

Greater Wellington's Riparian Management Strategy

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Executive Summary

The careful management of streamside (riparian) areas can help keep stream environments in a reasonably natural condition, even if the stream runs through rural or urban land. Depending on the kind of plants used and where they're planted, streamside management contributes to healthier river ecosystems and helps rebuild regional biodiversity. It will bring about long term improvements to river environments by improving water quality and aquatic habitat, and increasing ecological links through the wider landscape.

Greater Wellington cannot financially support the rehabilitation of all the thousands of kilometres of streams that would benefit from streamside management. Our analysis shows that the greatest benefits result from full streamside retirement and restoration directed at streams with high ecological value. Unsurprisingly, achieving this high level of benefit incurs the highest cost.

For this reason, we will give highest priority to stretches of streams where streamside conditions are threatening otherwise healthy aquatic ecosystems. Restoration of these streams with appropriate species will not only achieve significant benefit to the stream's aquatic habitat, it will bolster biodiversity in the stream catchment and surrounding area. Greater Wellington will contribute to the costs of rehabilitating these high value streams by providing funding for the establishment of locally suitable plants. For all other streams, Greater Wellington will establish an advisory service that can deliver information and advice to landowners about stream retirement and suitable streamside vegetation.

This Strategy outlines why Greater Wellington needs to act to promote the appropriate management of riparian areas on private land. Greater Wellington will do this by providing information and financial assistance to landowners. The level of assistance proposed is to —

- Provide information and advice to landowners about the appropriate management of streams; and
- Provide funding for re-vegetating the riparian areas of high value streams with appropriate species.

Greater Wellington support for streamside management of public land, including urban streams, will continue through the Take Care Programme.

In its draft Long Term Council Community Plan released in April 2003, Greater Wellington proposed to move from pilot programmes to a more formal programme with the budget increasing from \$170,000 in 2003-04 to \$230,000 per annum by 2005-06. This includes funding for monitoring water quality, hydrology and ecology of urban streams and streams being worked on through the Take Care Programme.

Contents

Executive Summary	3
Relationship with the Biodiversity Programme and other Council initiatives	7
1. Introduction	8
1.1 Purpose of this Strategy	8
1.2 The community's view on our approach	8
1.3 Connection with Biodiversity Programmes	8
2. What is Riparian Management?	10
2.1 What Riparian Management does	10
2.2 Riparian Management Methods	12
2.3 Potential problems: compromising flood works and encouraging pests	13
3. Why Greater Wellington needs to act	14
3.1 Controlling adverse effects of activities on the environment	14
3.2 Fulfilling statutory commitments	15
4. Recognising and providing for matters important to Maori	16
5. How to encourage riparian management	17
5.1 Providing financial support	17
5.2 Demonstrating benefits	17
5.3 Using the Resource Consent process	18
5.4 Working with the rural sector	19
6. Quantifying the benefits and costs	20
6.1 What are the benefits of riparian management?	20
6.2 What are the costs of riparian management?	21
6.3 A fair balance between landowners and the wider community	21
7. Determining Council financial contributions	23
7.1 What Greater Wellington will contribute to	23
7.2 Possible future costs for Greater Wellington	24
7.3 Urban streams	24
8. Where to begin: high priority rivers that would benefit most	26
8.1 Improving the instream environment	26
8.2 Providing spiritual or cultural value to Maori, and improving amenity	26
9. What we need to do to make riparian management happen	28
9.1 The next year	28
9.2 Making a long term commitment	28
9.3 Who will do the work?	29
9.4 Conclusion	29

Appendix 1. The policy framework and related Greater Wellington work	32
A1.1 Related Greater Wellington programmes for water quality and ecosystems	32
A1.2 Relevant policies from the Regional Policy Statement and Regional Plans	33
Appendix 2. Pilot programmes	35
A2.1 Purpose of the pilot programme	35
A2.2 Pilots as demonstration sites	35
A2.3 The Karori Stream	36
A2.4 The Kakariki Stream	37
A2.5 The Enaki Stream	38
Appendix 3. Assessing the benefits and costs of riparian management	40
A3.1 Quantifying the benefits	40
A3.2 Quantifying the costs	41

Tables

Table 1 Activities that can cause adverse effects on stream habitat.....	19
Table 2 Estimation of costs (\$ per metre) of applying four riparian management options to both sides of rural streams	23
Table 3 Relative achievement of benefits brought about by riparian management options	40
Table 4 Estimation of component costs of applying four riparian management options to one kilometre of stream	41
Table 5 Overall costs (\$ per stream metre) of managing the stream margins of urban and rural streams	42

Figures

Figure 1 Karori Stream, an urban stream in Wellington.....	36
Figure 2 Kakariki Stream, tributary of the Ngarara Stream, Waikanae.....	37
Figure 3 Enaki Stream, tributary of the Mangaterere River, Carterton	38
Figure 4 Papawai Stream, tributary of the Ruamahanga River, Greytown.....	39

Relationship with the Biodiversity Programme and other Council initiatives

This document constitutes a major part of the Greater Wellington Regional Council's programme to enhance the Region's ecosystems and biodiversity.

In 2000, Greater Wellington increased its investment in regional biodiversity because it recognised the need to halt the continued loss of remnant areas, species, and ecosystems. Greater Wellington's biodiversity programme addresses the following ecosystem types, which are depleted or under threat in the Region:

- Wetlands
- Rivers and streams
- Estuaries
- Dunes
- Lowland bush
- Coastal escarpments
- Marine ecosystems

Each of these types of ecosystem is addressed by Greater Wellington in different ways, both through plans and strategies, and through a wide variety of programmes and projects.

The Wetland Action Plan provides for all wetlands, except those alongside rivers (with flowing water) and estuaries (with salt water). Its focus is natural wetlands and does not deal with constructed wetlands (where these are created in areas where there were none previously).

The strategic direction for river ecosystems is set out in this document. This is being supplemented by a series of investigations into the health of river ecosystems, and the ecological communities that live in them (e.g. native fish).

Greater Wellington's work on estuaries has not yet been set out in a single document. The most significant activity is occurring in the Pauatahanui estuary, and this is described in "Towards Integrated Management - Pauatahanui Inlet Action Plan". Other estuaries on which Greater Wellington is working include the Waitohu, Otaki, and Riversdale estuaries.

Similarly, there is no overall strategy for Greater Wellington's dune restoration efforts. This is happening as discrete projects at a number of sites from Otaki to Castlepoint. It is expected that a strategy for Greater Wellington's dune efforts will be developed.

The Regional Pest Management Strategy provides overall direction for works and services relating to lowland bush "key native ecosystems". Programmes for coastal escarpments and marine ecosystems are still being developed but are site specific and unlikely to warrant strategic overviews or description at this stage.

1. Introduction

1.1 Purpose of this Strategy

The purpose of this Strategy is to get the riparian margins of more rivers and streams in the Region managed in a way that helps realise these environmental outcomes:

- Improved water quality
- Improved aquatic habitat
- Healthier river ecosystems
- The building of ecological links through the wider landscape
- Halting the decline of regional biodiversity
- Improved ability for Maori to exercise their traditional use of and guardianship over water and its environs
- Improved community recognition of the part streams play in environmental systems, and consequent improved care for those streams by the community.

Not all identified outcomes will be achieved from individual efforts on single stream reaches, but each person's effort will build on those of others. The riparian management programme is one of about a dozen Council-supported initiatives to improve water quality and protect ecosystems around the Region (see Appendix 1).

1.2 The community's view on our approach

Greater Wellington released a draft Strategy for community comment in July 2001. In general, consultation on the draft supported having a graduated funding arrangement that encouraged farmers to fence streams from stock and plant appropriate streamside species. People felt that Greater Wellington support for riparian management should apply to streams that are both good and bad (in terms of existing water quality, etc).

The criticisms of the funding arrangement proposed in the draft were that it did not sufficiently encourage the use of native vegetation and that it did not direct management towards streams that would get the greatest benefit, e.g. smaller streams in vulnerable places, or streams that have historically supported abundant fish life, e.g. the Horokiri Stream.

Iwi groups all stated that they couldn't select any particular stream or catchment to target. All streams are important, and all need a case by case approach to address cultural issues. All iwi groups supported the use of native plants, particularly native plants used for cultural purposes or that would enhance native fisheries.

1.3 Connection with Biodiversity Programmes

This Strategy has two principal foci - water quality and biodiversity. This means that we will promote riparian management to rehabilitate and restore the whole stream environment, not just reduce contaminants in the water.

Riparian areas are extremely rich in terms of their biodiversity. The main reason is that this environment is one where aquatic and terrestrial ecosystems meet and overlap. Some 450 species of native insect, 200 native crustaceans, molluscs and worms, 35 native (or indigenous) freshwater fish species, four frog species, and many of our 88 remaining indigenous land bird species live in the healthy examples of these areas, or visit them regularly. The problem is, the healthy areas that remain are much smaller than they once were and are still threatened by human activity. Many are no longer connected to other healthy riparian areas because riparian vegetation has decreased with the development of towns and cities and with the replacement of complex ecological systems with vast pastoral mono-cultures.

Restoring even ten metres of vegetation beside small streams helps return the stream to a more natural environment for aquatic life, including fish. New Zealand has a sparse but unique freshwater fish fauna with most of the native species only found in this country. There have been 31 freshwater fish species recorded in the Wellington Region since 1921, of which 23 are native.¹ One, the grayling, is now extinct. Five species (the shortjaw kokopu, giant kokopu, brown mudfish, koaro, and banded kokopu) require conservation action.² Native fish are primarily generalised invertebrate carnivores, eating a combination of aquatic and terrestrial insects.³ This makes streamside vegetation, where many terrestrial invertebrates live, an important part of the native fish habitat.

Eighteen of the native fish recorded in the Wellington Region need to migrate between fresh water and the sea, usually in relation to spawning. The spawning habitat requirements of many native fish are very specific. Inanga, for example, rely on tidally-inundated riparian vegetation in or near the river estuary.⁴ The banded kokopu, koaro and shortjaw kokopu lay their eggs on stream banks or amongst the coarse gravels on the stream margins when the small forested streams in which they live are in flood.⁵ This is why identifying, and then retiring and planting the spawning areas of riparian margins, and keeping the streams free for fish passage, is as important as restoring stream habitat for fish species.

In 2000, Greater Wellington increased its investment in regional biodiversity because it recognised the need to halt the continued loss of remnant areas, species, and ecosystem complexity and work towards restoring the Region's ecological balance. Streamside management is part of this larger programme because it can help to restore natural river ecosystems and establish ecological links.

¹ Strickland, R, and A Quarterman (2001). *Review of freshwater fish in the Wellington Region*. Cawthron Institute and Wellington Regional Council.

² Tisdall, C. (1994). *Setting priorities for the conservation of New Zealand's threatened plants and animals*. Department of Conservation, Wellington.

³ McDowall, R. M. (1990) *New Zealand freshwater fishes: a natural history and guide*. Auckland, Heineman Reed.

⁴ Taylor MJ, and GR Kelly (2001). *Inanga Spawning habitats in the Wellington Region, and their potential for restoration. Part 1: Kapiti, Porirua, Wellington, and Hutt City*. NIWA and Wellington Regional Council.

⁵ McDowall, R. (2000). *Hidden Treasures Exposed: discovering our freshwater fish fauna*. Cawthron Institute, New Zealand.

2. What is Riparian Management?

Riparian management is the management of stream margins, generally by retirement and planting, to achieve specific outcomes for the stream, or the riparian zone itself. The riparian zone has been defined as “any land that adjoins or directly influences, or is influenced by, a body of water”.⁶

2.1 What Riparian Management does

Even well planted stream margins can't replicate what goes on inside a forest, but they can help mitigate the effects of surrounding land uses and provide a nearly natural stream environment. Planted stream margins can help improve existing aquatic habitat by providing a food supply of leaf litter for instream herbivores, habitat for insects preyed on by instream carnivores, hiding places for fish (overhanging bank vegetation and inputs of wood), and places for fish to breed. Some of the many functions planted riparian margins can perform for water quality and aquatic habitat in the stream are described here.

Nutrients, sediment and germs are the most common contaminants affecting water quality in rivers. Nutrients (nitrogen and phosphorus) speed up the growth of aquatic weeds, sediment affects the colour and clarity of the water and can smother the beds of stony bottomed streams, and germs make the water unsafe for people to swim in and can affect its suitability for stock water supply, or its use in milking sheds.

Many riparian management techniques will lower the quantities of these contaminants reaching rivers. In rural areas, keeping stock away from streams, or limiting their access, stops them polluting water and damaging stream banks and beds. Ungrazed grass in riparian areas can be an effective filter of sediments and other pollutants if overland runoff is affecting water quality. The uptake of nitrate and phosphorus by streamside plants stops those nutrients reaching the river, but studies⁷ indicate that microbial denitrification removes more nitrate than plants can use to grow if the right environmental conditions (wet soils with long residence times), are present.

Riparian vegetation that shades the stream can slow down or stop the elevation of water temperatures that happens when small streams flow through open country over large distances. Cooler water is easier for fish and aquatic insects to live in, and shaded streams have lower sunlight levels on the water, helping slow the growth of aquatic weeds and algae such as periphyton.⁸ Prolific periphyton growths smother the beds of stony bottomed streams where aquatic insects and sometimes native fish would otherwise live.

Trees can also shade out and kill ground cover that helps protect stream banks from erosion. Loss of ground cover eventually causes the stream channel to change from the narrow deep channel typical in pasture land to the wider and

⁶ Ministry for the Environment (2000). *Managing Waterways on Farms: a guide to sustainable water and riparian management in rural New Zealand*. Wellington, NZ. Ministry for the Environment. P 5.

⁷ Schipper, L A, A B Cooper, and W D Dyck. (1991). Mitigating non-point source nitrate pollution by riparian zone denitrification. Proceedings of the Nitrate contamination: exposure, consequence and control conference, Nebraska, USA.

⁸ Rutherford, JC; RJ Davies-Colley; JM Quinn; MJ Stroud; AB Cooper (1999). *Stream Shade, towards a restoration strategy*. NIWA and Department of Conservation.

shallower channel more typical in forested land.⁹ Loss of ground cover may not be desirable because some ground cover is useful for filtering overland flow, and its loss may be avoided by planting species that provide only partial shade.

An appropriate variety of riparian vegetation can stabilise stream banks. This means less soil is washed into streams and less streamside land is lost. Muddy water not only makes life difficult for fish and aquatic insects; soil from farms usually has phosphorus bound up with it, some of which gets released into the water.

Rivers are natural corridors through the landscape and when bordered with native plants they help join up otherwise fragmented ecosystem patches. The current rate of decline in regional biodiversity could be slowed or even reversed if native vegetation is encouraged to grow in these corridors and in selected strategic areas. Native vegetation may be planted amongst willows or other exotics growing alongside or near rivers, or may be specifically planted to bolster an existing area of significant indigenous vegetation, or to provide habitat and food for birds and insects. Insects are an important food supply for native birds¹⁰ and fish.¹¹ However it grows, native vegetation builds complexity and diversity back into the Region's ecological systems.

The health of riparian areas is of considerable significance to Maori. To Maori, all parts of the natural world possess a mauri or life force (including humans) and all life is related. It follows that the health and wellbeing of the environment will affect the welfare of the people. Each river or stream carries its own mauri, a water body with a healthy mauri will provide for healthy ecosystems. Contaminants running into water ways contribute to the degradation of the mauri. Where the riparian vegetation has been removed or altered, it is also likely that mahinga kai species have been impacted upon. Consequently, Maori take a strong interest in efforts to restore the proper functioning of water bodies and associated ecosystems.

Streamside areas are highly visible parts of the environment that people enjoy looking at and for recreation. This is the stream's amenity value. People seek out waterways with high amenity for picnicking, swimming, bird watching, fishing, food gathering and so on.

Communities involved in the rehabilitation of riparian areas in their neighbourhoods can gain increased awareness of the part streams play in their environment. Building this awareness can increase their willingness and desire to get involved in solutions to caring for the streams.

The overall result is that managed and planted riparian areas have a "disproportionately large role" in decreasing land use effects on streams and aquatic life,¹² and make significant contributions to building ecological links through the landscape. Benefits to water quality in rural areas can often be

⁹ Davies-Colley, R J (1997). Stream Channels are Narrower in Pasture than in Forest. *New Zealand Journal of Marine and Freshwater Research* 31:599-60.

¹⁰ Heather, B D, HA Robertson (2000). *The Field Guide to the Birds of New Zealand*. Penguin Books.

¹¹ McDowell, R. (2001). Native fish conservation awareness workshop. A workshop sponsored by Department of Conservation at Kapiti Community Hall, Paraparaumu, 4 May, 2001.

¹² Collier et al., (1995). *Managing Riparian Zones: a contribution to protecting New Zealand's rivers and streams*. Vol. 1: Concepts and Vol. 2: Guidelines. Wellington, NZ, Department of Conservation.

achieved by simply retiring the stream from stock access, but most benefits to aquatic habitat, biodiversity and public enjoyment generally require going further with conservation planting.

2.2 Riparian Management Methods

Some riparian management methods already practised in New Zealand are:

- **electric fencing** to prevent or restrict stock access to stream banks and streams and drains
- **grass strips** where the grass alongside drains, small creeks and streams is left to grow so that it filters overland flow of contaminants
- **wetland planting** where headwater and riparian wetland seeps are protected or restored with rushes and sedges
- **permanent fencing** to exclude all stock from stream banks and streams
- **conservation planting** of trees, shrubs, and grasses, ideally with native vegetation, and in rural areas permanent fencing and separate water supply.

Choosing the management option that's right for the site depends on the impacts of the surrounding land uses on the stream, the existing water quality and aquatic habitat of the stream, and what beneficial changes can be achieved to the stream environment for what cost. This "horses for courses" approach can be staged into "first steps" and "best practice" management option for riparian areas.¹³

For example, where an unfenced stream flows through dairy farm land in an upper floodplain area, an appropriate First Step option may be to install electric fencing to prevent cow access, and establish an alternative water supply if none exists. This may be followed up with planting shrubs and trees for bank protection and shade.

Best Practice is a comprehensive level of management that is tailored to the site to achieve specific outcomes for the stream and riparian area. Best Practice options usually involve permanent fencing with conservation planting where a variety of plants are selected to achieve specific outcomes such as pollution interception and filtration, vegetation overhang for fish refuge, and native vegetation selected to rehabilitate stream habitat for aquatic life and enhance biodiversity. Appropriate Best Practice options will depend on the size of the stream, dominant impacts on the stream from surrounding land uses, dominant functions and uses of the riparian area, and the possible improvements that can be achieved for aquatic and streamside habitat in and alongside the stream.

But full streamside restoration is not needed in every situation, particularly if the outcome being sought is the reduction in overland runoff of sediment, nutrients and faecal contaminants or the avoidance of direct contamination by

¹³ Quinn, J., et al., (2000). Riparian Zone Classification Improves Management of Stream Water Quality and Aquatic Ecosystems. NIWA.

stock. Electric fencing with grassy filter strips, and small wetland seeps can prevent these contaminants entering streams, while good livestock practices, and soil and pasture management can reduce surface runoff to begin with.

2.3 Potential problems: compromising flood works and encouraging pests

Alongside the achievable benefits from riparian retirement and planting are two potential problems: compromising flood protection works, and creating places for animal and plant pests to thrive.

In areas targeted for riparian management, the effects of riparian planting on any identifiable flood risk must be considered, and flood protection measures must not be compromised. This applies to all rivers, not only rivers where Greater Wellington manages the flood protection works.

Where there are flood protection works, plantings on stopbanks must be prevented, and the extent, position and orientation of plantings in relation to the river may need to be restricted so that flooding effects are not increased and flood defence systems can be maintained. At the same time, the potential for flood mitigation planting to contribute to greater ecological diversity in river corridors should not be overlooked.

As well as providing ecological corridors through the countryside, rivers and streams are effective long distance transport routes for weeds and their seeds. In rural areas, grazing and active weed control has often kept weeds in check. If those areas are retired from grazing without weed control, weeds and grass can outgrow and smother desirable riparian plants, wasting time and money spent establishing the plants and providing an unwelcome seed bank for downstream properties. Streams in urban areas generally have well established streamside weed infestations with an ongoing supply of seeds from residential gardens and road reserve land. Extensive weed control is needed before any planting can begin and this often results in an interim season of unattractive dead plants or bare earth before the desirable plants get established.

Our experience with the riparian management pilot programmes (see Appendix 2) has taught us that weed control must be fully assessed and addressed at the beginning of the project. It must be included in the initial project cost for both urban and rural streams and an ongoing commitment to weed control for at least the first two years while the plants get established is essential. After that it can be part of normal weed control work required as part of property maintenance.

3. Why Greater Wellington needs to act

There are two reasons for Greater Wellington to be actively involved in riparian management. One is to show leadership by working with individuals and the community to avoid, remedy and mitigate the adverse effects of activities on the environment. The other is to fulfil the statutory commitment Greater Wellington made when choosing effective non-regulatory methods over regional rules as its preferred policy approach to address land use impacts on water and build ecosystem principles into resource management.

3.1 Controlling adverse effects of activities on the environment

Some farming and forestry practices, and some activities associated with urban areas, can cause adverse effects on rivers and streams. Discharges of sewage or agricultural effluent to rivers (point source discharges) cause immediate adverse effects downstream. Activities like pastoral farming, stock access to streams, forestry, horticulture, vegetation clearance, and stormwater runoff, generally have adverse effects that occur more gradually, but can affect much larger areas. The Resource Management Act (1991) places a duty on everyone to avoid, remedy or mitigate any adverse effect on the environment caused by their activities, whether or not the activity is permitted by a regional rule or discharge permit.

According to our monitoring results, there has been little or no improvement in the water quality of our rivers and streams between 1994 and 1999¹⁴ or in the subsequent three years.¹⁵ Environmental improvements arising from the change to land-based treatment and disposal of agricultural effluent, and better treatment of contaminants discharged directly to our waterways are expected to show up in many rivers over the next five years. But our investigations tell us that point source discharges are only part of the story. The levels of nutrients and other contaminants that trickle overland into our rivers, called non-point source discharges, are not decreasing. For example, our water quality data indicate that in the Ruamahanga River, downstream of all the main tributaries, nearly 90 percent of the nutrient load is from overland runoff and bank erosion during elevated flows. Faecal contamination of the lower Ruamahanga River during elevated flows is four times higher than it is during low flows. Given that high flows would dilute point source discharges, this increase must be caused by runoff from surrounding land.

Riparian management helps avoid, remedy and mitigate some of the adverse effects of rural and urban land uses. It does this by intercepting contaminants before they reach rivers, reducing their effects on aquatic habitat if they do reach the water, and restoring or reinstating areas of habitat that have been largely removed by development.

¹⁴ WRC (2000). *Measuring Up: the state of the environment report for the Wellington Region*. Wellington Regional Council.

¹⁵ WRC (2001). *Annual Freshwater Quality Report: Wellington Region 2000-2001*.

3.2 Fulfilling statutory commitments

In its Regional Policy Statement, Regional Freshwater Plan, and Regional Soil Plan, Greater Wellington has decided to take a non-regulatory approach to protecting riparian vegetation, and to controlling many of the effects of land use on water quality. Greater Wellington's preferred approach is to promote appropriate management of riparian areas (see RPS Freshwater Policy 8 in Appendix 1).

Using appropriate native species for riparian management is also necessary to help implement policies in the Ecosystems chapter of the Regional Policy Statement. These policies direct Greater Wellington to integrate ecological principles into resource management practice, provide linking corridors and buffer zones, and encourage the planting of native vegetation (RPS Ecosystems Policies 3, 9 and 10).

4. **Recognising and providing for matters important to Maori**

Maori have strong cultural, traditional and historic links with wetlands and inland waterways. These resources provide habitat and spawning grounds for indigenous plants, bird and fish life, building and weaving materials such as raupo and flax, and medicines and dyes used for seasoning timber and restoring precious artefacts. They are also a traditional source of foods such as eels, whitebait and watercress. Protecting the integrity of valued freshwater resources remains an important aspect of the responsibilities of Maori who are identified as the kaitiaki (guardians).¹⁶

Some of the ways a water body and its riparian area may be especially valued by Maori are:

- the role of the waterway in tribal creation stories
- the proximity of important waahi tapu, waahi taonga, settlement or other historical sites to the waterway or the riparian areas beside the waterway
- the use of the waterway as an access route or transport course
- its value as a source of mahinga kai and other cultural materials
- the continued capacity for future generations to access, use and protect the resources of the waterway and riparian areas.

In discussions with Iwi of the Wellington Region for the preparation of this Strategy, everyone made the comment that all streams should be assessed case by case. That is, Iwi were unwilling to select any particular stream or catchment and preferred that Iwi views should be sought project by project. In general, Iwi supported riparian management that would take into account food access, mahinga kai, and that education needs to go hand in hand with habitat enhancement.

Iwi need to be involved to identify those places that need attention so that they can maintain or support mauri. Since each river's mauri is different, it is likely the way of restoring the river ecosystem should also vary. Only the tangata whenua, as kaitiaki, know how the waterways have been valued and used by Maori. Iwi involvement in projects will be sought and encouraged wherever possible.

¹⁶ Information in this section draws heavily on *Managing Waterways on Farms: a guide to sustainable water and riparian management in rural New Zealand*, Wellington, NZ. (2000). Ministry for the Environment, and has been confirmed in discussions with Iwi in the Wellington Region during consultation on the Strategy.

5. How to encourage riparian management

Many landowners are becoming aware of how their use of the land impacts on waterways, and they are changing their practices accordingly. Others are slow to change. In a national study, the Ministry for the Environment identified that the main reasons why are cost, and lack of knowledge about the true impacts of farming (including pastoral farming, forestry, cropping, fruit growing, and so on) and farm generated contaminants. The report concluded that “where the knowledge does exist, quite extraordinary progress has been made by individual landowners, often at little or no net cost to the farming operation”.¹⁷

Greater Wellington’s experience with supporting covenants for protecting private land is that many landowners are enthusiastic about protecting and enhancing the natural environment, and will do so when motivated by relevant information and offered some financial assistance. Since July 2000, some 340 hectares of forest remnants and wetlands in the Wellington Region have been protected by QE II National Trust covenants, with funding assistance of less than \$80,000 from Greater Wellington.¹⁸

Greater Wellington can encourage better management of riparian zones of rivers over the long term by:

- providing landowners in targeted areas with financial support,
- demonstrating the benefits of riparian management options through information and education,
- considering requiring riparian management through consent conditions to mitigate the effects of some activities, and
- working with the dairy industry in their efforts to encourage the fencing of streams.

5.1 Providing financial support

Providing financial support to achieve environmental outcomes is a tool with a proven track record. It is being used successfully by Greater Wellington to reduce erosion through soil conservation grants, to restore wetlands, and plant public land beside streams through care groups. Setting an appropriate level for Greater Wellington’s financial contribution is discussed in section 6 below.

5.2 Demonstrating benefits

Getting high levels of landowner participation in riparian management relies on increasing their understanding of its benefits, and hopefully causing a domino effect throughout entire catchments. The experience of other Councils (e.g. Taranaki and Manawatu-Wanganui) is that riparian retirement and planting is embraced by landowners once they see it working in their locality.

Demonstrating the benefits of riparian management will also encourage people to retain existing riparian margins. This avoids the regulatory approach to

¹⁷ Ministry for the Environment (2000). *Managing Waterways on Farms: a guide to sustainable water and riparian management in rural New Zealand*. Wellington, NZ. Ministry for the Environment. P 3.

¹⁸ Porteous, T. (2000). *Implementation of the Ecosystems and Biodiversity Programme*. Wellington Regional Council Environment Committee Report 01.36, and updated in pers. comm. 2002.

protecting riparian vegetation that was considered but rejected during consultation on the Regional Soil Plan, and can complement the work Greater Wellington is doing promoting the use of QE II covenants.

A variety of educational, promotional, and communication tools will be needed to reach landowners across a number of catchments. The rate of uptake of these tools has not yet been determined, but Greater Wellington is gaining experience in how to communicate effectively through its biodiversity, environmental education, and catchment focused initiatives (Waiwhetu, Pauatahanui Inlet). These lessons will be applied to riparian management.

In part, Greater Wellington needs to inform landowners about how their activities impact on waterways and wetlands so that people can understand **why** they need to change. In part, advice is needed about **how** to implement the various management options (from first steps to best practice) so that keen farmers or care groups can proceed relatively unaided. We need to demonstrate through these communications that riparian management need not be a drain on farm productivity, and that where there is a high level of community benefit costs can be shared with the regional community.

Greater Wellington can also advise farm landowners about the wider issues of livestock management that can affect rivers and streams. Such issues include not overstocking, avoiding treading and pugging, keeping cattle out of streams and drains, soil management and pasture development (not cultivating right up to the stream edge, avoiding overgrazing, reducing erosion, applying fertiliser in accordance with nutrient budgets, and using filter strips). In other words, that good management of waterways does not begin and end at the water's edge but stretches across the whole of the farm.

5.3 Using the Resource Consent process

Greater Wellington can impose conditions on resource consents to mitigate the effects of activities. This is specifically encouraged in Policy 4.2.34 of the Regional Freshwater Plan (see Appendix 1).

Section 104 requires consent authorities to consider any application for a resource consent subject to the purpose of principles of the Act stated in Part II. The purpose of the Act is to promote the sustainable management of natural and physical resources. Sustainable management explicitly includes avoiding, remedying, or mitigating any adverse effects of activities on the environment. Section 104 also specifically requires the consent authority to have regard to (among other things) any actual and potential effects on the environment of allowing the activity, and any relevant objectives, policies, rules, or other provisions of a plan or proposed plan.

Examples of some actual and potential effects on stream environments of allowing activities that may be mitigated by riparian management are given in Table 1 below.

Table 1 Activities that can cause adverse effects on stream habitat

Activity	Some effects of the activity, and how streamside planting can help mitigate them
Discharge of contaminants to land near streams	<p>Runoff of contaminants to the stream. Nutrients, sediment and disease-causing organisms are the most common contaminants affecting aquatic habitat and water quality in rivers. Many riparian management techniques will lower the quantities of these contaminants reaching rivers, and can help mitigate their effects if they do reach the water.</p>
Works in the bed of streams, or affecting stream banks	<p>Destruction of pools and riffles and existing vegetation, erosion of stream banks. Streamside vegetation can create overhang for fish refuge, help maintain a more natural instream environment, and stabilise stream banks.</p>
Abstractions from rivers and streams	<p>Large abstractions, or a lot of small abstractions, will decrease the stream flow, making it easier for instream water temperatures to increase. Riparian vegetation that shades the stream can slow down or stop the elevation of water temperatures.</p>

There are some activities in and near streams that will have effects on aquatic habitat that cannot be avoided. It is clear though, that the Act envisages that the applicant will mitigate the effects of their activity. Where mitigation can be achieved by riparian management, this can be required by conditions imposed on the consent.

5.4 Working with the rural sector

The New Zealand farming industry recognises the importance of New Zealand's high environmental standards and values when marketing their product internationally.¹⁹ For example, as part of its commitment to protect the environment, the dairy industry is encouraging dairy farmers to avoid water quality degradation by controlling stock access to waterways and wetlands. Greater Wellington will continue to work with the dairy industry and other rural industries to achieve our common goals.

¹⁹ Dairying and the Environment Committee (2002). *Market Focussed, an environmental management system for New Zealand Dairy farmers*. Fonterra.

6. Quantifying the benefits and costs

To determine who should pay for riparian restoration or how the costs should be allocated between the community and landowners, we identified what the likely benefits and costs are, and who the beneficiaries and exacerbators are.²⁰

6.1 What are the benefits of riparian management?

Generally speaking, there are six classes or kinds of benefit from riparian management. These are:

- **Biodiversity benefits** – the benefit to the biological and genetic diversity of all living organisms from the continued healthy functioning of the riparian and riverine ecosystem. Aquatic fauna require good water clarity, few weeds, low water temperatures, and diversity of habitat. Birds require roosting and nesting places, and links to other habitat. All fauna (birds, fish, insects and so on) require their appropriate food supply. Flora require diversity of environments, and plant and animal pest control.
- **Recreational benefits** – such as the ability to use the water for contact recreation (paddling and swimming), fishing, and bird watching, and aesthetic surroundings. Water contact requires good water clarity, low weeds, low faecal contamination, and access. Fish and birds require working ecosystems. Aesthetic surroundings depend on context and perception.
- **Ecosystem benefits** – benefits that natural ecosystems provide for people such as pollutant detoxification and removal, flood protection and bank protection. Pollutant removal requires filtering vegetation, nutrient uptake or denitrification zones. Flood protection requires healthy upper catchments and effective wetlands. Bank protection requires vegetation that tolerates variations in water levels and withstands flood flows.
- **Landowner benefits** – benefits provided to landowners, and others, such as shade and shelter for stock, clean stock water (for drinking and dairy shed cleaning), a clean green image, meeting environmental quality assurance programmes, and aesthetic surroundings. Shade and shelter require appropriate trees planted in accessible places. Clean stock water needs to be palatable with low faecal contamination.
- **Bequest benefit** – the benefits for future generations from their potential use and enjoyment of the resource.
- **Cultural benefit** – the benefit arising for Maori from their use of the resource in ways they consider appropriate.

²⁰ The cost-benefit analysis here relies heavily on a report from Environment Waikato, the New Zealand Rural Trust and the Matamata-Piako District Council about the Piako River. See Environment Waikato (2000). *Case Study - Riparian Management on the Piako River: A New Approach to Costs and Benefits*.

Not all riparian management options (from simple stock exclusion to full-scale ecological restoration) will necessarily realise all six benefits. We have assessed the relative benefits of implementing the range of riparian management options at the streams in the pilot programme,²¹ and compared these to the streams' current condition (see Table 2 in Appendix 3). The assessment shows that the greatest community benefit, particularly to biodiversity and recreational values, is achieved by Best Practice options (i.e. doing more than simply excluding stock). This suggests that a community contribution would be appropriate for riparian works that incorporate these more comprehensive, and thus more expensive, management options.

6.2 What are the costs of riparian management?

There are three kinds of costs associated with riparian management:

- **Material costs** – such as for plants, herbicides, weed mats, protection from animals, fencing materials, electricity for fences, stock crossings, and troughs and pumps for alternative water supplies.
- **Labour costs** – such as for planting, weed control, constructing fences.
- **Lost opportunity costs** – such as lost production on rural land. Lost opportunity costs are generally not incurred when riparian margins are managed on public land unless there is a loss of public access.

The level of cost depends on the kind of works undertaken, and the kind of surrounding land use. Estimated costs are listed in Table 3 in Appendix 3. The cost analysis shows that for streams flowing through pastoral land, permanent fences can account for about half the cost of the stream retirement. Fencing costs apply regardless of the width of the retired area yet sufficient riparian width is an important part of the Best Practice package. The way in which Greater Wellington supports riparian management needs to encourage landowners to retire sufficient width to achieve improvements in aquatic ecosystems, biodiversity and recreation opportunities for the community.

6.3 A fair balance between landowners and the wider community

A comparison of the benefits (see Appendix 3) that might be expected when different forms of riparian management are applied to three different streams shows that stream improvements brought about by fencing alone will bring only some benefit to the wider community. More expensive management options (full stream retirement with native planting) are needed to realise significant improvements in the predominantly community benefits of river recreation and biodiversity.

Leaving some costs with landowners recognises their duty under the Resource Management Act (1991) to avoid, remedy or mitigate the adverse effects of their activity on the environment. The level of costs paid by the community needs to recognise that both they and the landowner are beneficiaries of the riparian management implemented, but that the level of community benefit

²¹ For a description of the streams in the pilot programme see Appendix 2.

increases more than the landowner's when wider strips are planted, especially with native plants.

A fair community contribution will recognise that landowners are both exacerbators of the problem and beneficiaries of the solution, and that the greatest community benefit occurs when Best Practice options involving native plant restoration are implemented. Our conclusion is that the landowners should retain responsibility for fencing streams running through their properties, and that a community contribution can apply when the community benefit is high in terms of ecological outcome.

7. Determining Council financial contributions

7.1 What Greater Wellington will contribute to

Greater Wellington will contribute to the cost of riparian management on streams with high ecological value (see section 8 below). This is consistent with the level of community benefit that riparian work in these places has.

The costs of riparian management are highest for full streamside retirement and restoration with plants that build biodiversity (see Table 2 below).²² These high costs will produce the greatest benefits if restoration is directed at streams with high ecological value. It makes sense for Greater Wellington to contribute to the costs of rehabilitating these high value streams because landowners may be unwilling to undertake the extra treatment they require.

Table 2 Estimation of costs (\$ per metre) of applying four riparian management options to both sides of rural streams

	Stream fenced and not planted	Stream fenced (10 m), with exotic plants	Stream fenced (5 m), with native plants	Stream fenced (10 m), with native plants
Permanent fence (dairy electric)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)
Plants, weed control and labour	—	\$10.43	\$22.38	\$44.76
Total cost	\$23.70 (\$6.90, dairy)	\$34.13 (\$17.33)	\$46.08 (\$29.28)	\$68.46 (\$51.66)
Fencing as a proportion of overall cost	100%	69% (40%, dairy)	51% (24%, dairy)	35% (13%, dairy)

As Table 2 shows, even the most basic forms of treatment are not cheap. Fencing alone costs nearly \$24 a metre for a permanent fence. For this reason, it is not possible for Greater Wellington to contribute adequately to the fencing of the many thousands of streams where retirement and restricting stock access is desirable. We cannot do riparian management everywhere we would like to. Thus, restricting Greater Wellington's contribution to high value streams is a practical reality, as well as one driven by the assessment of costs and benefits.

For high value streams, Greater Wellington will contribute to the cost of re-vegetating the riparian area with appropriate species (overwhelmingly natives, but allowing for the use of some exotic species where particular conditions require them) and maintaining them for two years to a point where the area is

²² See Appendix 3 for a full description of these costs, and how we derived these costs.

thriving and secure. The landowner retains responsibility for constructing and maintaining the capital assets created as part of a riparian retirement (the fence, bridges, alternative stock watering).

One consequence of this approach is that there will be no **financial** support for rural streams with low quality aquatic habitat and depleted stream life. Investing in such streams is unlikely to achieve the objectives of the strategy in the short term except for improved water quality. However, Greater Wellington will assist landowners that wish to act for their streams in other ways. It will:

- Run field days;
- Provide information and advice to landowners who want to retire stream margins about locally suitable plants, and how to establish and look after them;
- Continue to support the trial Enaki catchment project to build our knowledge and understanding of riparian management in intensively farmed catchments that would not qualify on the basis of their ecological significance;
- Undertake trials and promote ways by which landowners can control weeds and manage riparian strips that are predominantly rank grasses.

7.2 Possible future costs for Greater Wellington

Full streamside restoration of high priority streams in rural areas would see one hectare of high quality riparian habitat restored for every kilometre of stream (half a hectare on each side). This is based on the assumption that a five metre strip is retired. For both sides of the stream, this would cost \$46 per stream metre (being one metre in length and 10 metres in total width) at current prices, \$24 for fencing and \$22 for establishing and maintaining the vegetation. Because the landowner would pay for the fence, Greater Wellington's costs would be \$22 per stream metre, or \$22,000 per kilometre. For \$100,000, both sides of about 4 kms of stream margins could be completed annually.

Of course, the width of the strip will not remain constant at five metres either side. Factors such as topography, soil type, and stream size mean it will vary from place to place. It is reasonable to expect that \$25 a stream metre would be sufficient, in most cases, to meet the need for a functioning riparian zone.

7.3 Urban streams

Urban streams can have significant potential amenity and biodiversity benefits from streamside restoration, especially if combined with stormwater education programmes, road reserve restoration, and encouraging fish friendly culverts.

Greater Wellington is successfully using the community care group approach to enhance streamside areas on public land. Of the 22 projects funded in this way to date, 19 are restoring riparian areas (including wetlands) to achieve stream or river improvements. This recognises that riparian planting will provide some benefit to almost any stream and builds on people's existing enthusiasm and willingness to improve their environment.

The care group approach is working well on the streams care groups have chosen to restore, although we do not know whether the groups have the resources to do full scale riparian restoration. At \$18 to \$35 per metre depending on riparian width (see Table 5, Appendix 3), the financial commitment through the Take Care programme to streams flowing through public land is a comparable commitment to that for rural streams through this riparian programme. Continuing to support care groups may be the best approach to achieving effective streamside management of urban streams, especially with territorial authority involvement.

Most Care Groups are monitoring the state of “their” streams using the Stream Health Monitoring Assessment Kit (SHMAK). This information is useful to show long term trends in stream health but Care Groups and Greater Wellington need a strong scientific information base for the stream, including its physical and chemical condition, its hydrology, and its ecological state. Establishing and maintaining this information base will cost \$20,000 per year.

8. Where to begin: high priority rivers that would benefit most

8.1 Improving the instream environment

To identify the rivers that would benefit most from streamside retirement and planting, we are using Geographic Information System (GIS) modelling. The process we are using to do this is described in a separate report.²³

Our initial modelling showed that there is more than 7,700 km of streams in the Region where riparian management should provide some benefit to water quality and aquatic habitat. The stream sections were identified according to whether the soils are vulnerable to erosion, and whether the surrounding land uses would contribute to overland runoff, stream bank damage and cause adverse effects on water quality. Fourth order streams and larger were excluded because these are generally too wide to benefit from riparian management, and sometimes have flood control issues as well.²⁴

Greater Wellington cannot financially support the rehabilitation of all of these streams and so we will give highest priority to stretches of streams where streamside conditions are threatening otherwise healthy aquatic ecosystems. Restoration of these streams with appropriate species will not only achieve significant benefit to the stream's aquatic habitat, it will bolster biodiversity in the stream catchment and surrounding area.

The criteria we are using to identify high priority streams from those that we know would benefit are:

- The stream already has a reasonable amount of high quality aquatic habitat that can be extended and improved by riparian management.
- Riparian management will be effective at rehabilitating any degraded aquatic habitat in the stream catchment.
- The stream will be able to be a functioning ecosystem for the aquatic life that would naturally live there (for example, there are no major barriers to fish passage).
- The stream could provide ecological links and corridors once it is rehabilitated because of the relatively short distance to the sea or Lake Wairarapa.
- The selected stream catchments are representative of the range of stream types in the Region.

8.2 Providing spiritual or cultural value to Maori, and improving amenity

Iwi expressed the view during preparation of the Strategy that providing spiritual or cultural value to Maori is a matter to be taken into account on a

²³ Greater Wellington Regional Council (2003). *Selecting high priority streams for riparian management*. In press.

²⁴ Stream order is determined by the number of its tributaries. First order streams have no tributaries, second order streams have only first order tributaries, third order streams have at least one second order tributary, and so on.

stream by stream basis. Once the high value streams are identified we will work with Iwi to determine how to provide spiritual or cultural value to Maori from the stream rehabilitation.

Providing or improving amenity and recreational opportunities will work best on areas with high visibility and accessibility to the public, or streams that will lead to the enhancement of water quality in those areas. The potential for riparian management to improve amenity and will be assessed on a case by case basis. Ways to bring about these benefits can be incorporated into each project, as appropriate.

9. What we need to do to make riparian management happen

9.1 The next year

Greater Wellington will continue to support riparian work in three pilot programmes begun in early 2001 (see Appendix 2), and begin work on a fourth stream. The two objectives of the pilot programmes are:

- to demonstrate the benefits of riparian management in a way that is meaningful to the people of the Wellington Region, and
- to enable Greater Wellington officers to learn how to carry out riparian management effectively.

With the funds allocated for 2002-03 (\$70,000), Greater Wellington will be able to assist with the retirement and planting of at least four kilometres of streams in the pilot programmes.

Over the 2002-2003 year, Greater Wellington will:

1. Continue to consult with the community about achieving riparian management of the Region's streams.
2. Assess and report on achievements of the pilot programmes.
3. Hold field days at each of the pilot sites where we will:
 - explain riparian management issues such as weed control, appropriate riparian plants and planting plans, and how to get the maximum benefit to the stream from riparian management,
 - describe any changes in aquatic habitat and water quality of the particular stream revealed by the monitoring programme, and
 - disseminate regionally relevant information about the benefits of riparian management
4. Prepare and disseminate information and advice for landowners and other relevant parties.
5. Identify the high priority catchments where Greater Wellington will give financial support to riparian work.

9.2 Making a long term commitment

Appropriate management of riparian zones throughout the Region is a very long-term project where gains in water quality and stream habitat enhancement will only become evident over long time periods. Uptake of a riparian management ethic, especially unassisted uptake, is likely to be gradual.

Investing in riparian management is comparable to Greater Wellington's long-term investment in soil conservation. Most of Greater Wellington's soil conservation work is in the Wairarapa where there is about 95,000 hectares of unstable pasture land. Since 1953, Greater Wellington has helped prepare farm plans for 90% of the 530 farm properties in this area.

To achieve the projected levels of up-take for riparian management (four kilometres per year), we will need to promote riparian management widely in the rural community and the availability of the full range of Greater Wellington services in relation to it (from information to financial assistance). At present, our pilot programmes have been managed by staff in addition to their normal workloads. While this is sufficient to manage these small areas, the full implementation of a programme of advice, information generation and dissemination, and work in the field with landowners, requires the commitment of a full time person. This position should also be responsible for promoting the full range of biodiversity services available from Greater Wellington (e.g., the land protection service). The cost of such a position, and the production of information on riparian management, will cost approximately \$100,000 annually. This would bring the total annual cost of the private land programme to \$200,000, an increase of \$100,000 on the current allocation.

9.3 Who will do the work?

The pilot programmes are being supported by Land Management staff in the Wairarapa Division and Resource Policy staff in the Environment Division.

Staff in the Resource Policy and Environment Co-ordination Departments of the Environment Division are already building experience with Care Groups working on public land. This approach, especially if incorporated with joint projects with the territorial authorities, is the most appropriate to use to support and encourage riparian management for urban streams.

Staff in the Operations Department in the Wairarapa Division have considerable experience in working with farmers to promote sustainable land management. Riparian management is a logical extension to some of their work and can be managed within the soil conservation grant framework that is also well established.

9.4 Conclusion

Riparian management is not a silver bullet to reduce all effects of all land uses on streams. Stormwater reduction and treatment options, particularly in urban areas, can also help mitigate the effects of land use, as will sustainable land management practices.

In rural areas, sustainable land management practices like planting trees to reduce erosion, and applying agricultural effluent to land at a rate that matches the soil's capacity to absorb and treat it, are part of the package to reduce the effects of land use on both surface water and groundwater.

Greater Wellington is not working alone for the enhancement of the Region's rivers and streams. The farming communities, Iwi organisations, the territorial

authorities, the schools and the many environmental groups throughout the Region are all contributing to improved treatment of our streams and the creatures that live in them. We have decided that to contribute effectively to rebuilding the Region's biodiversity, Greater Wellington will begin by supporting work on stretches of streams where streamside conditions are threatening otherwise healthy aquatic ecosystems. Restoration of these streams with appropriate species will not only achieve significant benefit to the stream's aquatic habitat, it will bolster biodiversity in the stream catchment and surrounding area.

It will not be possible to recreate the high shade, low temperature, forest ecosystems that existed in the river valleys before humans settled in the Region in anything but a few special areas. But even small areas of indigenous habitat can help build ecological links that can be added to over time. The key factor is time. Time to implement, and time for nature to begin to reassert itself; but the wait should be worthwhile.

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Appendix 1. The policy framework and related Greater Wellington work

A1.1 Related Greater Wellington programmes for water quality and ecosystems

In addition to the riparian management programme, some of the programmes Greater Wellington is supporting to improve water quality and protect aquatic ecosystems are:

- Take Care, an Environmental Education Initiative supporting groups in restoration and planting projects for streams, rivers, and wetlands;
- Take Charge, working with businesses to prevent pollution;
- Take Action for Water, working with schools to raise awareness and care for rivers and streams;
- Ecological restorations undertaken by Greater Wellington staff and related organisations (e.g., Te Whiti Park, Waikanae River, Kaiwharawhara Stream, Kakaho and Horokiri estuaries) under the RPS implementation programme;
- Trees for Survival;
- Community water quality monitoring projects;
- Stream clean-ups (ad hoc work days, litter removal etc);
- Wetland grants under the Wetland Action Plan and Key Native Ecosystem programme;
- Flood protection river corridor enhancements;
- River clean-ups (major works such as on the Waiwhetu Stream);
- Existing wind and soil erosion plantings along river banks;
- Restoration of high value ecosystems on Greater Wellington land (e.g., Rimutaka Incline riparian planting).

A1.2 Relevant policies from the Regional Policy Statement and Regional Plans

Policy 8 of the Freshwater Chapter of the Regional Policy Statement is:

To promote the retirement and planting of riparian margins for the purposes of maintaining or improving the structural integrity of the beds and banks of water bodies, flood management, maintaining or enhancing water quality, and encouraging the healthy functioning of aquatic and riparian ecosystems.

In determining catchments, subcatchments, or reaches of water bodies to which this policy might apply, to have regard to the following:

- (1) Any existing inferior water quality (including high water temperatures, and nitrate and dissolved phosphate levels);
- (2) Any existing inferior habitat quality (including instream habitat);
- (3) The potential of land uses to affect water quality and their proximity to a watercourse;
- (4) The actual or likely contamination from non-point source contamination;
- (5) The extent of any bank degradation, erosion, or loss of vegetation;
- (6) The actual or potential uses made or to be made of the water body;
- (7) The actual or potential amenity values of the water body (including scenic and recreational values);
- (8) Any relevant Maori spiritual or cultural values; and
- (9) Any significant flora or fauna in the water body.

Methods 30 to 33 of the Freshwater Chapter of the RPS direct the Council to:

- identify where adverse effects on water bodies can be addressed by territorial authorities
- identify waterways that would benefit from managed riparian margins
- encourage landowners to create and manage riparian margins
- manage our own land to control non-point contaminant sources

Policy 4.2.34 of the Regional Freshwater Plan is:

To avoid, remedy, or mitigate adverse effects which are associated with, or are a consequence of, an activity by placing conditions on resource consents, particularly where adverse effects are likely to occur on the following:

- characteristics of spiritual, historical or cultural significance to tangata whenua; or
- natural values; or
- amenity and recreational values; or
- lawful public access.

Methods 8.4.10 to 8.4.14 of the Regional Freshwater Plan direct the Council to:

- involve the community in identifying priority areas that would benefit from improved riparian management
- provide technical support and advice to landowners
- prepare a booklet for landowners about the benefits and costs of riparian management techniques
- investigate other means for providing riparian zones in severely degraded areas
- implement appropriate riparian management practices in areas under the management or ownership of the Council.

Method 6.1.6 of the Regional Soil Plan directs the Council to:

- produce and distribute riparian management guidelines for landowners.

Appendix 2. Pilot programmes

A2.1 Purpose of the pilot programme

The purpose of the pilot programmes is to demonstrate the benefits of appropriate riparian management on aquatic ecosystems and the wider environment and to test and refine Greater Wellington's ability to implement riparian initiatives. Three streams have been selected for the programme. A fourth, the Papawai Stream, was added in 2002.

The streams are in both urban and rural environments to demonstrate different kinds of riparian management. The sections of streams in the three established pilot programmes were classified using a stream type classification technique.²⁵ This is so that the kind of riparian zone management adopted is appropriate to the stream type while achieving our wider purposes of halting the decline of biodiversity and involving communities in environmental care.

A2.2 Pilots as demonstration sites

There is plenty of evidence in the literature showing that appropriate management of riparian margins benefits aquatic habitat and water quality and the wider stream environment. These benefits are not well recognised in the wider community.

Greater Wellington will hold workshops and field days at each of the pilot streams. These will show why particular approaches were adopted for each site, what they have achieved, and how Greater Wellington can support landowner initiatives.

The instream physical and biological condition of these streams will be monitored over at least the first three years to assess the benefits of riparian management. The measured benefits can be compared with projected benefits that were estimated for each of the three pilot streams at the beginning of the programme (see Table 3 in Appendix 3).

The monitoring results can also be used to validate and refine Greater Wellington's approach to where it promotes riparian management, if this is necessary, and reconsider the kind of management options recommended. Information from the Freshwater Ecosystems studies that will be completed in 2003 will also be used to develop more specific riparian management options for particular sites to enhance aquatic habitat.

²⁵ Quinn, J. (1999). *Towards a Riparian Zone Classification for the Piako and Waihou River Catchments*. EW Technical Report TR99/16, Environment Waikato.

A2.3 The Karori Stream

The Karori Stream (see Figure 1 below), is a Wellington urban stream whose upper catchment is affected by residential stormwater runoff and whose stream banks are infested with weeds. Revegetating the stream banks is a staged project down the length of the stream running through the Makara Peak Mountain Bike Park. The stream banks require extensive weed control before being planted with native plants by volunteers from the Bike Park Supporters.



Figure 1 Karori Stream, an urban stream in Wellington

Riparian management work done up to 30 June 2002:

- Prepared a weed plan after a professional weed assessment of the entire streamside area within the Makara Peak Mountain Bike Park (about one kilometre of stream).
- Prepared a restoration plan for the entire streamside area within the Makara Peak Mountain Bike Park.
- Planted 2,400 native plants and controlled weeds along about 300 metres of one side of the stream.
- Erected a billboard explaining the project at the car park for the Makara Peak Mountain Bike Park.

Total cost 2000-2002: \$12,445 paid by Greater Wellington. All labour was volunteered by Makara Peak Mountain Bike Park supporters with some help from Conservation Corps and volunteers from Greater Wellington staff.

A2.4 The Kakariki Stream

The Kakariki Stream (see Figure 2 below), is a Kapiti Coast sand country tributary of the Ngarara Stream originating in hills behind Waikanae whose mid catchment is affected by residential stormwater runoff, lack of shade and stock damage to banks and water. This stream is being retired from stock access with permanent fencing and planted with predominantly native vegetation by the landowners and schoolchildren from Paraparaumu College.



Figure 2 Kakariki Stream, tributary of the Ngarara Stream, Waikanae

Riparian management work done up to 30 June 2002:

- fenced a riparian width between 3 to 7 metres wide along 200 metres of one side of the stream.
- planted about 500 metres of stream length (some stream was already fenced but not planted) with about 2,800 native and 50 exotic plants.
- controlled weeds after planting, both with herbicides and manually.
- Erected a billboard explaining the project on the Nga Manu Nature Reserve driveway.

Total cost 2000-2002: \$20,296, of which \$12,906 (about 64%) was contributed by Greater Wellington (or \$11,021 of \$18,411, 54%, if billboard costs are excluded).

A2.5 The Enaki Stream

The Enaki Stream (see Figure 3 below) is a tributary of the Mangaterere River. This is a central Wairarapa plains stream originating in the Tararua Range whose mid to lower catchment is affected by lack of shade, stock damage to banks, and rural runoff. Sections of this stream are being retired from stock access with permanent fencing and planted with a mixture of exotic and native vegetation.



Figure 3 Enaki Stream, tributary of the Mangaterere River, Carterton

Riparian management work done up to 30 June 2002:

Retired 1,200 metres of stream from grazing over three properties, including a 1.6 ha native bush remnant, and planted:

- 600 shrub willow to combat active streambank erosion.
- 270 willow and poplar poles for flood protection, shade, and as pioneer plants to help native species planting in 2-3 years' time.
- 1,200 native species under previously planted willows and poplars.
- On a fourth property, planted protected poplar and willow poles on 170 metres of stream to treat erosion threatening an adjacent road
- Retired a 0.25 ha wetland seep and established 10 species of deciduous hardwood timber trees as a trial.

Total cost 2000-2002: \$14,382 of which \$8,011 (56%) was contributed by Greater Wellington.

A2.6 The Papawai Stream

The Papawai Stream (see Figure 4 below) is a tributary of the Ruamahanga River. This is a central Wairarapa plains stream that starts near the Waiohine River, with flow supplemented by water from springs and water supply races. The stream flows through Greytown, and is affected by lack of shade, rural runoff, a sewage discharge and large water abstractions.

In September 2001, the Maori Standing Committee of the South Wairarapa District Council discussed the draft Riparian Strategy and asked us to consider including the Papawai Stream as a pilot project. In 2003, Greater Wellington staff began discussions with landowners in the catchment about management options for the riparian margins.



Figure 4 Papawai Stream, tributary of the Ruamahanga River, Greytown

Riparian management work done up to 30 June 2002:

- No work to date.

Appendix 3. Assessing the benefits and costs of riparian management

A3.1 Quantifying the benefits

Table 3 shows benefit estimates of applying two kinds of riparian management options to the stream sections in three of the pilot programmes (see Appendix 2). These riparian management options are First Steps (taken here as stock exclusion only) and Best Practice, where riparian management is designed for desired outcomes for the particular section of the stream in the pilot.

The scores range from a low score of Bad, up to Poor, Av (average), Good, and finally Ex (excellent). The scores in this Table will be compared to an assessment of the stream after three years of being in the pilot programme.

Table 3 Relative achievement of benefits brought about by riparian management options

Benefit	Karori Stream			Kakariki Stream			Enaki Stream		
	Now	FS	BP	Now	FS	BP	Now	FS	BP
Biodiversity									
Aquatic habitat	Poor	—	Poor	Poor	Av	Good	Good	Good	Ex
Bird habitat	Poor	—	Ex	Poor	Poor	Ex	Poor	Poor	Good
Plant habitat	Poor	—	Ex	Poor	Av	Ex	Poor	Poor	Good
Recreation									
Eeling	Poor	—	Av	Av	Av	Good	Poor	Poor	Av
Trout	Poor	—	Poor	Poor	Poor	Poor	Av	Av	Good
Whitebait	NA	—	NA	Poor	Av	Ex	NA	NA	NA
Water contact	Poor	—	Poor	Poor	Av	Good	Av	Av	Av
Aesthetic	Poor	—	Ex	Poor	Av	Ex	Poor	Av	Ex
Ecosystem									
Pollution control	Poor	—	Poor	Poor	Good	Good	Av	Av	Good
Stable banks	Good	—	Good	Poor	Av	Good	Poor	Av	Good
Landowner									
Shelter and shade	Poor	—	Good	Bad	Bad	Good	Poor	Av	Good
Stock water	NA	—	NA	Poor	Av	Av	Av	Good	Good
Flood control	—	—	—	—	—	—	—	—	—
Bequest	—	—	—	—	—	—	—	—	—
Cultural	—	—	—	—	—	—	—	—	—

A score moves one step up the scale (for example from good to excellent) if the change is thought to be noticeable. “Bad” is the worst possible state, and “excellent” is the best possible state, given the surrounding land use. That is, if surrounding land is used for productive farming, an excellent rating means that the score is the best possible within this environment.

The bequest value and cultural benefits have not been scored because they are too complicated and site specific for this study.

This assessment shows that scores rarely move more than one step up the scale of stream improvements if the First Steps option is implemented, whereas they move up to four steps up the scale if the Best Practice option is implemented.

A3.2 Quantifying the costs

Table 4 shows cost estimates of applying four kinds of riparian management to a stream. These options are:

- Stream fenced on both sides, without plants or weed control
- Stream permanently retired with 10 metres each side planted in poplars and shrub willows (2 hectares per stream km)
- Stream permanently retired with 5 metres each side planted in native species (1 hectare per stream km)
- Stream permanently retired with 10 metres each side planted in native species (2 hectares per stream km)

Table 4 Estimation of component costs of applying four riparian management options to one kilometre of stream

	Stream fenced and not planted (\$)	Stream retired (10 m), with exotic plants (\$)	Stream retired (5 m), with native plants (\$)	Stream retired (10 m), with native plants (\$)
Material costs				
Permanent fence	14,120	14,120	14,120	14,120
Electric fence	(3,900)			
Willows		4,800		
Poplars		516		
Native plants (1.5 metre centres)			8,888	17,776
Weed control		273	972	1,944
Labour costs				
Permanent fence	9,580	9,580	9,580	9,580
Electric fence	(3,000)			
Planting			8,355	16,709
Weed control		1,170	4,166	8,333
Lost opportunity costs				
Total estimated cost	23,700 (6,900)	34,125	46,081	68,462

The material and labour costs for fencing are taken from WRC Soil Conservation cost estimates for sites of moderate difficulty, with both sides of the stream fenced (\$3.45 per metre dairy fence, \$11.85 per metre permanent fence).

For riparian margins planted entirely in exotic species, the plant numbers are 1,920 shrub willows and 30 poplars per hectare (equivalent to a spacing of about 2.25 x 2.25 metres).

The native plant costings are based on 4,444 plants per hectare (equivalent to a spacing of about 1.5 x 1.5 metres). Plants are costed at \$2.00 per plant, and planting labour is costed at \$1.88 per plant. The plant costs are low based on our expectation that we can economise on plant costs through long term plant purchasing arrangements. Costs assume two years weed control.

Lost opportunity costs arise because some kinds of riparian management remove some kinds of land from productive use or recreational use. These costs have not been calculated because it is too complicated for this study. For example, lost production doesn't apply to land in urban areas, and in rural areas the lost opportunity costs depend on the actual amount of production lost, and the value of that production. The 219 dairy farms in the Wairarapa part of the Region, for example, produce 470 kg milkfat per effective hectare, on average,²⁶ but not all lost dairy land beside streams would have this production value, and not all land beside streams is used for dairy farming.

Table 5 Overall costs (\$ per stream metre) of managing the stream margins of urban and rural streams

Per metre cost	Stream fenced and not planted	Stream retired (10 m), with exotic plants	Stream retired (5 m), with native plants	Stream retired (10 m), with native plants
Permanent fence (dairy fence)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)	\$23.70 (\$6.90, dairy)
Plants, weed control and labour – rural	—	\$10.43	\$22.38	\$44.76
Fencing as a proportion of overall cost	100%	69%	51%	35%
Plants and weed control – urban	—	—	\$17.89	\$35.78

The costs for urban stream management assume that labour is volunteered by Care Group members. Riparian management of urban streams does not incur costs for fencing, but the weed control costs can be higher. For example, weed control of about one hectare of very weedy land beside the Karori Stream in Wellington was estimated at \$4,000/ha. Plant costs are higher because they require closer planting (6,944 stems).

²⁶ Livestock Improvement Corporation Ltd (2000). *Dairy Statistics 1999-2000*.