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Your Regional Council

Land and Riparian

Management Strategy

July 1999

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Cover photograph

The upper Tamaki River, showing riparian margins fenced and planted as part of the South East Ruahines River Scheme.
Photo by John Phillips.

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FOREWORD

For land users and especially farmers, sustainable management of the land is part of daily life and business. **horizons.mw** is concerned in managing the natural and physical resources, the land and also the air and water, of the Manawatu-Wanganui Region. We all share a common interest in achieving sustainable land management.

The Land and Riparian Management Strategy is a voluntary, not a regulatory approach to resource management. Shifting towards more non-regulatory methods is a strategic direction for **horizons.mw**. The benefits of a voluntary over a regulatory approach include:

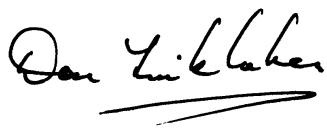
- no interference with the operation of a free market;
- marketing opportunities for primary produce may be created; and
- all actions are voluntary and positively focused.

In the Land and Riparian Management Strategy, **horizons.mw** is challenging the land users of the Region. The challenge is to make good business decisions that are also wise environmental decisions, creating added value and a better environment at the same time.

We are sure this is possible. Our future generations require nothing less. Our goal is that the decisions every land user makes every day are made in the knowledge of their consequences. These decisions should be made on the basis of the best information available.

horizons.mw is in the information business. In the area of land management, **horizons.mw** sees itself primarily as a source of information and expertise. This Strategy is about getting the information that people need, to them, to assist them make good land management decisions.

In 1999 **horizons.mw** adopted a new name. Our approach to resource management is: "Out there. Working." **horizons.mw**, together with other agencies, will be working with the land users of the Region to achieve results that benefit both themselves and their community.



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CHAIRMAN

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CHAPTER ONE - INTRODUCTION

1. Reasons for preparing a strategy

Land and water are vital resources for the Region. **horizons.mw**, through the Regional Policy Statement and Regional Plans, has identified resource management issues and put in place a framework of policies and rules, for the management of land and water. A vital part of this framework is the recognition that many activities affecting the environment cannot effectively be controlled by rules. Part of the Council's strategic direction is an emphasis on greater use of non-regulatory methods to achieve environmental outcomes.

The Regional Policy Statement commits **horizons.mw** to prepare a "Riparian Management Strategy". The project has been expanded to also address environmental problems caused by general land use, and management practices. There is much in common between land and riparian issues, and it is simpler to address both together. The Land and Riparian Management Strategy (the Strategy) considers both riparian management and land issues, with the important proviso that it includes only non-regulatory methods. Any methods involving rules are contained within the framework of regional plans.

The Strategy addresses large issues across the whole Region and has been prepared over only twelve months. This document is not a final statement, only the start of a process, involving many different actions and investigations. We do not yet have all the answers. In some areas the Strategy seeks to identify the right questions, and outlines the actions proposed to provide the answers.

The Strategy ultimately depends on the support of land users. Therefore land users are entitled to ask "what's in it for me?" We believe that most land users will benefit from information or advice that **horizons.mw** can provide through the actions in the Strategy. Also, it is worth repeating that the Strategy is not a statutory document and no one is compelled to any actions under it.

2. Relationship to the Proposed Land and Water Regional Plan

The Proposed Land and Water Regional Plan (LWP) was notified on 31 May 1999. The LWP identifies, as a non-regulatory method, the development of a Land and Riparian Management Strategy. The LWP identifies a number of instances where regulation is not considered to be the most effective or efficient means to address the issues in the Plan. The LWP also identified the need for a document that will consider and draw together a wide range of non-regulatory methods to address various issues.

The Strategy is therefore complementary to the LWP in that it specifies particular non-regulatory actions that will be undertaken to address some issues specified in the Plan.

The Issues in the Strategy are the same as some Issues in the LWP. The Objectives of the LWP are listed in Appendix A for easy reference. Some actions within the Strategy may also help address issues identified in the Manawatu Catchment Water Quality Regional Plan, and the Proposed Regional Plan for the Beds of Rivers and Lake and Associated Activities. The Strategy integrates non-regulatory approaches within **horizons.mw**.

3. Consultation

In March 1998 the Council published a "Discussion Paper for Regional Land Management" and sought public submissions. The paper identified a preferred option of limited regulation as part of the Proposed Land and Water Regional Plan, plus the preparation of (separate) Land and Riparian Management Strategies. Twenty-six submissions were received and they overwhelmingly (by 24 to 2) supported the Council's preferred option. Subsequently the separate strategies proposed were combined into the Land and Riparian Management Strategy.

horizons.mw wishes to thank four agencies that are stakeholders in the Strategy and have supported its preparation. They are Department of Conservation, Federated Farmers, the Fish & Game Council, and Ministry of Agriculture and Forestry. Other agencies, notably the territorial local authorities and the Vegetable Growers Federation, have also given valuable support.

A draft has been made available to individuals and organisations on **horizons.mw's** mailing list. Comments received have been incorporated.

4. Resource Description

The Region covers 2.2 million hectares, contains part of the central volcanic plateau, and is divided by the Ruahine and Tararua ranges. Three major river catchments, the Manawatu, Whanganui and Rangitikei together cover 75% of the land area.

4.1 Land and Soil

The central volcanic plateau has a base of greywacke with fertile soils of mainly volcanic origin, including pumice, lava flows and lahar deposits.

The Tararua, Ruahine, and Kaimanawa Ranges are all composed of greywacke. Other significant ranges are the Hauhungaroa Range; and the Puketoi Range, which separates the Manawatu Catchment from drier country on the east coast. Extensive hill country lies west of the Ruahine and Kaimanawa ranges, particularly from Wanganui to north of Taumarunui. From the northern margin of the Wanganui coastal lowland, the inland hill country consists of narrow ridges with steep, sloping valley sides and deeply entrenched streams that have little or no floodplains. This dissected upland is a result of streams cutting down into tilted and uplifted areas of soft sedimentary rock. Slip scars on these hillsides show evidence of many large-scale mass movements. Between the Whanganui and Rangitikei Rivers lies a distinctive large area of "papa" rock referred to as the Mangaweka mudstone. Sandstones and mudstones are prominent in the middle-reaches of the Whanganui River and in the Matemateaonga Range to the west. Between Wanganui and Pohangina lies an area of unconsolidated sandstone that is especially vulnerable to erosion from flowing water (for instance gullying). Further sandstone and siltstone are found in the north in the upper reaches of most rivers draining the hill country. Erosion is common throughout the area and second-growth bush or dense gorse covers many steep ridges.

Between the hill country and the coast lie rolling downland, plains and terraces. The Manawatu is an area composed almost entirely of sedimentary rock types, including marine and river terraces of conglomerates and sands, overlain with loess, gravels, sands and silts. The soils in these areas are generally highly productive. The downlands include top pastureland and some cropping. The plains such as the Manawatu have been intensively developed for grazing, cropping and horticulture. The alluvial plains are prone to flooding and a network of flood protection schemes has been developed to protect urban and rural communities. Extensive drainage, particularly in the lower Manawatu, has converted large areas of wetlands into pasture and intensive crop production.

Around Ohakune is an extensive area used for cultivation, particularly of carrots. Carrot washing plants affect the water clarity of streams and rivers, and are point source discharges to water regulated under the Act. In addition to these point discharges, overland runoff from cultivated areas containing sediment also reduces water quality.

Sand dunes and coastal lakes and wetlands occur along the west coast of the Region. This coastline extends more than 100 kilometres in a smooth curve, incorporating windswept, sandy, surf beaches cut by the mouths of several rivers.

To the west of Wanganui, the coast is characterised more by stony beaches and low cliffs. In the past, migration of coastal sand dunes occurred particularly in the coastal areas south of the Rangitikei River. However, migration has considerably diminished due to changes in the management of this land, particularly forest establishment and retirement fencing of many coastal areas from livestock grazing. Sand country in the Region is used for pastureland and cropping although there is a high risk of wind erosion if not managed properly. Exotic forestry is suited to this type of land and is becoming more widespread.

To the east of the Ruahine and Tararua Ranges there are fertile river valleys, then a rugged hilly topography. The landscape is both young and rapidly changing in geological terms. Many rocks have been crushed or folded, making them relatively more erodible by water, and the hills are often less steep than west of the ranges. Between Eketahuna and Woodville are two broad terraced river valleys and a low central ridge that separates the parallel flowing Mangahao and Mangatainoka Rivers. Within this area the sediments are formed from a variety of rock types but in general they are limestones and muddy sandstones in the north and mudstones in the south. The eastern coastline shows signs of rapid uplift as evidenced by the extent and height of successive wave-cut terraces, and consists of varied landforms from sandy beaches to rugged cliffs.

4.2 Surface waters

The land types influence the characteristics of the rivers, producing significant differences in the river types in the region. Headwater streams are often turbulent and fast flowing having unstable beds, with large boulders. The size of streambed material and the speed of flow decrease as streams become larger. Mountain rocks are hard, and waters in these streams are typically clear. In contrast, rivers and streams rising in the soft sedimentary hill country contain rocks, silts, sand and mud, the exact composition depending on the parent material. Water quality in these rivers is directly affected by land management practices, such as the extent of protection against erosion and the riparian vegetation. Once large rivers reach alluvial plains land management practices do not have as noticeable an effect on water quality as in smaller streams. The plains are also where the larger centres of population generally are. The major issues then become flood management, erosion control and bank stability, protection of amenity values, and recreational use.

The main effects of land use on surface water are sedimentation, from erodible hill country without sufficient trees; and input of contaminants and nutrients from intensively farmed areas. The effects of rock type on surface water quality follow from the susceptibility to erosion of the different rock types. Broadly speaking, the effects are greatest for banded and other mudstone, unconsolidated sandstone and argillite; less for siltstone and hard sandstone, and least effects arise from greywacke and limestone.

The surface waters of the Region have been initially classified into 17 types by Phillips[1], mainly according to the nature of the catchment lithology but also considering the nature of the river or stream (i.e. size, and whether highland or lowland). A description of this classification is given in Appendix B, with some initial observations of significant differences. A final classification and map will require substantial further investigation.

4.3 Groundwater

The main groundwater resources of the region comprise the large system of sedimentary aquifers known as the South Wanganui Sedimentary Basin, extending from Wanganui south to the Kapiti district; plus mainly shallow fluvial aquifers adjacent to river valleys. An estimated 9000 bores tap into the South Wanganui Basin, and about 3000 bores tap fluvial groundwater in the Tararua District.

The quality and quantity of groundwater available varies at different localities. Wanganui has mainly deep artesian water from sand and limestone aquifers, providing plentiful water with high quality.

The Wangehu and Turakina river valleys have deep artesian water.

The Rangitikei valley has moderate to poor quality and limited amounts of deep groundwater. Shallow groundwater is readily available only close to major rivers.

The Manawatu has generally poor quality shallow groundwater and high yielding, good quality deep groundwater. Deep groundwater quality is the best in the Palmerston North area, quality is less towards the Oroua catchment.

The Horowhenua has moderate amounts of shallow groundwater, with some contamination by high levels of nitrate. There is no reliable, deep groundwater alternative.

Tararua has variable quality shallow groundwater, with large amounts being available only adjacent to rivers.

[1] J Phillips "Effects of Land Use and Management on Surface Freshwaters in the Manawatu-Wanganui Region" (MWRC) 1998.

CHAPTER TWO – ISSUES

5. Issue 1 - Degraded groundwater quality in Horowhenua, and potentially in other areas

Nitrate-nitrogen degrades groundwater quality in the Horowhenua area, and potentially all of the sand country on the west coast of the Region. In Horowhenua excessive nitrate levels have been measured in many groundwater bores[2]. Soil types are permeable, making unconfined groundwater vulnerable to further contamination by discharges to land. The source is not known for sure, but is suspected to be chiefly high rates of fertiliser use associated with intensive agriculture and horticulture.

Groundwater use, and its potential for further use, is higher in Horowhenua than elsewhere in the Region. Further contamination would compromise the resource's ability to meet the reasonably foreseeable needs of future generations.

Elevated nitrate levels and bacteria counts in groundwater have been detected near Pahiatua, and elevated nitrate levels in several other areas east of the ranges. The cause is not known but possible sources are dairy factory waste irrigation, dairy farm wastes, fertiliser use, and septic tanks.

5.1 Desired outcome

No increase in groundwater contamination, as indicated by the number of bores showing elevated levels of nitrate

6. Issue 2 - Declining groundwater levels

Cumulative decline of groundwater levels occurs when more groundwater is abstracted from an aquifer than is naturally replenished. Groundwater levels either reach a new equilibrium (at a lower groundwater level) or continue to decline. A cumulative decline occurred in the early 1980s in the 'medium confined aquifer' at Whakarongo, near Palmerston North. Groundwater levels there have now stabilised at a new level, about three metres below the previous level.

A localised but more conspicuous effect of groundwater abstraction is the drawdown effect, where water levels decline in bores near the abstraction. This is called 'interference' and can cause decreased yield in the nearby bores.

[2] G Bekesi March 1999 "Nitrate-Nitrogen in Horowhenua Groundwater Monitoring Results 1999". Manawatu-Wanganui Regional Council.

Declining groundwater levels may cause changes in groundwater quality. Causes of undesired groundwater quality change are seawater intrusion and mixing of different quality groundwater. Seawater intrusion is not a significant problem in the Region because, except in Wanganui, there are few groundwater abstractions in coastal areas.

Adverse effects caused by the mixing of different groundwater is strongly suspected in some areas of the Region. Even small changes in groundwater levels can cause mixing of groundwater or the modification of natural groundwater flow paths. Changes in groundwater levels can be caused by continuously discharging artesian bores.

6.1 Desired outcome

Groundwater levels are maintained

7. Issue 3: Accelerated soil erosion on vulnerable land

Erosion occurs naturally as a long-term geological process that shapes the land. Accelerated erosion occurs at a rate greater than the natural rate. A period of accelerated erosion inevitably follows the clearance of the original forest vegetation. Accelerated erosion is made worse by land management practices such as cultivation near watercourses, cultivation of steep slopes, and grazing of steep and unstable land.

Accelerated erosion is widespread in the Manawatu-Wanganui Region. Much hill country comprises soft sediments (particularly mudstone, siltstone, and unconsolidated sandstone) that are vulnerable to erosion. Areas most affected are in the Pohangina valley, the East Coast hill country, and in a band from Hunterville/Mangaweka to the Whanganui river and further north. The central volcanic plateau has pumice soils that erode easily if exposed to water. Some parts of the plains are subject to wind erosion.

The Region contains over 900,000 hectares of hill country assessed as susceptible to soil slip erosion. Of this nearly 400,000 hectares is susceptible to severe erosion[3]. These areas are typically steep slopes with soft sedimentary rock types.

Cultivated areas on the plains, in exposed situations, are also prone to wind erosion. Instances in the Region include the Manawatu, Ohakune, and Dannevirke. Recent research[4] into a worse-case scenario on exposed and continually cultivated sites in the Manawatu indicates wind erosion of 10 - 14 tonnes per annum (or about 1 mm per annum).

[3] Data from the New Zealand Land Resource Inventory.
[4] L R Basher, S J Burgham, T G Shepherd, T H Webb "Assessment of wind erosion rates on the Canterbury and Manawatu plains, New Zealand, using caesium-137" in prep, Landcare Research 1999.

The New Zealand Land Resource Inventory records a number of land characteristics (eg. soil type, land use, slope, surface geology, potential erosion, actual erosion, vegetation, locality and management measures recommended). Map 1 (on page 10) shows the area of the Region mapped in the New Zealand Land Resource Inventory suffering slight erosion (light shade), and moderate to extreme erosion (dark shade). This data is from around 1980. However, experience suggests that it will not have changed substantially. The map shows that erosion is widespread in the Region.

Erosion on mountain land has been excluded from Map 1. Mountain land is susceptible to erosion, but is generally not developed.

Erosion has many different forms and most occur in the Region. The most common types are soil slip, earthflow, sheet, and gully erosion. All types represent loss of the soil resource. Gully and streambank erosion always affect water. Of erosion on hillslopes, approximately half of soil lost ends up in water.

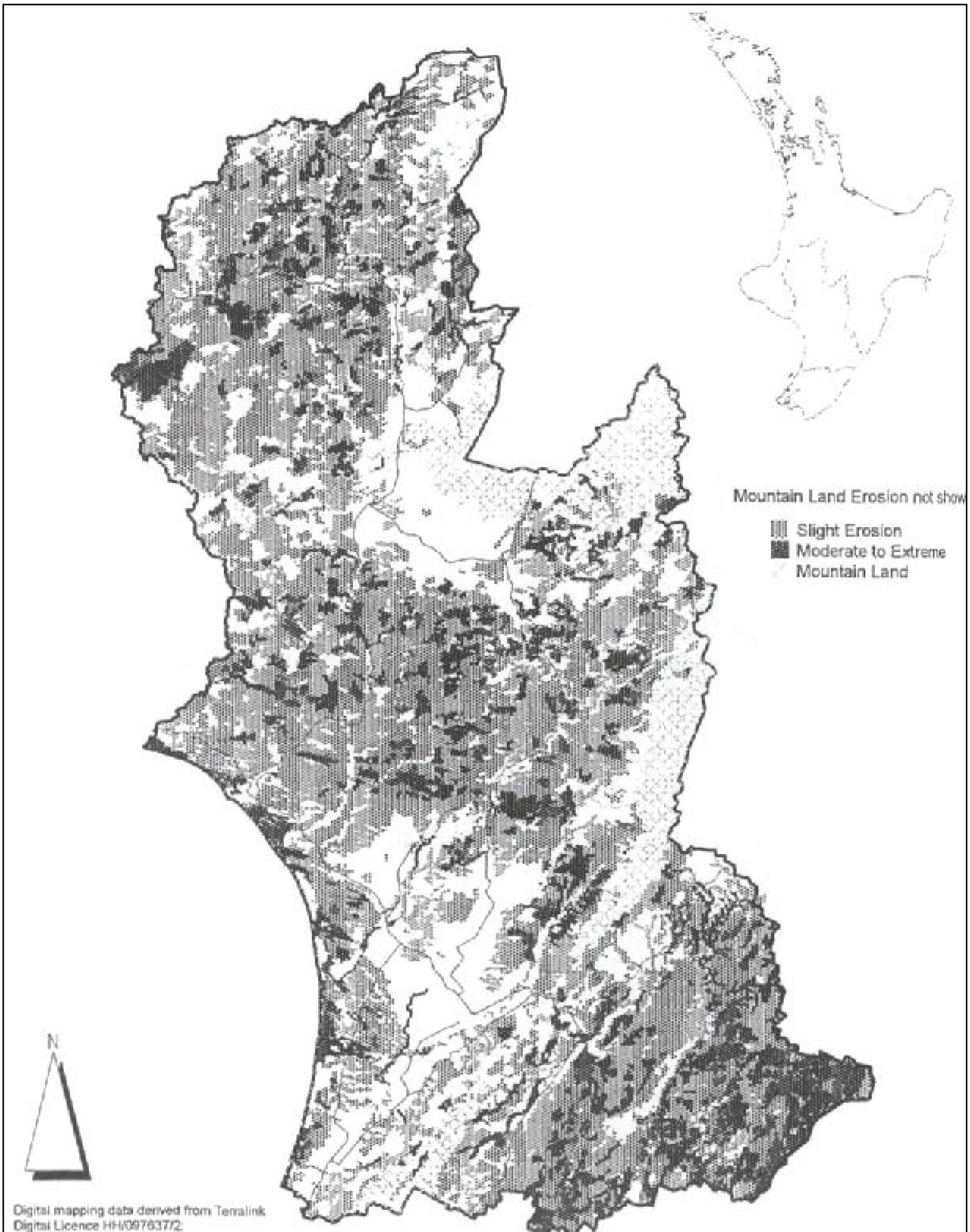
Research in neighbouring regions with similar hill country, as well as in Manawatu-Wanganui, shows that erosion reduces the productivity of soil and the future versatility of land for a range of uses.

Research on Wairarapa hill country[5] showed recently eroded soil slip sites yield only 20% as much grass as uneroded sites, and long term productivity (after 40+ years) is still only around 77%. The failure of even the oldest scars to return to their former productivity led the authors to state that *"the results of this study suggested that pasture production on hill soils formed under pastoral agriculture was unlikely to return the production levels supported by soils formed under the original forest vegetation"*. The extent of erosion scars was widespread - *"there was no uneroded ground remaining on the side slopes"*.

Land in Taranaki,[6] took at least 40 years for eroded slip scars to achieve maximum re-vegetation. Yields from them were 35% lower than uneroded sites of similar slope and geology. After 80 years, two out of three slip erosion sites showed full recovery (equivalent to uneroded pasture). However, the authors' opinion was that cumulative erosion would increase summer droughts over the entire hillslope, because overall soil water-holding capacity was reduced.

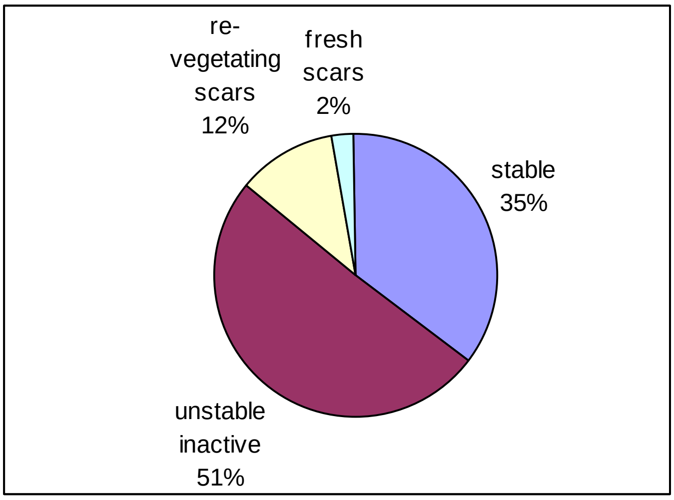
[5] Lambert et al "Effect of soil slip on seasonally dry Wairarapa hill pastures". NZ Journal of Agricultural Research 27: 57-64 1984.
[6] DeRose R C, Trustrum N A, Thomson N A, Roberts A H C "Effect of landslide erosion on Taranaki hill pasture production and composition". NZ Journal of Agricultural Research 1996

Map 1: Erosion present in the Region as recorded in the New Zealand Land Resource Inventory



Overall, 60 percent of the hill country in the Region has protective vegetation that reduces erosion to near-natural levels. This leaves about 500,000 hectares of hill country at risk to accelerated erosion. Most of this is in hill slopes, gullies and stream banks. Hill slopes are 45 percent covered in trees, gullies are half covered, and stream banks are about half covered. By comparison, ridges, downlands and terraces are over 95 percent covered in dense pasture.

Some 65 percent of the hill country is unstable and 14 percent of the hill country has fresh or re-vegetating scars.



The effectiveness of land uses, other than pasture, in preventing erosion are shown in the table[7]:

Technique	**Effect (% reduction in erosion compared with pasture)**
Sparse space-planted trees (>12m apart)	10%
Dense space-planted trees (<12 m apart)	60%
Mature plantation trees, close canopy scrub or indigenous forest	90%

Forest remnants contribute to the proportion of land that is effectively protected against accelerated erosion, as well as being attractive features of the landscape. Unfortunately many are only temporary. Unless stock is excluded from grazing in forest remnants no regeneration will occur, and all the trees will eventually die.

[7] Measures of a Changing Landscape: State of the Environment of the Manawatu-Wanganui Region. Horizons.mw 1999.

7.1 Desired outcomes

All land is used within its productive capability[8]

8. Issue 4 - Wind erosion in sand country

The Region contains a total 79,000 hectares of sand country, mainly used for pastoral farmland or exotic forestry. Light sand dune soils become highly susceptible to wind erosion if the vegetative cover is removed. Animals, especially cattle and rabbits, are the main cause of erosion in light sand soils. Activities that disturb soil, such as those associated with forest harvesting, tracking, and cultivation can also accelerate wind erosion in lighter sand soils. Most land users have learnt to use appropriate land management practices, such as immediate replanting following forest harvesting, fencing to permit differential grazing of dunes and plains, provision of sufficient shelterbelts, and minimal tillage cultivation techniques. However, recent sample measurements indicate 18% of dunes lack protective vegetation at present, so more still needs to be done to control wind erosion.

8.1 Desired outcomes

The sand country has vegetation cover that provides protection against wind erosion.

9. Issue 5: Degraded soil quality

The Region contains much intensive agriculture, and these soils are vulnerable to progressive deterioration if not appropriately managed. Soil loses productive capability in various ways, generally referred to as “loss of soil structure”. Soil must do more than contain essential nutrients. The ideal soil structure allows both air and water to permeate, and the soil must support a varied range of organisms, and biological and chemical processes.

Ways that soil structure can be lost include:

a. Physical compaction from vehicle wheel pressure or stock treading.

b. Deformation from being “stirred up” when saturated. In this state the soil cannot be compressed, but can be deformed by stock or by cultivation so that it dries out into a hard state.

c. Cultivation when the soil is too dry can result in soil structure loss through being effectively smashed into dust.

[8] The term “productive capability” refers to the physical aspect of sustainability, and not to whether a particular use is either wise or economically viable.

d. Loss of organic material in the soil (essential to preserve soil structure) can occur progressively from cropping. This can be mitigated by regular addition of organic material, and by including pasture in the crop rotation.

All cropping land in the Region is potentially affected.

Research[9] shows localised instances in the Region, such as at Kairanga, where soil health has deteriorated substantially in just a few years. The result is higher levels of inputs being required and lower crop yields. Soil health is therefore a local issue in some places. There is currently no overview of the state of the Region’s soil resource because soils vary greatly throughout the Region. Soil resources must be monitored to assess whether changes in management techniques are required to secure their long term productive capacity.

Cultivating sloping land results in soil eroding and moving downhill over time. Research[10] has shown instances near Ohakune where topsoil loss on upper slopes was up to 500 mm, and comparable amounts were deposited on toe slopes. Mean soil loss was calculated at 320 mm. Appropriate methods to reduce the risk of erosion are contour ploughing and minimal cultivation techniques, and early season harvesting.

Soil health is a major factor in determining sustainable land use. The Council needs to know that effective monitoring of soil health is being carried out. This is a substantial task, and is likely to be best achieved by involving all interested parties: the Regional Council and district councils, farmers, researchers, and other agencies in co-operative data sharing and soil health monitoring.

Desired outcome

Nutrient storage capacity and structure of soils are maintained

10. Issue 6: Degraded surface water quality and aquatic habitats

Inappropriate land management causes adverse effects on water in four main ways:

- sediment (suspended solids both inorganic and organic);
- disease-causing micro-organisms (such as viruses & bacteria);

[9] T G Shepherd “Sustainable soil-crop management and its implications for grain growers”. International Conference on Sustainable Land Management, Napier, 1991.
[10] L R Basher, C W Ross, J Dando “Surface Erosion in the Ohakune Area: a Progress Report” Landcare Research 1998.

- nutrients (principally phosphate & nitrate); and
- persistent and/or bio-accumulating toxic contaminants (e.g. some pesticides, heavy metals, hydrocarbons, and complex organic compounds).

Wetlands are a special case discussed separately.

Rivers, lakes and wetlands all have amenity and intrinsic values. Knowing what values are at risk is important in making land management decisions.

Sediment

Sediment is naturally present in all rivers but accelerated erosion can dramatically increase the amount. The volumes of sediment carried by rivers in the Region are very large. For example, the Manawatu River is estimated to carry 2.6 million tonnes of suspended sediment annually[11], and the Whanganui 3.2 million tonnes[12]. Large flood events will produce substantially greater amounts.

Excess sediment has many adverse effects on aquatic habitat. It affects invertebrates and fish, can inundate downstream property and reduce the flood-carrying capacity of rivers. Reduced clarity directly affects amenity values.

Micro-organisms

Micro-organisms from animal faecal matter enter water via overland runoff and by direct stock access to streams. This creates a risk of disease to people (and animals) in contact with water. There are also strong aesthetic and cultural aspects to the issue, as faecal contamination (whether dangerous or not) is offensive to most people.

Factors which lead to high levels of micro-organisms are not well understood and the overall impact is difficult to evaluate. There is a health risk to people and animals.

Nutrients such as phosphate and nitrate

Phosphate and nitrate are the major nutrients affecting water quality in the Region. Excessive periphyton growth is a common problem, but the extent that this is caused by nutrient input from diffuse sources is unknown.

[11] "Gravel Transport and Extraction in the Lower Manawatu River" NIWA Consultancy Report MWR 005 Sept 1993.
[12] "Water Resources of the Wanganui River" Tonkin &Taylor Dec 1978.

The nutrient status of rivers in the Region is very variable, and while reductions of nutrients are desirable, existing knowledge[13] indicates it may be very difficult to reduce concentrations at low flows (particularly from non-point sources) sufficiently to control the main problem in rivers, the growth of filamentous algae.

The eutrophic state of lakes in the Region supports the need for action on nutrients, from both diffuse and point sources, in lake catchments. Lakes tend to act as retention basins for contaminants discharged within the catchment. All lakes in the Region are at risk of eutrophication and some are already affected.

Toxic contaminants

No significant effects resulting from concentrations of toxic contaminants are apparent to date in the Region.

Wetlands

Wetlands are permanent or intermittently wet areas of fresh, brackish, or saline shallow water and land water margins. Plants and animals that characteristically inhabit wetlands have adapted to living in wet conditions. There are many different kinds of wetland and because they are often the borders between dry land and water it can be difficult to define their boundaries precisely.

These highly productive aquatic systems were once a prominent feature in many parts of the Manawatu Wanganui region. The flood plains of the Manawatu River had large areas of swamp with very high natural fertility. Very few of these wetlands remain, and those that do are still altered by the general lowering of the water table produced by drainage for farm development. A remaining example of lowland wetland is the Makerua Swamp Management Reserve near Tokomaru.

Wetlands are important habitats for large varieties of plants and wildlife, in particular birds. For example the fernbird lives in wetland habitat and is one of the region’s threatened species. Wetlands provide feeding, breeding and roosting areas for migratory wading birds and fish spawning. Often the greatest diversity is around the shallow margins. Many remaining wetlands support vegetation and wildlife unique to the specific wetland. Wetland habitats are especially sensitive to disturbance, through drainage undertaken to improve surrounding land for farming.

[13] J Phillips 1998 “Effects of Land Use and Management on Surface Freshwaters in the Manawatu-Wanganui Region” (MWRC).

Artificial wetlands, such as farm ponds, do not support the same diversity of life as natural wetlands. However, they are still important to wildlife, in particular providing birds with "stepping stones" or links to larger wetlands and water bodies.

Wetlands provide important life supporting services such as improvement of water quality and clarity. One of the most important functions is the removal of nitrogen from surface water and the removal of suspended sediment. Wetlands are important for ground water system recharge. Natural wetlands adjoining rivers and streams also mitigate the effects of flooding by reducing the peak flow levels.

On-going development, drainage, and processes such as eutrophication and sedimentation threaten the remaining wetlands and the habitats they provide. Unfenced wetlands are susceptible to grazing and trampling by stock. They are also sensitive to invasion by exotic species of plants, such as pampas, tall fescue and clover, which smother less aggressive native plants.

The variety and complexity of wetlands makes each one unique. Wetlands are dynamic systems. Management of wetlands involves being aware of changes over time, and the effects of land management practices in the surrounding catchment.

Wetlands were once very common in the Region but very few remain, as a result of land clearance and drainage for farming. Those that survive should be preserved, both for their value as aquatic habitats and for their contribution to improving water quality.

10.2 Desired outcomes

Maintain and enhance the amenity and intrinsic values of rivers, lakes and wetlands and their margins

11. Issue 7: Degraded riparian margins

Riparian margins are moist, nutrient rich and open to light, and therefore are places where plants grow vigorously. Riparian margins are important in the generation and maintenance of species and genetic diversity in the landscape. Healthy riparian margins have many beneficial effects, including bank stability, shading the water, providing appropriate nutrient inputs (leaf litter), habitat for birds, and filtering overland runoff. In the Region at present riparian margins are often prone to erosion, and weed infestations. Many have been cleared of their original vegetation; and are grazed by stock that both prevents natural regeneration, and is a source of excreta directly into the water. However, there are some situations of weed infestation that at present seem to be best managed by light grazing.

Removal or degradation of riparian vegetation reduces the range of species and genetic diversity in ecosystems. Degradation results from clearing of riparian vegetation, stock grazing, or introduced weeds and pests. The presence of grazing animals alters the ecological balance and threatens the long-term viability of riparian systems, especially where the understorey is damaged and regeneration of plants is inhibited.

Riparian margins create habitat for fauna both in and out of the water. Adult phases of aquatic insects such as the stonefly live out of the water. Tree canopy provides cover and roots in the water provide physical habitat for in-stream aquatic life.

Riparian margins serve ecological functions as migration corridors for fauna specifically associated with riparian margins and, where surrounding native terrestrial habitat is lacking, for fauna in general. Riparian trees provide a terrestrial carbon source (leaf fall) for in-stream aquatic life.

Shade from the riparian canopy also reduces in-stream temperatures and temperature fluctuations, and limits excessive periphyton growths. These functions are particularly important for streams and small rivers.[14,15]

Riparian vegetation filters contaminants in runoff from surrounding land. Riparian wetlands remove some nitrates from overland runoff by returning nitrogen to the atmosphere. Riparian vegetation provides bank stability, which in turn can also affect the stability of adjacent hill slopes. Bank erosion reduces in-stream habitat quality and water quality.

In this Region riparian margins have been extensively modified by land development. There is little riparian margin in its original state, apart from reserves and forest and national parks.

The biological and physical mechanisms involved in riparian margins are extremely complex and varied, and a single solution is not possible. Appropriate riparian management needs to be determined by consideration of the values most important for a particular river, and site specific factors. In general indigenous vegetation is preferred, because it has evolved naturally to provide the appropriate combination of bank stability, shade and nutrients; and because of its habitat values. In general the presence of grazing animals is not preferred.

11.1 Desired outcomes

Maintain and enhance the amenity and intrinsic values of rivers, lakes and wetlands and their margins

[14] J Phillips 1998 “Effects of Land Use and Management on Surface Freshwaters in the Manawatu-Wanganui Region” (MWRC).
[15] Collier *et al* 1995 “Managing Riparian Zones” NIWA/Department of Conservation

CHAPTER THREE – ACTION PLAN

Section 12 outlines the main directions of the action plan. Section 13 is a table that presents, for each issue: the desired outcome, one or two short-term goals, the localities chiefly affected, and specific actions proposed by **horizons.mw** and other agencies.

The desired 'outcome' describes the environmental result. 'Short-term goals' are for **horizons.mw** to achieve either by a stated date, or no later than the first review of this Land and Riparian Management Strategy. **horizons.mw** commits itself to the actions listed now. Some of these actions are specific, others represent willingness to respond, within our available resources, to group initiatives supporting the Strategy. It is not realistic to specify in advance and in detail all actions that are relevant to the Strategy.

Section 14 expands and explains, where necessary, some of the actions listed in section 13.

12. Action Plan – Main Directions

12.1 Assisting individual land users

horizons.mw already offers information and advice, and incentives to support actions, to individual clients. The advice can range from an answer to a specific question, to an environment plan for a whole property covering sustainable land use and recommended riparian management. In each case it will be site-specific for local conditions.

The main source of advice and information for land users has been soil conservation staff in the Land Management Department. Staff are now broadening their role to include all land management resource issues, rather than concentrating on just soil conservation. The move to the new title "Land Management Officer" will reflect this broadening of scope.

12.2 Advising groups of land users

horizons.mw seeks to extend the successful co-operation with individual clients to include more interactions with groups. In particular, **horizons.mw** will evaluate the benefits of concentrating advisory effort in a localised area, likely to be a single catchment or sub-catchment.

12.3 Co-operating with other agencies

Rivers, lakes and wetlands all have amenity and intrinsic values. Under the Resource Management Act **horizons.mw** must have particular regard to them. Both **horizons.mw** and other agencies have knowledge about amenity and intrinsic values, and collation of this information will be valuable in assessing future priorities.

Many different agencies are interested in sustainable land management and contribute to it in many ways. **horizons.mw** offers to work with all groups and agencies that support the Strategy, and to be a co-ordinator of group action where that is appropriate.

horizons.mw will also seek to co-ordinate the dissemination of research findings, and the adoption of codes of recommended practice whether existing or yet to be prepared.

12.4 Sharing information

Feedback from clients of **horizons.mw** advisory services has been that information provided must be to the point, and simple to read and understand. **horizons.mw** will review its present brochures in the light of customer needs, and publish a new series of simple information brochures called "information sheets". These will be prepared progressively, will be made available free to land users, and will advise on preferred management practice for common land types and significant environmental effects. A list of proposed titles is included at Appendix C.

12.5 Increasing public awareness

horizons.mw will promote public awareness of the strategy, and the availability of services and information from the Council and from other sources in the community. Publicity will include a leaflet to ratepayers, and newspaper articles. Environmental award schemes will be used to reward excellence in environmental management.

13. Specific actions by horizons.mw

Action Table for the Land and Riparian Management Strategy

Issue 1: Degraded groundwater quality in Horowhenua, and potentially in other areas

Desired outcome	Short-term goals	Localities	Actions
No increase in groundwater contamination as indicated by the number of bores showing elevated levels of nitrate	• Land users and the public informed of the problem • Cultivators use fertiliser in amounts the crop can take up	• Horowhenua • West coast sand country & dune lake catchments • Pahiatua area	• Work with individuals, groups, and agencies such as VegFed, to inform land users of groundwater issues. • Promote adherence to the Code of Practice for Fertiliser Use. • Prepare information sheets advising on best management practices for irrigation efficiency and groundwater contamination. • Undertake a research project investigating the quantity, type, and spatial distribution of fertilisers used, and assess their effects on waterways, by 2001. • Undertake a research project identifying and mapping non-point source discharges (with potential to contaminate groundwater), by 2002. • Undertake a desktop study investigating pasture irrigation methods, with a survey of large irrigation techniques in the Region, by 2001. • Continue to monitor changes in groundwater quality through the Regional Monitoring Strategy.

Issue 2: Declining groundwater levels

Desired outcome	Short-term goals	Localities	Actions
Groundwater levels are maintained	• Land users and the public informed of the problem • Groundwater users avoid wasteful use	• Whakarongo	• Work with individuals, groups, and agencies such as VegFed, to inform land users of groundwater issues. • Prepare information sheets advising on best management practices for irrigation efficiency. • Undertake a desktop study investigating pasture irrigation methods, with a survey of large irrigation techniques in the Region, by 2001. • Continue to monitor changes in groundwater levels through the Regional Monitoring Strategy.

Issue 3: Accelerated soil erosion on vulnerable land

Desired outcome	Short-term goals	Localities	Actions
All land is used within its productive capability	• Protect land (using existing methods), and evaluate using a catchment approach. • Identify areas where catchment values are most threatened by accelerated erosion – by Dec 2002.	• Steep hill country (as represented on map page 10)	• Continue to offer information, advice and incentives (through the environmental grant scheme) to individuals and groups on land capability and control of accelerated erosion. • Review the criteria for the environmental grant scheme by 2000. • Prepare an Environmental Plan for a property on request and at no charge (subject to staff availability). • Evaluate the benefits of using a catchment approach to advisory services, by 2001. (See 14.1 for details). • Prepare information sheets advising planting of native trees, vegetation clearance, and best management practices for land types with significant accelerated erosion impacts. • Promote adherence to the LIRA Code of Forestry Practice, and the adoption of Environmental Management Systems by forestry companies. • Continue to monitor changes in rates of erosion through the Regional Monitoring Strategy. • Initiate a research project investigation the significance of different sediment sources on waterways, by 2002. • Undertake a research project investigating those factors (e.g. geology) that affect water quality in waterways, by 2001. • Collate existing knowledge of catchment values – by 2002.

Issue 4: Wind erosion in sand country

Desired outcome	Short-term goals	Localities	Actions
The sand country has vegetation cover that provides protection against accelerated wind erosion	• Protect land (using existing methods). • Identify areas where catchment values are most threatened by wind erosion- by Dec 2002	• West coast sand country	• Continue to offer information, advice and incentives (through the environmental grant scheme) to individuals and groups on control of accelerated wind erosion. • Review the criteria for the environmental grant scheme by 2000. • Prepare information sheets advising best management practices for land types with significant accelerated erosion impacts. • Promote adherence to the LIRA Code of Forestry Practice, and the adoption of Environmental Management Systems by forestry companies. • Continue to monitor changes in rates of erosion through the Regional Monitoring Strategy.

Issue 5: Degraded soil quality

Desired outcome	Short-term goals	Localities	Actions
Nutrient storage capacity and structure of soils are maintained	Establish reliable monitoring of the state of cultivated soils	• All soils, especially where cultivated	• Continue to offer information, advice and incentives (through the environmental grant scheme) to individuals and groups. • Continue to monitor changes in soil quality through the Regional Monitoring Strategy. • Develop, in association with Landcare Research, a self-monitoring process for landowners to monitor their own soil quality, by 2000. • Use GIS tools to present regional baseline data, from the National Soils database, plus monitoring data on land-use differences and changes in topsoil quality, by 2002.

Issue 6: Degraded surface water quality and aquatic habitats; **and**
Issue 7: Degraded riparian margins

Desired outcome	Short-term goals	Localities	Actions

Maintain and enhance the amenity and intrinsic values of rivers, lakes and wetlands and their margins.	• Protect and enhance riparian margins (using existing methods), and evaluate using a catchment approach.
	• Identify areas where improvements to water quality and habitat can be made and will produce the greatest benefits- by Dec2001
		• Whole Region (with local differences)	• Work with landowners through soil conservation advice and regional grant assistance to:
			  • Establish riparian margins with vegetation to protect against erosion
			  • Fence or otherwise separate grazing animals from streams wherever practicable
			  • Establish a riparian buffer zone between surface water and areas of soil disturbance sufficient to filter overland runoff.
			• Evaluate the benefits of using a catchment approach to advisory services, by 2001. (See 14.1 for details).
			• The Department of Conservation will seek that appropriate riparian management is undertaken on public riparian land administered by the Department, but leased out for grazing.
			• Manage the riparian margins within horizons.mw's river schemes. (See 14.2 for details).
			• Work with territorial local authorities to identify priority rivers for esplanade reserves and strips.
			• Promote self-assessment processes for land users and groups to assess their own riparian margins. In particular:
			  • Promote the stream-sense programme to schools.
			  • Promote the SHMAK programme to land users.

Desired outcome	Short-term goals	Localities	Actions
			• Promote the "Waterway Self Assessment Form" prepared by Miranda Polglase and Russell Death, Massey University 1999 (also available from Federated Farmers in Palmerston North. • Prepare information sheets advising on reticulated stock water, irrigation efficiency, the protection of riparian margins, and what riparian vegetation is appropriate on different land. • Investigate the use of the concept of "stream-friendly farms". • Promote adherence to the Code of Practice for Fertiliser Use. • Undertake a research project investigating the quantity, type, and spatial distribution of fertilisers used, and assess their effects on waterways, by 2001. • Undertake a research project identifying and mapping non-point source discharges, by 2002. • Initiate a research project investigation the significance of different sediment sources on waterways, by 2002. • Undertake a research project investigating those factors (i.e. geology) that affect water quality in waterways, by 2001. • Initiate a research project to characterise surface waters based on physical, chemical, biotic processes, by 2000. • Initiate a research project to identify and characterise wetlands in the Region, in conjunction with district councils, Department of Conservation, and Fish and Game, by 2000. • Develop the Regional Ecosystem Framework to provide baseline ecological data for policy development. Related ecological projects include an inventory of natural areas, and a riparian habitat survey. A scoping study will evaluate habitat fragmentation, and the viability of corridor restoration options. • Collate existing information on intrinsic and amenity values of rivers, lakes and wetlands and their margins, by Dec 2001. • Continue to monitor changes in the state of rivers, lakes and wetlands and their margins through the Regional Monitoring Strategy.

14. Explanation of actions

14.1 Catchment approach

The catchment approach will evaluate the benefits of concentrating advisory effort in a localised area. This is likely to be a single catchment or sub-catchment, but could be any community of interest, eg. land users facing common soil and land use issues. Initially trial schemes will occur in the eastern and central service areas, in areas selected by the local managers responsible. The western and northern areas will continue with similar initiatives under the Whanganui Catchment Strategy that are presently under way, principally in the Ohura catchment. The results and experience gained will be reviewed collectively.

Criteria for the selection of catchments are:

a. There is an identifiable community of interest.
b. The main issues present are common to most land users.
c. The extent of the benefits foreseen.
d. Economic significance and viability.

After catchment selection a soil conservator will be assigned to the selected catchment. The first step is to prepare a brief. The brief will assemble known information on relevant information such as:

- LUC classes;
- water quality;
- hydrology/rainfall;
- land use (especially pasture, forestry); and
- local knowledge.

The brief will set a local policy. For example, it might assess the greatest contribution to erosion is from a particular land class, and identify local riparian management issues.

Objectives for the pilot schemes will be set at the local level and approved by the Regional Land Manager. For example, objectives may include:

- a personal approach to all land users within 3 months;
- a majority (or some set percentage) of all land users express support for the Strategy, (defined as being prepared to start a management programme based on advice from **horizons.mw**) within 12 months; and
- particular objectives set for critical land classes. E.g. achieve 50% forestry on some Class VII e land; achieve 25 poplar poles per hectare on some Class VI e land; achieve a stated amount of riparian retirement.

14.2 Land managed by horizons.mw

horizons.mw manages the riparian margin in thirty river and drainage schemes throughout the Region. The schemes are in designated areas, and comprise flood, erosion and drainage control activities. Often only parts of catchments are included. The schemes are primarily funded by rates collected from those ratepayers, both rural and urban, who benefit from the schemes. **horizons.mw** also provides some financial assistance from its general rate.

14.2.1 Case Study: South East Ruahines Scheme

On the eastern side of the Ruahine ranges a myriad of streams flow down to join the Manawatu river. Fourteen of these are included in the South East Ruahines Scheme. The streams rise in steep country, are fast flowing, and carry large amounts of gravel. As the water reaches the foothills it slows down and gravel carried by the streams forms a ‘fan’, spreading out on either side of the stream and often choking the surrounding farmland. The depositions cause the bed to rise above the surrounding land, making it very unstable and prone to flooding and possibly to change its course. Installing weirs and creating riparian gravel reserve areas stabilises the beds and the excess gravel, which are then extensively planted with a range of species. The most used species are various types of shrub willow.

Land in the Scheme is still owned by the farmers. They forego grazing of the land completely, and then agreed riparian areas are fenced with a permanent 8 wire fence. The Scheme then pays for planting, and the trees become the property of the land user.

The scheme already shows dramatic improvements in the stability of river beds and gravel retention. In addition, the extensive plantings have changed the landscape. Regeneration of native species is occurring under the canopy. Unfortunately no figures for water quality are available, although it is obvious that plantings shade the water and therefore keep it cooler than previously, and less sediment and gravel are transported because of the more stable banks.

The scheme shows just what is possible given the necessary inputs of agreement on action, riparian land removed from grazing, permanent fencing, and ongoing professional management.

CHAPTER THREE: IMPLEMENTATION, MONITORING AND REVIEW

15. Implementation

A long time frame is appropriate for land and riparian management. We need to understand complex processes resulting from more than a century of intensive land use, initiate appropriate changes in preferred management practices, and then measure the effect of those changes.

horizons.mw is committed to a long-term approach, and subject to review sees the Strategy lasting for 25 years at least.

The Strategy addresses issues both at a local scale and across the whole region. The Strategy sets a direction and also includes specific actions. The actions listed involve many different sections of **horizons.mw**, as well as other agencies.

The initial stages of implementation of the strategy are the actions that **horizons.mw** has committed itself to undertake. These are stated in Part Two, Action Plan and will generally be addressed within the first three years of the strategy.

The list of actions listed in the Strategy is bound to be incomplete. Some ‘actions’ are only statements of intent, and involve other agencies and groups. **horizons.mw** supports group initiatives to address the issues raised in the Strategy. **horizons.mw** is available to advise groups on request and will facilitate the setting up of groups where appropriate. These actions will be influenced by others and will develop in various ways that cannot be specified now.

horizons.mw has established a policy implementation section, which will be responsible for co-ordinating implementation of the Strategy. The policy implementation section will also have a key role as a contact for organisations participating in the Strategy.

16. Monitoring

Monitoring of the Strategy will occur at two levels. **horizons.mw** now has in place a Regional Monitoring Strategy and in June 1999 released its first State of the Environment report. This Council-wide system to monitor land and water resources now exists and will show changes to the environment over time. The degree of success of the Strategy will be shown in future State of the Environment reports. (The next is scheduled for 2002).

The completion of the actions specified will be individually monitored by **horizons.mw**. This is a responsibility of the policy implementation section.

17. Review

The issues of accelerated erosion, surface water quality and aquatic habitats, and riparian margins are Region-wide in their scope. A key stage of the Strategy occurs around 2001-02 for these issues. **horizons.mw** will then be able to identify areas where action is most needed and will produce the most community benefit. This process will principally be based on:

- the findings of the relevant scientific projects;
- the initial results of the catchment approach to delivering land management advice at the local level; and
- the results of collating catchment amenity and intrinsic values.

The expected shape of the Strategy in future will be more detailed policies for different parts of the Region. The more detailed policies are likely to be at a catchment and sub-catchment level.

horizons.mw will formally review the Strategy no later than June 2003.

The review will:

- consider all the results achieved from the specific actions set out in the Strategy;
- consider the effectiveness of methods adopted, based on measurement of results and feedback;
- assess public awareness and response to the strategy;
- review the overall effectiveness of the strategy;
- present more detailed and localised policies for the long term; and
- set new targets as appropriate.

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APPENDICES

Appendix A: Objectives of the Proposed Land and Water Regional Plan

1. Discharges to Land Chapter

DL Objective 1 Improving groundwater quality

To maintain groundwater quality in the Region, and to improve groundwater quality where it is locally degraded.

DL Objective 2 Improving groundwater quality

To reduce bacteria and nutrient leachate into groundwater.

DL Objective 3 Improving surface water quality

To reduce sediment, bacteria and nutrient runoff to lakes, rivers and streams.

(Cross reference to Chapter Three, DSW Objective 3; and Chapter Six, LM Objective 2)

DL Objective 4 Safeguarding soil quality

To avoid long-term soil quality degradation.

(Cross reference to Chapter Six, LM Objective 3)

2. Discharge to Surface Water Chapter

DSW Objective 1 Surface Water Quality

To maintain or enhance water quality in rivers to standards at least suitable for contact recreation at flows less than half-median.

DSW Objective 2 Maintaining Surface Water Quality

To maintain water quality in those rivers that have existing high water quality.

DSW Objective 3 Eutrophication

To avoid accelerated eutrophication and sedimentation of lakes in the Region.

(Refer also to Chapter Two, DL Objective 3.)

3. Surface Water Takes and Uses Chapter

SW Objective 1 Maintaining surface water quantity

To maintain water levels in lakes and wetlands, and flows in rivers at levels that maintain or enhance their life-supporting capacity.

4. Groundwater Takes, Uses, Damming and Diverting Chapter

GW Objective 1 Groundwater levels

To avoid unsustainable decline in groundwater levels.

5. Land Management Chapter

LM Objective 1 Accelerated soil erosion

To protect vulnerable soils from activities that cause accelerated soil erosion.

LM Objective 2 Surface water quality

To reduce sediment, bacteria and nutrients in runoff to lakes, rivers and streams.

(Cross reference to Chapter Two, DL Objective 3)

LM Objective 3 Soil quality

To avoid long-term soil quality degradation.

(Cross reference to Chapter Two, DL Objective 4)

LM Objective 4 Riparian margins

To protect and enhance riparian margins.

Appendix B: Surface water types in the Manawatu-Wanganui Region.

Surface water type	Examples
Gm – greywacke mountainland	Ruahine, Tararua, Kaimanawa forest parks
Gt - High altitude tussock plains (‘Tongariro tephra’ overlying greywacke + some tertiary lithologies)	Upper Rangitikei tussocklands, Moawhango, Hautapu
Gl - greywacke lowland	Lower Rangitikei, upper/mid Manawatu cobble-bed rivers (Mangahao, Mangatainoka, Oroua, Tamaki, etc), Ohau, Waikawa
Al - alluvial low-gradient	Lower Manawatu (drained wetland & floodplain), Whanganui tidal reaches
Vm – volcanic mountainland	Tongariro National Park
Vh - volcanic hill country	Ongarue, lower Whakapapa, lower Manganuiateao
Vp - volcanic plains	Upper/mid Mangawhero, Makotuku
L - limestone	Makuri, Waihi (trib. of Akitio)
Sc - consolidated sedimentary (hard & consolidated sandstone, massive mudstone)	Mid-Whanganui (Whanganui National Park), mid-Turakina & lower Mangawhero
Ssh – soft sedimentary ‘humid’ (siltstone, banded mudstone, unconsolidated sandstone in high-rainfall zones)	Ohura, Hikumutu, Matarawa, Kai-iwi
Ssd – soft sedimentary ‘dry’ (mudstone in lower rainfall zones)	Tiraumea, Akitio, Owahanga, upper Manawatu (above Dannevirke)
S-g - sedimentary catchments with gravel/cobble river beds	Mid-Rangitikei, Whanganui (Taumarunui to Ohura junction), mid/lower Pohangina
Ls - small lowland stream catchments (in loess or alluvial landforms)	Mangaone, Tutaenui
Ll - lowland lake catchments	All dune lakes with catchments in ‘Ls’ stream ecotypes, eg. Dudding, Wiritoa
SCl – sand country lake catchments	Dune lakes with catchments within sand country, eg. Pukepuke, Kaikokopu, Omanu
SCs- sand country streams	
We - wetlands	Range of types throughout region

Appendix C: Information sheets: proposed titles

Priority One – for 1999-2000 year

- Soil conservation advice – what is it?
- Regional grant assistance – what is it and how do I get it?
- What is stream-sense /SHMAK?
- What is an environmental plan? (or farm plan)
- How to minimise stock impacts on streams
- Weed management in riparian margins
- Riparian management (10 key points)
- Managing dairy effluent series (?)
- Reticulated stock water
- Good practice cultivation – contour ploughing and buffer strips
- Adherence to the Code of Practice for Fertiliser Use
- Irrigation efficiency

Priority Two - for 2000-2001 year

- Setting up a landcare or streamcare group
- Stream-friendly farms – how to achieve one
- Wetland protection – what can I do?
- Farm nurseries for tree production
- Protection of forest remnants
- Native trees – where to plant and why
- What riparian vegetation is appropriate on my land?
- Effluent discharges – calculation of land areas necessary for discharges to land
- Groundwater contamination
- Use of LIRA and adoption of environmental management systems
- Vegetation clearance
- Pest control operations in fenced areas – what to do

Priority Three - for 2001-2002 year

- What is river eco-typing?
- Self-monitoring of soil quality by land users
- What is the Regional Ecological Framework?
- Land uses surrounding coastal dune lakes
- Self-assessment for riparian margins
- Protection of riparian margins
- Composting bedding matter and dry effluent

GLOSSARY

This glossary is included to explain words and technical terms in the Strategy. Definitions in *italics* are those as per Section 2(1) of the Resource Management Act 1991 or otherwise stated.

accelerated erosion	soil erosion occurring at a rate exceeding the rate of natural weathering; and commonly due to human activity.
adsorb	refers to solid particles holding other molecules to their surface.
amenity values	*means those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.*
ecosystem	a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
erosion	the wearing away of the earth's surface by physical processes, e.g. the action of water, wind, etc.
habitat	means the preferred place for an animal or plant to live.
indigenous	native to New Zealand.
intrinsic values	*in relation to ecosystems, means those aspects of ecosystems and their constituent parts which have value in their own right including-* *(a) their biological and genetic diversity; and* *(b) the essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience.*
issue	means a matter of concern to the Region's community regarding activities affecting some aspect of natural and physical resources and the environment of the Region.

land	*includes land covered by water and the air space above land;* (but in regard to this document does not include the beds of rivers or lakes, or the coastal marine area).
lithology	the physical characteristics of a rock, including colour, composition and texture.
Land Use Capability Classes	Land Use Capability Classes (LUC) define land units based on their capacity for permanent sustained production. This capacity depends largely on the physical qualities of the soil and the environment. Such factors include altitude, slope, geology, soil type, vegetation and erosion.
macro-invertebrates	water-dwelling insects, worms and molluscs.
monitoring	means regularly checking.
non-point discharge	involves diffuse discharges such as run-off or leachate from land, onto or into land, air, a body of water or the sea.
point source discharge	a discharge from a specific and identifiable source, onto or into land, air, a body of water or the sea.
productive capability	refers to the physical aspect of sustainability, and not to whether a particular use is either wise or economically viable.
quickflow	runoff which leaves a catchment soon after heavy rain
Regional Plan	a plan that may be prepared by a regional council to carry out its functions.
Regional Rule	a rule made as part of a regional plan.
regulation	rules used to control activities.
Resource Consent	written approval for an activity that would otherwise contravene the Act.

riparian management	means the collection of activities and practices that can be applied to the riparian margin, in order to improve the natural characteristics and functioning of the waterway itself as well as the riparian margin.
riparian margin	means a strip of land adjacent to a waterway which is frequently moist, and which generally extends from the perceived change in contour of the flood plain to the waterway itself.
soil organic storage capacity	refers to persistent organic-mineral complexes in topsoil, which resist decomposition under natural conditions, and positively correlate to soil resilience and fertility by providing storage and exchange capacity for water and nutrients.
soil conservation	the management of land to maintain New Zealand's soil and water resources, and includes: a. the maintenance of the productive potential of the region's soil resources to retain sustainable land use options for present and future generations, b. the maintenance of catchments to provide a high quality water resource for downstream users, c. land management practices that further enhance the protection of waterways from suspended sediments, nutrient, harmful micro-organisms and other pollution, d. the mitigation of the impacts of land related hazards including flooding, subsidence and erosions, e. the maintenance of aesthetic, scientific and cultural values related to land and water. (Note: This definition is taken from the 1987 National Water and Soil Conservation Authority (NWASCA) "Soil Conservation Policy" (NWASCA Circular No. 1987/13).

soil disturbance	the disturbance of land surfaces by any means, including cultivation.
vegetation	any plant material whether growing or not, living or dead, and shall include tree trunks, roots and branches.