure quality.

Flow measurement

Measurement of surface water flow is an important component of our water quality monitoring project. Flooding, stream geomorphology, and aquatic life support are all directly influenced by stream flow, and runoff and stream flow drive the generation, transport, and delivery of many pollutants. The knowledge of water flow will help the group relate back to the 'yield' of sediment and nutrients and work out which catchment has the highest relative contribution based on its size and load. HBRC has generously offered to install a data logger at the Rapids on Pongaroa Station to help us measure accurately this very important parameter (discharge).

Operational plan (for 2015)

Table 40 : operational plan

Timeframe	Measures	Sites	WCMG	WCMG CHIndex programme	Partners
December 2014	Fresh Water monitoring, in stream habitat & periphyton monitoring	all sites	WCMG	Yes	HBRC for the Saline monitoring
February	Fresh Water monitoring, in stream habitat & periphyton monitoring Electric fishing : Fish survey	all sites 3 sites	WCMG		HBRC for the Saline monitoring HBRC/DOC
April	Fresh Water & Saline monitoring, in stream habitat, & periphyton monitoring Macro Invertebrates Community Index	all sites	WCMG WCMG	Yes	 HBRC
June	Fresh Water & Saline monitoring, in stream habitat & periphyton monitoring	all sites	WCMG		
August	Fresh Water & Saline monitoring, in stream habitat & periphyton monitoring	all sites	WCMG	Yes	
October	Fresh Water & Saline monitoring, in stream habitat & periphyton monitoring	all sites	WCMG		

December 2015	**Fresh Water & saline monitoring and in stream habitat and periphyton.** **Tissue sample**	**all sites** **1 sample**	**WCMG** **WCMG**	**Yes**	**HBRC for the Saline monitoring**

Partnership framework

Table 41 : partnership framework

Specific needs	**Agency support**	
Training around water sampling, in stream bed sedimentation evaluation, periphyton monitoring etc.	HBRC	
Fish survey	HBRC/DOC/WCMG	
Macro Community Community Index	HBRC/WCMG	
Dissolved oxygen and turbidity	HBRC (loggers)	
Purchase of a HOBO depth meter	HBRC	WCMG
Flow measurement	HBRC/WCMG	

Long term monitoring proposal

Table 42 : long term monitoring plan

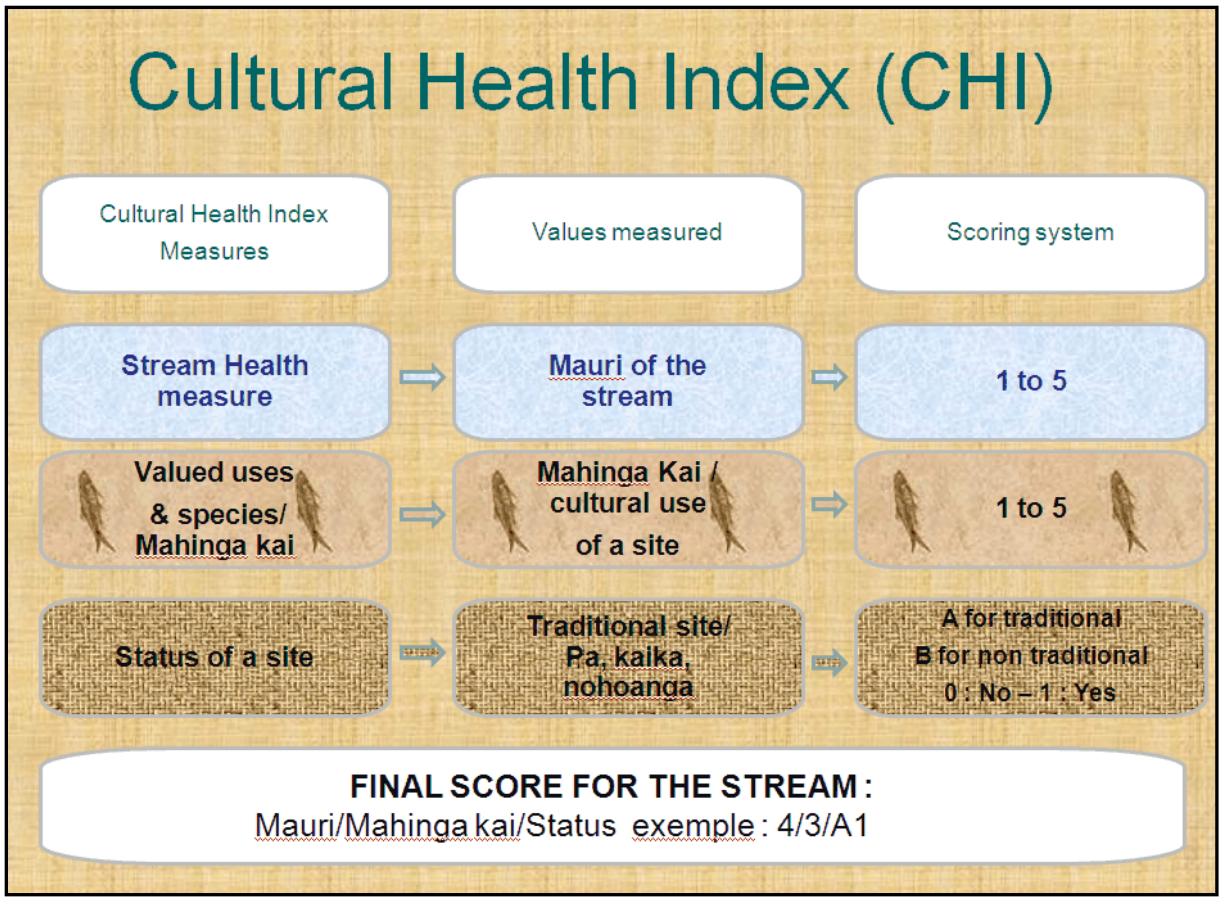
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Water monitoring programme as proposed above	6 sites	3 sites	3 sites	3 sites	3 sites	6 sites	3 sites	3 sites	3 sites	3 sites	6 sites
In stream bed sedimentation, periphyton monitoring	6 sites	3 sites	3 sites	3 sites	3 sites	6 sites	3 sites	3 sites	3 sites	3 sites	6 sites
Macro	Yes		Yes		Yes		Yes		Yes		Yes

Invertebrate Community Index											
Tissue samples	Yes					Yes					Yes
Fish survey	yes					yes					yes
Budget	**12K**	**7K**	**8.5 K**	**7 K**	**8.5K**	**12K**	**8.5K**	**7K**	**8.5K**	**7K**	**12K**

➢ Cultural health Index protocol :

In 2013, Tangata Whenua wanted to be involved in a water monitoring project that measures the improvements from community led work in the catchment over time but looks at things from the cultural perspective of our two marae who are the leaders for the project. The Cultural Health Index (CHI) is a tool that Māori use to assess and manage waterways in their area. Our CHI project started in March 2013 for a period of 3 years. This programme involves the local community and the school, it is highly beneficial from a community engagement perspective and should be continued in the future.

Principles behind the Cultural Health Index technique:



-Stream health measure (8 indicators)

- Catchment Land Use (score between 1 and 5)
- Vegetation on banks & margins 100m on either sides (score between 1 and 5)
- Use of the River banks/margins 100m on either sides (score between 1 and 5)
- River bed condition (sediment) (score between 1 and 5)
- Changes to river channel (score between 1 and 5)
- Water quality (score between 1 and 5)
- Water clarity (score between 1 and 5)

- Variety of habitats (score between 1 and 5)

⇒ ***Stream Health Score*** (Averaged score between 1 and 5)

- Mahinga kai measure

- How many Mahinga Kai species are present (Birds, animals, fish plants including Rongoa (food & medecine) observed at the site) ? (score between 1 and 5)
- Are the Mahinga Kai species that were gathered in the past still there ? (score between 1 and 5)
- Are the Mahinga species accessible for gathering ? (score between 1 and 5)
- Would Maori return to the site again (No scores 1, Yes scores 5

⇒ ***Total Mahinga kai score*** (Averaged score between 1 and 5)

- Status of the site

- A- means the site is a traditional site
- B- means it is not a traditional site
- Would you use this site in the future ? : No : scores 0, Yes : scores 1)

⇒ **Status score (either A0, A1, B0 or B1)**

Final score : *Stream Health Score* / *Mahinga kai score* / Status score

Operational plan :

Table 43 : operational plan for the Cultural Health Index programme

CHI monitoring	**Timeline**
CHI water monitoring	March, August and December
Fish monitoring	March and September

4-1-2 Bird monitoring programme

The WCMG is in the process of fencing off the river margins and establishing 200000 native trees over the next 5 years. One of the main goals is to restore the habitat for fresh water native fish species, improve water quality and bring back the bird life that used to live there.

A bird monitoring programme was developed in December 2014 with the help of HBRC, DOC and local bird watchers in order to demonstrate the effectiveness of the management actions undertaken. This programme, like the others will be ongoing.

Update January 2015:

5 sites have been identified in different parts of the Taharoa Trust in order to better understand the birdlife already present and measure the impact of the conservation initiatives over time (habitat restoration and pest control). GPS coordinates are indicated in the table below. Blue plastic triangles have been stapled on fence posts to identify easily the different monitoring sites.

The traditional 5 minutes count method is used and implemented by local bird watchers on a monthly basis with support from DOC and local volunteers. This monitoring programme will have to expand as the restoration of the Whangawehi stream progresses.

Protocole : (5 minutes bird count and data sheet see appendices)

Table 44 : GPS coordinates and site description of the bird monitoring sites on the Taharoa Trust

	Description	Easting	Northing
Site 1 :	First gate when reaching the flood plane	E 2025163	N 5658583
Site 2 :	Same site as stream bank monitoring point opposite Te Toki trees	E 20211846	N 5658376
Site 3 :	Ormond's boundary	E 2021850	N 5658380
Site 4 :	Te Puia wetland, point opposite the hot spring	E 2026166	N 5657056
Site 5 :	Hay barn	E 2024846	N 5658376

4-1-3 Stream bank and habitat monitoring programme

This monitoring programme was developed in order to record:

- Stream bank change (gradient, course etc.) over time in a retired area with no stock access.

- Vegetation development and growth in the newly planted area.

Protocol :

The protocol consists in taking every year in January a series of photos at different photo points identified and GPSed. A protocol has been developed for each site including bearing, frame, angle etc for consistency in the monitoring. These sites are located above the stream level to allow a better view point over time. Photos are laminated and stored for records and further analysis

Table 45 : GPS coordinates and site description of the stream bank monitoring sites

	Bearing	Easting	Northing
Taharoa Trust			
Site 1 : Old Rewarewa along the main track	Captures the stream from above the old flood gate to the boundary with Pongaroa Station. North East bearing	E 2025329	N 5658446
Site 2 : Opposite the Titoki block	Captures the stream upstream and downstream from this point	E 2024953	N 5658445

4-1-4 Pest monitoring plan

The WCMG developed with the Taharoa Trust and Grandy Lake Forest a small scale predator control plan which is implemented since December 2014. A small number of traps and bait stations have been laid and are serviced on a fortnightly basis from October to March and monthly from April to September. This programme will be expanded over time but it is important to be able to measure the impact of this small scale programme on the pests' populations. A monitoring programme will have to be implemented at a later date to measure the impact of the pest control effort.

Technique recommended:

Residual trap catch (see documents in the annexes)

The residual trap-catch (RTC) index is a simple method of determining relative possum abundance. A national protocol for the use of this method was developed by the National Possum Control Agencies (NPCA 2000). The protocol requires that lines of 10 leg-hold traps, with the traps spaced 20 metres apart, are set for three consecutive fine nights and are randomly located within the treatment area. Lines are in different locations, before and after control. The number of lines to be used is determined by the size of the management area. The standard performance target commonly set for a reduction in possum densities, is a residual trap catch of < 5% (i.e. less than 5 possums caught for every 100 trap-nights).

Chew cards

Chew Cards are very sensitive to the presence of pests. They are low cost, easy to interpret results and have the advantage of identifying the presence of a range of pests including rats & possums. Where pest numbers are low they can play an excellent role in providing monitoring data. Chew card monitoring has to be carried out at least once, every year.

Tunnel tracking

Tracking tunnels can be reasonably sensitive to the presence of rodents (rats) when they are present at low densities. Therefore, the technique can be a useful management indicator for determining the results of rodent control operations.

4-2 Governance monitoring tool : NZ Navigator

NZ Navigator is an on-line assessment tool that has been developed for New Zealand community organisations by Platform Trust, Association of Non-Governmental Organisations of Aotearoa (ANGOA), Social Development Partners, Bishop's Action Foundation and is supported by the Department of Internal Affairs.
NZ Navigator is focussed on building strong and effective organisations and communities, enabling users to assess the performance of their organisation by rating all the important areas of the organisation's operation – direction, governance, leadership, people, administration, finances, communication, evaluation, and relationships.
The WCMG undertook the assessment in 2014 with very good scorings (Successful in all 8 categories). It is recommended to undertake this assessment on a yearly basis.

5-Health and Safety

The Whangawehi Catchment Management Group developed a comprehensive Health and Safety procedure including:

– a pre commencement checklist.

– a safety Inspection checklist

– a pre operation Physical hazard identification.

– codes of practice.

– Emergency procedure for accident.

– use of risk manager for community planting days.

– Contractor's booklets for Health, safety and environment plan.

The WCMG needs to follow the coming changes in the Health and Safety legislation.