Hutt River Floodplain Management Plan

For the Hutt River and its Environment

October 2001

Hutt River Floodplain Management Plan - *for the Hutt River and its Environment*
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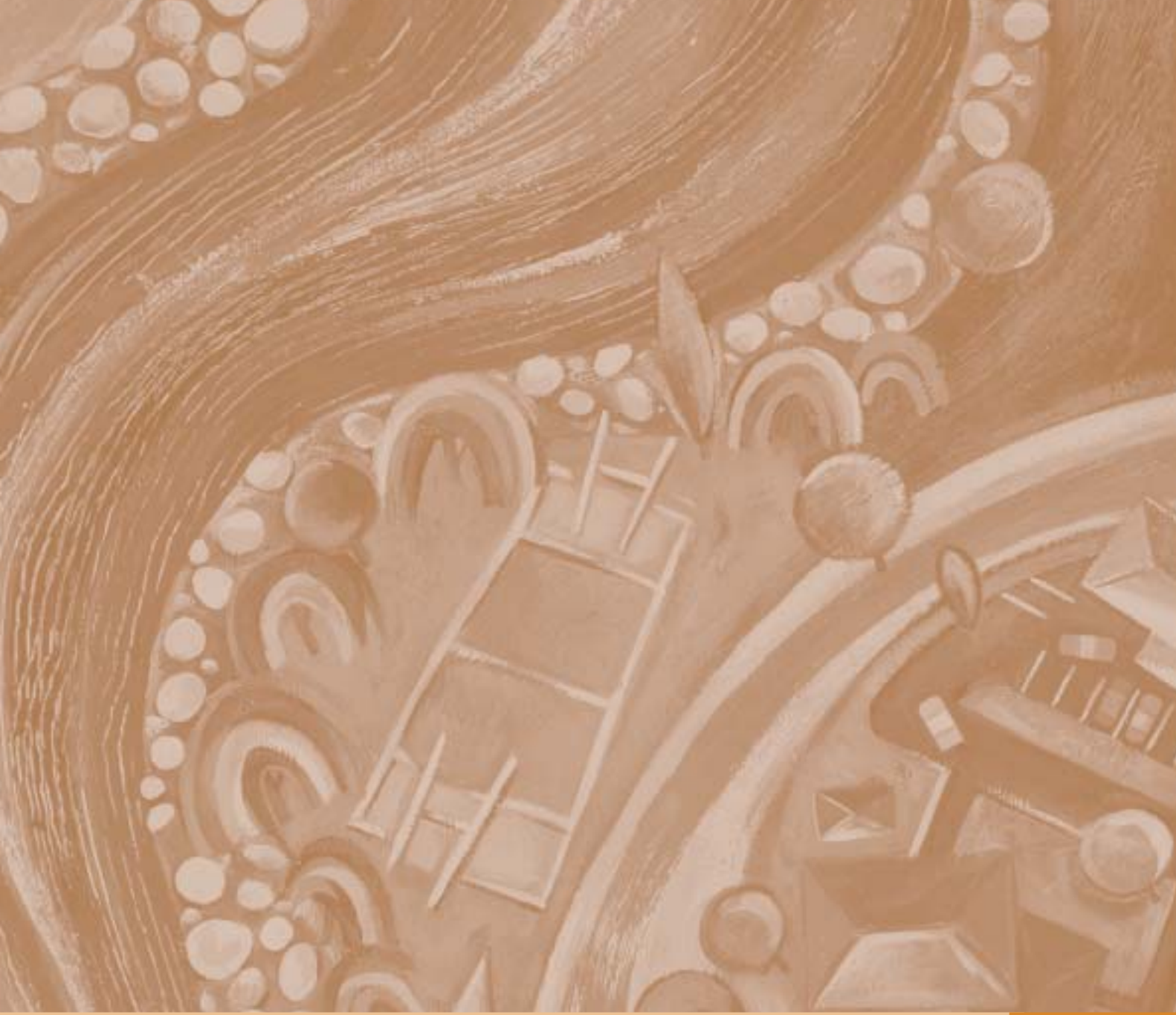

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THE REGIONAL COUNCIL

caring about you & your environment

ACKNOWLEDGEMENTS

Major contributions to this Plan and the measures it contains have been provided from:

- the Hutt River Floodplain Management Advisory Committee: Chairman Stuart Macaskill, Mayor John Terris, Mayor Rex Kirton, Cr Dick Werry, Cr Margaret Cousins, Cr Shirley Harris, Cr Joy Baird, Cr Rosemarie Thomas, Cr Wayne Guppy, and Liz Mellish and Teri Puketapu from the Te Ati Awa iwi.
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HE MIHI

Whakarongo ake au ki te tangi o te manu nei a te Matui

Tui, tui, tui, tuia

Tuia ai runga, tuia ai raro, tuia ai roto, tuia ai waho

Tuia te here tangata ka rongo te po, ka ronga te ao

Tena koutou e nga iwi whanui, Titiro mai, titiro mai

Ko koutou, tatou nei kei te noho I te taha o te wai o Kairangi

Ko te roimata hekenga mai I te tihi o Rimutaka tae noa atu

ki te moana o Raukawakawa

Me huri atu nei ki te pae o maumahara, ki a ratou kua wehe ki to po

E nga matua, haere, haere, haere. Takahia atu ra ki tua o te arai, ki te kainga

tuturu o te tangata, ki hawaiki nui, hawaiki roa, hawaiki pamamao

Kati ra mo ratou o te wahi ngaro

Tihei mauriora

He pukapuka panui tenei hei whakamarama, hei whakatiaki mai

Te haere o tenei mahi o te Kaunihera. Anei hoki etehi o nga korero

E pa ana ki te whenua, me ona tikanga

Heoi ano, he mihi tenei ki a koutou katoa e noho mai nei

He honore, he kororia ki te Atua I runga rawa

Maungarongo ki te whenua

Whakaaro pai ki nga tangata katoa

Tena koutou, tena koutou, tena tatou katoa

This Mihi acknowledges the joining together of people who have strong links with the Hutt Valley and the Hutt River – Te Awa Kairangi.

Watermark image by A. Palmer, 2001©.

TO THE WELLINGTON REGIONAL COMMUNITY

The Plan – A Timely Document

The Hutt River Floodplain Management Plan is the result of more than 10 years work by the Regional Council, the Upper Hutt and Hutt City Councils, the Manawhenua and the people of the Hutt Valley.

Living with the River, the Plan's 1996 Phase One Summary Report, concluded that:

- historically, flood management was mainly in response to flood events
- the standard and quality of flood protection measures on the river range from poor to satisfactory
- community awareness of flood risk is unacceptably low.

This Plan turns these around. The outcome of a comprehensive planning process, it proposes strategic solutions to manage the flood risk in the Hutt Valley. These solutions are innovative, thorough and cost-effective, and have the full support of the three councils as well as the communities they represent.

The Hutt River, its floodplain and the flood protection measures are significant to the whole region, adding to the economy, providing environmental opportunities and contributing to the wellbeing of us all. As politicians, our terms in office are finite but you will continue to live with the river, and be aware of its moods and power.

Your Input

Your attendance at public or local meetings, your reading and responses to our newsletters, and your submissions as we developed the Plan were invaluable. Defining the flood problem, selecting the design standard, determining the balance between structural and non-structural measures, and choosing a linear park as the basis for the *Environmental Strategy*, required your appreciation and understanding of many complex issues. These were big decisions and your input gave us the confidence to make them, knowing that there was underlying community support.

Where The Plan Takes Us

The Plan is a living document. It is a blueprint for the next 40 years, proposing to spend $78 million on new works. The Regional Council has already committed $20 million to works over the next 10 years and will complete the Plan by 2040. Concurrently we will be working to develop and implement the non-structural measures and to implement the *Environmental Strategy*. The Plan will be reviewed every 10 years, or after major floods, so it will be refined in response to needs that arise.

A Co-operative Effort

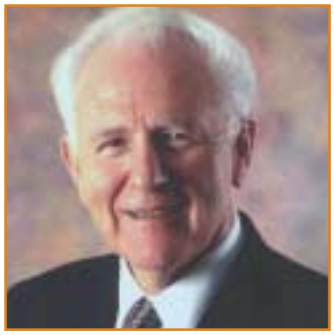
Working so closely and positively with each other to understand our particular responsibilities for governance, management and local problems, has had a unifying influence. The river respects no boundaries that separate our communities. From this process, we believe we have a floodplain management plan that is an outstanding example of the benefit that can be gained when our councils and the community work together.

Our Wish For The Future

We have all worked hard to complete the Plan. Now we need you to work with our councils, through input to the detailed design and approval of the structural measures, the development and implementation of the non-structural measures, and implementation of the *Environmental Strategy*, to bring our Plan to fruition.

These are major community opportunities and responsibilities.

Thank you



Stuart Macaskill, Chairman, Wellington Regional Council

John Terris, Mayor, Hutt City

Rex Kirton, Mayor, Upper Hutt City

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WHO SHOULD USE THIS PLAN ?

The Hutt River Floodplain Management Plan (the Plan) is important to you if you are a resident of Lower or Upper Hutt cities, or belong to a public agency, interest group, club or business associated with these cities. You should use this Plan to determine:

- if you are directly affected by the flood hazard
- if you will be directly affected by any flood protection structures or possible planning and emergency management measures
- how you can help to prepare yourself for flooding
- how your community's money is used to fund works under the Plan
- if there are opportunities to enhance the river environment that will benefit you.

The Plan contains a wide range of information including:

- areas directly affected by flooding from the Hutt River
- selected *structural* and *non-structural* measures
- environmental enhancement opportunities arising from the *Environmental Strategy*
- work programmes
- funding and cost details
- land directly affected by the Plan's measures
- the policy backing for all measures, and the Environmental Strategy.

Councillors, council officers and staff of environmental, health and utility agencies should all use this document in their day-to-day work, supporting a community that continues to live with the river.

Swimmers at Maoribank Corner, Maoribank, Upper Hutt.

FOR YOUR REFERENCE

The technical terms in the Plan are described in the **Glossary**. These terms are given in *italics* when they are first used in each chapter.

WHY THIS PLAN IS IMPORTANT

Do you need to worry about flooding? After all, you may not have been affected so far where you live. In fact flooding from the Hutt River is one of the biggest environmental and emergency management issues facing residents of the Hutt Valley (the Valley). A major flood of the Hutt River could be devastating. It could cause injury, even death, and result in hundreds of millions of dollars worth of damage to property and community assets in the Valley. The impact on people – in terms of social disruption, trauma and stress, and to jobs and businesses – would magnify the initial physical impacts of the flood. This Plan contains measures to substantially reduce these potentially devastating impacts.

The Wellington Regional Council and Hutt and Upper Hutt City Councils[1] are doing something about this threat. They are responsible for ensuring that the flooding problem is appropriately managed, and the Plan is a 40-year blueprint for managing and implementing programmes that will gradually reduce flooding effects from the Hutt River. It is a joint effort, and reflects the varied and shared responsibilities of the three councils.

The Plan presents a 'holistic' approach to managing *flood hazard effects*[2], combining:

- physical protection (structural measures)
- appropriate ways of using land and preparing communities for flooding (non-structural measures)
- opportunities to enhance the river environment (environmental opportunities).

Traditionally the approach has been more to react after something happens. By moving away from this kind of approach to managing floods, the Plan gives more certainty to Hutt Valley residents for the long-term and sustainable management of flooding.

The Plan's ultimate goal is to improve the community's resilience to flooding, and enable the two cities involved to maintain or enhance their present level of economic vitality and quality of life.

HOW THE DEVELOPED FLOODPLAIN HAS INFLUENCED THIS PLAN

Ever since humans first settled in the area communities have been learning to live with the Hutt River. Since colonial times the pattern of development in the Valley has tended to squeeze, confine and modify the Hutt River, while at the same time forming the second most densely populated and asset-rich floodplain in New Zealand. As a result, the approach to managing floods has focused on keeping the river out – building physical protection to control flooding. Inevitably, measures developed under the Plan have been heavily influenced by this legacy of floodplain development.

These days the key focus of floodplain management planning is more on keeping people and development away from floodwaters. But, unlike the generations who preceded us, we are not developing a new settlement. The river and the community are next-door neighbours, so one of the Plan's goals remains to keep floodwaters away from the intensively developed urban areas of the floodplain. This means continued reliance on physical protection against flooding. However, the Plan also offers many additional solutions to improve and empower respectively the community's protection and response to flooding.

1 *These city councils have jurisdiction over the Hutt Valley area, with Upper Hutt City occupying the upper valley and main catchment.*

2 *Flood hazard effects is defined in Chapter One: Introduction.*

WHAT THE PLAN DOES

The Plan is a foundation for implementing structural and non-structural measures, and an environmental strategy for enhancing the river environment. These ideas will be explained below. Putting it simply, the Plan records how we have gone about developing the various measures, and tells you where we are going in implementing them.

The Plan also establishes the framework for paying attention to the community's changing needs. As structural and non-structural measures and environmental opportunities are refined and implemented, Plan outcomes are monitored and the Plan is reviewed.

Design Standard Guides Levels of Protection

The whole basis for flood protection in this Plan is the *2300 cumec*[3] *risk-based design standard*.[4] A design standard is the river flow (or size of flood) that physical works are designed to withstand.

The Hutt River rages – downstream of Mooshine Bridge, Upper Hutt. October 1998.

A *risk-based standard* has been applied to all flood protection measures. What this means in the case of physical protection is that the level of physical works for a local area has been determined by assessing the social, economic and environmental benefits and costs of providing this flood protection. So rather than suggesting building huge barriers down the entire length of the river that we could never afford, we look at areas along the river and see what the most appropriate and cost-effective protection would be.

The standards applying to physical works are therefore a mix of the:

- 1900 cumec standard (1 in 100-year flood)[5]
- 2300 cumec standard (1 in 440-year flood)
- 2800 cumec standard (rare flood).

The risk-based design standard means new and upgraded flood defences will protect major urban areas in the floodplain from a 2300 cumec (1 in 440 years) flood. Other areas will have a lower flood standard, with an emphasis on alternative measures. The Plan proposes to spend an estimated $78 million on physical works over the next 40 years to achieve this standard.

What are Structural Measures?

Structural measures are physical works such as *stopbanks*, or rocks and vegetation placed to protect river edges. Structural measures also include replacing and modifying bridges and raising residential homes.

Types of Structural Measures Planned for the Hutt River

Stopbanks

Stopbanks are the principal defence against flooding in the Hutt Valley. The main stopbanks protecting major urban areas will be upgraded to the 2800 cumec capacity. Stopbanks protecting smaller urban areas (including Totara Park, Whirinaki Crescent and Manor Park) will be upgraded to the 2300 standard. Gemstone Drive's stopbank will be upgraded to the 1900 standard.

3 *A cumec measures water flow. 1 cumec (1 cubic metre per second) equals 1 cubic metre passing a given point every second.*

4 *See the Glossary or Chapter Three for a definition of design standard, including the 2300 cumec risk-based standard.*

5 *1 in 100-year flood means the flood event will happen on average once every 100 years. This is the probability of flooding.*

Bank-Edge Protection and River Realignment

Bank-edge protection works protect river *berms* and stopbanks from erosion. Having built a barrier to keep the river out we don't want the river to wash it away, so the idea is to plant shrubs and trees or place rock along river banks to help protect them. The main stopbanks located very close to the river will generally be protected with heavy rock along the bank edges. Major river realignment will be carried out in the Ava to Ewen Bridge reach to relieve flood pressures on the western stopbanks.

A riverside carpark disappears under rising flood waters, Lower Hutt CBD. October 1998.

House Raising

The Plan proposes an option of financial support to raise houses above the 1900 cumec flood level for residents of Bridge Road – Gemstone Drive (Upper Hutt) and Belmont (Lower Hutt).

Bridge Replacement

All bridges and their associated floodways will be upgraded to the 2800 cumec standard when they reach the end of their useful life. In most cases replacement will be funded solely by bridge owners.

Will These Structural Measures be Failsafe?

The measures will provide varying degrees of physical protection against a range of floods, but they are not failsafe. They cannot be solely relied on by vulnerable communities whose overall protection will be limited, or in large floods where the added risk of structural failure increases. This added or "left over" risk is known as the *residual risk*[6] , and is provided for by non-structural measures.

What are Non-structural Measures?

Non-structural measures deal with the residual risk of flooding by improving community resilience against the flood hazard and helping people to avoid the flooding problem to start with.

They address:

- land use: through policies and rules in district plans or voluntary actions that deal with constructing buildings and structures, doing earthworks and using land in a wise manner
- emergency management: by preparing the community to cope with flooding.

Non-structural measures are particularly cost-effective. They encourage property owners to take the responsibility for lessening flooding effects on themselves. *Land-use measures* are particularly important, and therefore will be stronger, in areas with little or no structural protection from flooding. *Emergency management measures* target all residents and landowners in the Hutt Valley. They are vital when flooding happens, particularly if flood defences fail.

6 *See the Glossary and Chapter One: Introduction for more information about residual risk.*

Types of Non-structural Measures

Managing Land-uses and Development

The measures proposed in the Plan are based on principles, which are ideas that have been developed about what should be done to manage the residual risk. The non-structural principles in Chapter Five propose developing a number of new district plan objectives, policies and rules. These would especially target the unprotected flood-prone areas located right next to the Hutt River. The principles cover:

- constructing large structures and buildings
- undertaking earthworks
- storing hazardous substances
- locating utility facilities
- locating new habitable buildings.

Encouraging the community to take voluntary actions will focus on providing technical information and advice to the community about flooding effects and ways to reduce its impacts. Information and advice applies to all Hutt Valley residents.

Flood Protection Operations staff carrying out a sand-bagging exercise in Speedy's Stream, Lower Hutt.

Emergency Management

The non-structural principles for emergency management measures are aimed at continuing to improve:

- knowledge about the flood hazard
- understanding the effects of floods
- preparedness for floods
- responding to floods
- recovery following floods.

We already have good emergency management programmes and procedures, but these will be enhanced to ensure they provide comprehensive community coverage. Examples include:

- providing updated flood hazard information
- looking at the potential of other hazards to occur during floods
- improving links with the media.

Improving the quality and coverage of non-structural measures will require an increased commitment from the three councils. Developing and implementing measures will particularly involve resource planning and emergency management resources from the city councils on an ongoing basis.

What Is the Environmental Strategy ?

The Environmental Strategy (the Strategy) identifies opportunities to enhance the Hutt River's environment. For the Strategy, the community's preferred blueprint is to develop the river and its margins as a *linear park*, which provides the overall vision for the river and its environment. The Strategy's vision is for a tranquil environment where people can escape the bustle of urban life and enjoy the natural character of the river environment.

The Strategy provides concept plans that identify ideas or opportunities for enhancing the river environment in line with this linear park vision. These opportunities are either linked to capital works within each *reach* along the Hutt River, or exist as separate enhancement opportunities.

Flood waters submerge Harcourt Werry Drive, Lower Hutt. October 1998. R. Thomas ©.

The three councils, iwi and the wider community will be responsible for implementing the Strategy. Over the next 40 years the Regional Council will spend an estimated $3 million on Strategy projects linked to capital works. Additional expenditure on enhancement projects could exceed a further $8 million over the life of the Plan.

Ultimately, the Strategy will influence the character, function, habitat, look and feel of the Hutt River's environment.

THE PLAN PROCESS FOLLOWED

How did we reach all of these decisions, and who was involved? The Hutt River Floodplain Management Plan brings together many years of intensive work by:

- the Hutt Valley community
- the Wellington Regional Council, Hutt and Upper Hutt City Councils
- the Te Ati Awa iwi
- various interest groups, public agencies and businesses.

An advisory committee (the Hutt River Floodplain Management Advisory Committee) made up of councillors from the Regional Council, the two Hutt Valley councils and iwi has steered the process since 1998. Public consultation, commencing with *Living with the River*[7] in 1996, has helped the Regional Council to develop complementary structural and non-structural options, and the Environmental Strategy.

During this period the flooding problem has been analysed, local floodplain management issues have been identified, and various options were considered, developed and selected. Meanwhile, existing flood defences have continued to be maintained and, in some cases, improved.

The guidance of iwi, community groups, public agencies, business and the wider community will continue to be sought as the three councils implement the Plan.

7 *'Living with the River' summarises the first phase of investigations into the Hutt River flooding problem. This publication also records the community's major concerns.*

THE PLAN'S GOALS AND EXPECTED PERFORMANCE

This Plan must be able to adapt to the changing needs of successive generations of people living in the Hutt Valley. Monitoring the Plan's performance provides information about these changing needs.

The Plan's implementation will be measured against a series of expected goals or *anticipated results*. Measuring anticipated results tells us whether the Plan has achieved what it set out to do, along with the community's reaction to its implementation. The anticipated results will be monitored and reported, as will the Plan's overall performance and direction and the continued appropriateness and affordability of various measures.

Steam powered gantry constructing a Hutt River stopbank in 1902. Alexander Turnbull Library, Wellington.

HOW DO I FIND MY WAY AROUND THE PLAN ?

The Hutt River Floodplain Management Plan is divided into eight chapters. The *Summary* outlines why the Plan is important and who should use it. It then gives an overview of the flood protection measures and environmental works proposed over the next 40 years.

Chapter One: Introduction: Preparing the Hutt River Floodplain Management Plan sets the scene by describing the Hutt Valley's geographical features, its historical flooding problem, and the Regional Council's approach to floodplain management planning. The Plan's objectives are also presented.

Chapter Two: Nga Tikanga Maori outlines the relationship tangata whenua have with the Hutt River and its environment. It includes their aspirations for managing the river, and their cultural values and significant sites along the river.

Chapter Three: The Design Standard: Guiding the Outcomes explains the way the flood protection standard for the Hutt River was selected and what the new standard means for floodplain management in the Hutt Valley. The chapter includes policies supporting the design standard and sets the scene for the next three chapters.

Chapter Four: The Outcomes: Upgrading Structural Protection is the first of three chapters that explain what is going to be done and how, and the policies that support the selected measures and the Environmental Strategy. Chapter Four describes the structural measures that will be used to manage the flooding problem in specific areas by physically keeping the floodwaters away from people and property.

Chapter Five: The Outcomes: Improving Non-structural Measures describes the non-structural measures to be implemented. These complement the structural measures by emphasising the residual risk and, where possible, keeping people away from floodwaters. Strategies are developed in terms of council regulations, voluntary actions and emergency management.

Chapter Six: The Outcomes: Enhancing the River Environment outlines opportunities for enhancing the Hutt River's environment as the other measures are put in place. It also displays concept plans that present a possible future "look" for the river environment.

Chapter Seven: Implementing and Funding the Plan looks at how the work will carried out and funded.

Finally, *Chapter Eight: Anticipated Results and Monitoring: Measuring Outcomes and Reviewing the Plan* sets out the results and outcomes we expect from implementing the Plan, and how we will measure to see if the Plan has done what it set out to achieve. Ongoing monitoring and reviews ensure that the Plan remains in tune with the Hutt community's changing needs.

The *Appendices* provide additional information supporting the Plan, the *Glossary* lists some of the more technical terms and concepts and provides brief explanations, and the *Reference List* lists reports from earlier phases of the floodplain management planning process, which provide background and added detail to this Plan.

PRODUCED BY FLOOD PROTECTION GROUP, WELLINGTON REGIONAL COUNCIL

INTRODUCTION: PREPARING THE HUTT RIVER FLOODPLAIN MANAGEMENT PLAN

1

Boulcott Golf Course under water, October 1998.

1.1 INTRODUCTION

This chapter sets the scene for the Plan. It describes:

- the Hutt Valley's geography
- the Hutt Valley's present and historical flooding problem, and how future flooding could affect Lower and Upper Hutt City residents
- the Regional Council's approach to managing the *flood hazard*
- Plan objectives
- the Regional and City Councils' responsibilities for managing the flood hazard.

1.2 LIVING WITH THE RIVER

The Hutt River, Wellington Harbour and beyond, from Manor Park, Lower Hutt.

The Hutt Valley today covers an area of markedly contrasting land uses. The upper valley and hill areas, which occupy over 65 percent of the full catchment, are mainly covered in mixed regenerating native forests with some exotic plantations. The lower catchment, once itself densely forested, is today heavily developed. Nearly 130,000 people live in the Valley, mostly on its *floodplain*. This vibrant urban community contains a high level of personal, business and public investment in buildings, businesses and utilities, which form a major component of the Wellington regional economy.

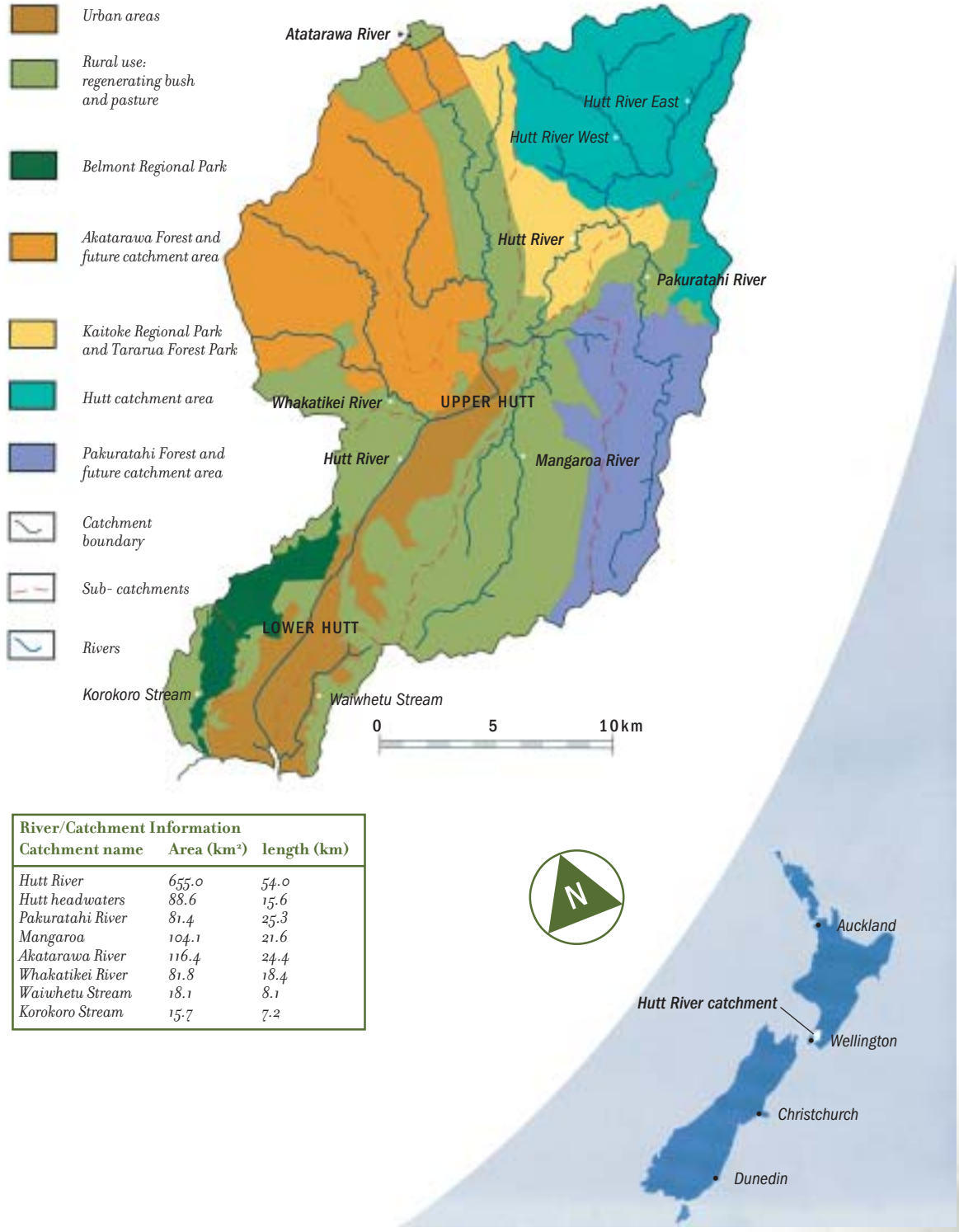
The Hutt River is also an important recreational resource, with over one million visitors each year, more visits than any regional park. Because of its proximity to major urban areas the Hutt River is a unique resource, highly valued by the community and appreciated by travellers and visitors. But the floodplain is an evolving physical environment. Active geological, alluvial and climatic processes continue to shape the river valley and its headwater environment. It is this changing and changeable nature of the river – combined with its proximity to the community – that creates a problem.

The Flood Problem

Since people first began living in the Hutt Valley many centuries ago their lives have been influenced by the river. Along with the safe anchorage provided by the harbour, the fertile Hutt River floodplain also attracted early European settlers eager for land and a new life. But within two months of the arrival of the first New Zealand Company ships the river burst its banks and inundated the tiny settlement.

Over the next 150 years intensive settlement and land use have created a highly modified environment. The valley floor and nearby hill slopes have lost most of their natural vegetation cover, and the floodplain has become almost completely urbanised. The quest for land has squeezed the river into its present path, creating a significant flood hazard for the growing Hutt Valley community.

FIGURE 1: HUTT RIVER AND ITS CATCHMENT



River/Catchment Information

Catchment name	Area (km²)	length (km)
Hutt River	*655.0*	*54.0*
Hutt headwaters	*88.6*	*15.6*
Pakuratahi River	*81.4*	*25.3*
Mangaroa	*104.1*	*21.6*
Akatarawa River	*116.4*	*24.4*
Whakatikei River	*81.8*	*18.4*
Waiwhetu Stream	*18.1*	*8.1*
Korokoro Stream	*15.7*	*7.2*

Throughout its recorded history many large floods have swept through the Hutt Valley (see Table 1). Historically, the response has been to progressively build a flood defence system along most of the Hutt River's length, gradually straighten the river channel, and excavate substantial quantities of gravel to improve the river's flood capacity.

DO YOU WANT TO KNOW MORE ?

Ref 3:	Creating Flood Disasters
Ref 4:	Demographic Trends
Ref 31:	Hutt River Environmental Strategy
Ref 49:	Living with the River
Ref 50:	Maori Place Names and Sites
Ref 60:	Rugged Landscape
Ref 63:	Upper Catchment Investigation

Mechanical methods were first used to control the river in 1865, and the first flood defences were built in 1894 to protect Petone, after it was inundated by flood waters. Banks were added between 1901 and 1906, stretching from the river mouth to Boulcott, and a gravel extraction and river straightening programme was implemented from 1916. In 1940 the Government began developing residential "state housing" areas in the eastern and northern parts of Lower Hutt Borough. The *flood defences* were extended north to Taita Gorge and later through Upper Hutt to Maoribank between 1956 and 1972 to protect the new housing estates.

Since 1972 isolated and substandard *stopbanks* have progressively been extended or rebuilt, and existing stopbanks maintained. Gravel extraction and river straightening have steadily been replaced by a focus on re-establishing bank-edge vegetation and strengthening bank edges. Approximately $20 million has been spent on these structural works, yet we still do not have a consistent and adequate flood protection system throughout the Hutt Valley. There are still significant areas where improvements are needed to achieve basic flood security against even 50- to 100-year floods.

Flooding Affects Everyone

Chances of Flooding

If we just keep doing the flood protection work we have been doing, there is a significant chance that sections of the existing Hutt River flood defences will fail during the next 100 years.[1] The likelihood that a 1 in 100-year flood (1900 cumecs), with the potential to *breach* the existing defences, will occur during this period is 63 percent – about a two in three chance. It means a flood of this size could happen in your lifetime. If that happens, then widespread flooding of some urban areas would almost certainly occur if stopbanks were not upgraded.

A 1 in 440-year flood (2300 cumecs) flood has a 20 percent chance of occurring in the next 100 years – a one in five chance, while a 2800 cumec flood has about a 4 percent chance.

Much of the Hutt Valley was under water during this flood in 1955. Photograph from the Evening Post©.

1 *Technical investigations undertaken as part of the Plan's development have established this.*

Table 1: Hutt river historical floods

DATE	FLOOD EFFECTS IN THE PAST
1855	The river rose 600 mm higher than had ever been seen before and completely destroyed the third Hutt bridge, already damaged by the 1855 earthquake.
1858	This was the most disastrous flood European settlers had experienced (approx. 2000 cumecs[2]). The river burst its banks and flowed across the floodplain into Black Creek and the Waiwhetu Stream. Nine lives were lost in Taita, the Hutt Valley road was deeply gouged, and the new Hutt bridge was damaged.
1878	Two large floods swept the valley, with water covering the entire floodplain. The river overflowed considerably at Boulcott into Black Creek.
1893	A large flood (1500 cumecs) inundated Petone properties, some to over a metre. A second flood (1700 cumecs) also covered most of Petone. As a result the Petone stopbank was built in 1894.
1898	The largest flood on record (2000 cumecs) covered the valley floor. Floodwaters were knee deep in Lower Hutt township and came within 225 mm of the deck of the Hutt bridge. A second flood (1500 cumecs) almost filled the valley again.
1931	The largest flood since the inception of the Scheme's structural works in 1901 (1400 cumecs) carried vast quantities of gravel down the river. The flood severely tested the Scheme works, and there was severe erosion next to the Daly Street stopbank, threatening Lower Hutt. The river rose 5.2 m to within 600 mm of the stopbank crest at Moera. At Silverstream, banks burst and flooded a large area. The Manor Park Bridge and the Haywards suspension bridge were swept away. Extensive gravel deposits and berm erosion occurred at Manor Park, and part of the Taita Gorge road was washed out.
1939	This flood (1600 cumecs) caused floodwaters to cover unprotected areas north of Boulcott. At Silverstream the entire flat became a vast stretch of water. In the protected lower valley, water came to within 150 mm of the floodwall crest at Ewen Bridge, and to within 600 mm of the stopbank crest between Ewen and the river mouth.
1976	Heavy rainfall over the floodplain caused all the major streams to flood. A small flood occurred in the Hutt River, closing the floodgates and blocking the outlets of the urban drainage systems. Widespread surface flooding occurred throughout the valley.
1998	Two floods within a week of each other (1305 cumecs and 1540 cumecs) caused extensive bank-edge damage. However, overall the flood protection system coped very well considering the size of the second flood. No breaches occurred. Most damage was sustained at known trouble spots. There was extensive erosion at Block Road, Avalon, Owen Street, Nash Street, Mary Hughes Grove and Manor Park Golf Course. Low-lying houses were flooded in Hathaway Avenue. The stopbank at Ariki Street was sandbagged when floodwaters began seeping through the base. The Upper Hutt City Council services bridge at Akatarawa was destroyed.
2000	As in 1998, two floods occurred within a week of each other (largest 1245 cumecs). Once again the system coped, with bank edges experiencing light to moderate erosion damage. Sites downstream from Maoribank corner and next to Mary Hughes Grove experienced the worst damage.

The above table uses a number of terms to discuss the history of flooding in the Hutt Valley. These terms, and many like it, are discussed in the Glossary.

2 *All flows are provided as if measured at the Lower Hutt City Centre.*

Impacts on the Community

A large flood over the Hutt floodplain would have wide-ranging social and psychological impacts on the Hutt Valley community. There would be physical damage and disruption to homes, schools, workplaces, community facilities (such as public halls and clubrooms), essential services (including hospitals) and emergency services.

DO YOU WANT TO KNOW MORE ?

Ref 8:	Flood Frequency Update
Ref 19:	Hutt River Environment and Social Impacts
Ref 32:	Hutt River Flood Damages
Ref 38:	Hutt River Modern History
Ref 49:	Living with the River

A particularly large flood affecting an under-prepared community may cause injury or even death. Utilities such as electricity, water supply and telecommunications could be put out of action for days. Escalating damages to property will heighten the degree of social disruption, stress and trauma.

The financial cost from such a flood could exceed one billion dollars. Damage to buildings and roads could take many months to repair, crippling the day-to-day functioning of the Hutt Valley community. Recovery from a large flood is likely to be slow. The associated disruption would have an enormous impact on the regional economy, and may affect the national economy as well.

Social and psychological impacts (intangible damages) are likely to cost individuals and the community at least as much again as the physical or tangible damages.

Predicting the Extent of Flooding

The character and extent of large floods can be difficult to understand until they actually happen. However, the Regional Council has put considerable effort into developing scenarios to predict the consequences of floods.

Figures 2 to 5 are known as 'flood extent maps'. They show the potential extent of floodwaters in the Hutt Valley for a 2300 cumec flood[3] , both with and without the *structural works* proposed under the Plan. For each set of figures, the first figure shows flooding with breaching of the upgraded flood defences. Breaches have been simulated for every kilometre along the stopbank to show the maximum potential depth and extent of flooding in flood-prone areas. The second figure shows flooding with no breaching, reflecting the ultimate desired performance of the completed works.

In any one flood it is unlikely that all the stopbank breaches shown would occur, or that the overall flooding extent would be as great as that shown on the flood maps. The flood for this scenario is assumed to last little more than a day.[4] The term 'breaching' includes overtopping of stopbanks, which is more likely in places where parts of stopbanks are lower than adjoining stopbanks. (This term and many like it are defined in the Glossary.)

3 *This is the design standard flood – the flood that the upgraded system will be built to protect against.*

4 *The scenario contains approximations in order to simplify the analysis, but overall fairly represents the types of floods that have been recorded in the past.*

Flood Hazard Effects

What Are They ?

Flood hazard effects[5] are the undesirable results of flooding. In the *river corridor* fast-flowing waters can erode land from the river edges and berms, damage stopbanks and other flood protection structures, and deposit sizeable debris (including trees and building material) and large amounts of sand and gravel from the riverbed.

In developed floodplain areas flood waters are highly dangerous. Fast flows can sweep people off their feet, move vehicles and substantially damage homes and other buildings. Deeper, slow-moving waters or ponding can be equally dangerous.

How They Can Be Worsened

Flood hazard effects can be worsened by human activities, such as placing structures and buildings inappropriately or using land poorly. These worsened effects include:

- diverting or blocking flood flows into other areas
- introducing debris to flood flows, creating dams and damaging structures downstream
- increasing erosion in the *upper catchment*, causing increased sediment supply
- increasing peak flows in floods, thereby increasing flood impacts
- increasing flood levels, which compromises the flood defence system's effectiveness.

What Human Activities Can Cause

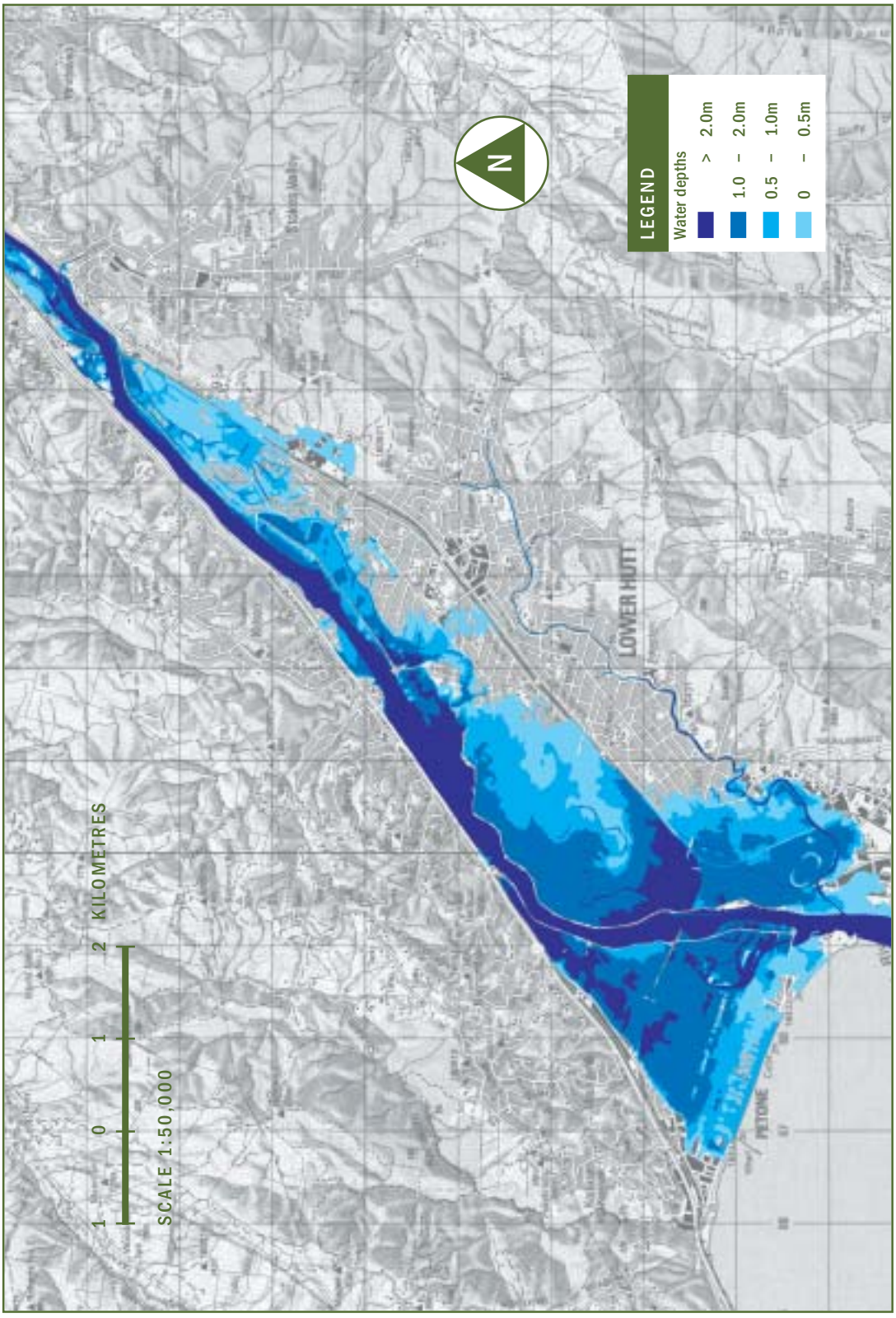
Often people think 'How can what I'm doing worsen things for others?' But a large number of undesirable land-use activities adjacent to the Hutt River can have a cumulative flood hazard effect. Cumulative effects are effects that arise in combination with other effects. This means they can add to the flooding hazard worsening the overall effects of flooding.

Such effects may happen infrequently but can produce a high potential impact, such as severe stopbank damage. Land uses near the river can worsen flooding effects in many ways. For example, constructing more small buildings in the river corridor can provide additional sources of debris, and debris carried by flood waters can significantly damage stopbanks and bridges.

One of the unlucky ones. A business located inside the Hutt River's stopbanks is flooded. Lower Hutt, October 1998.

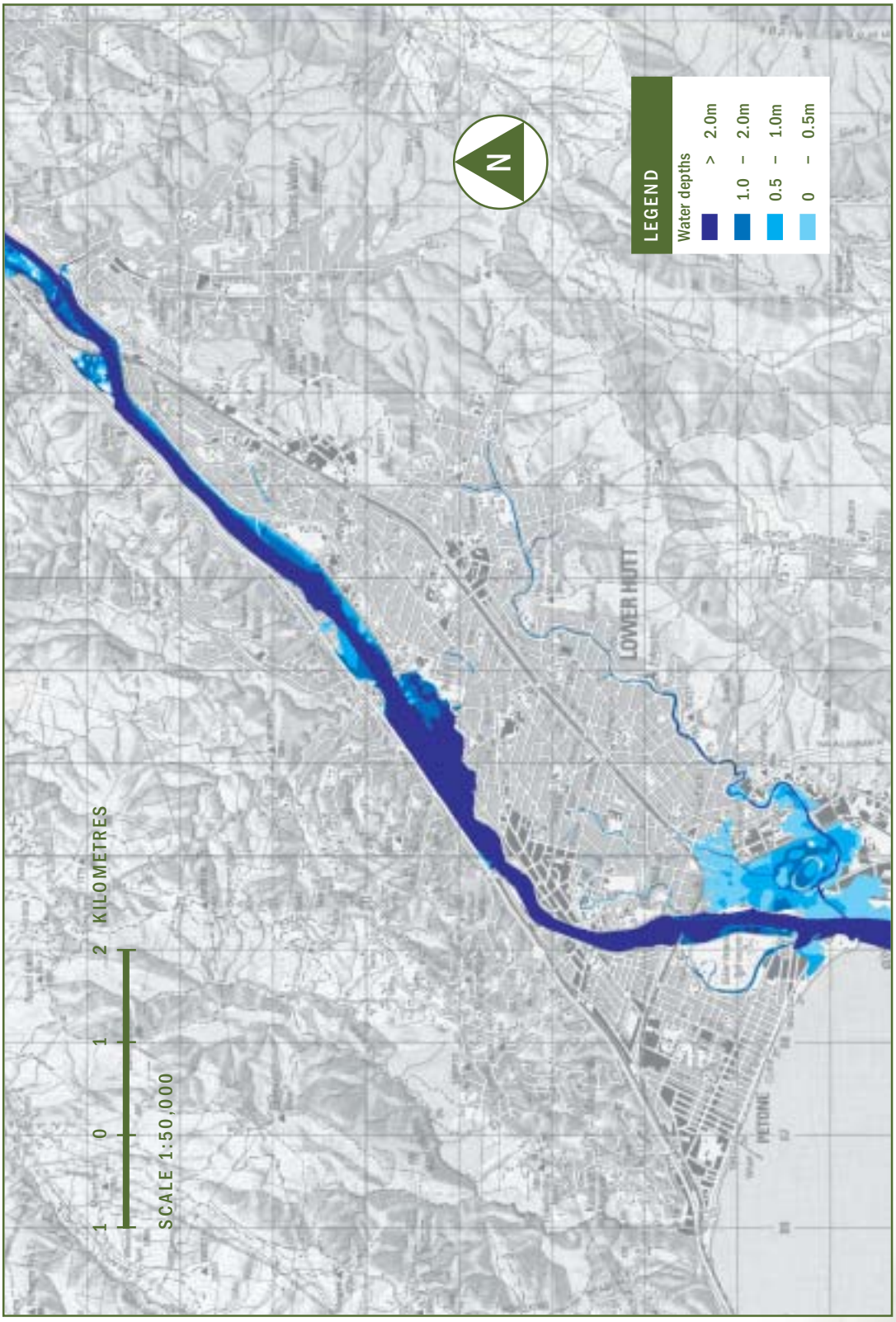
5 *The legal meaning of the term environmental effect is defined in Section 3 of the Resource Management Act 1991.*

FIGURE 2: FLOOD EXTENT MAP (WITH BREACHES) - LOWER HUTT



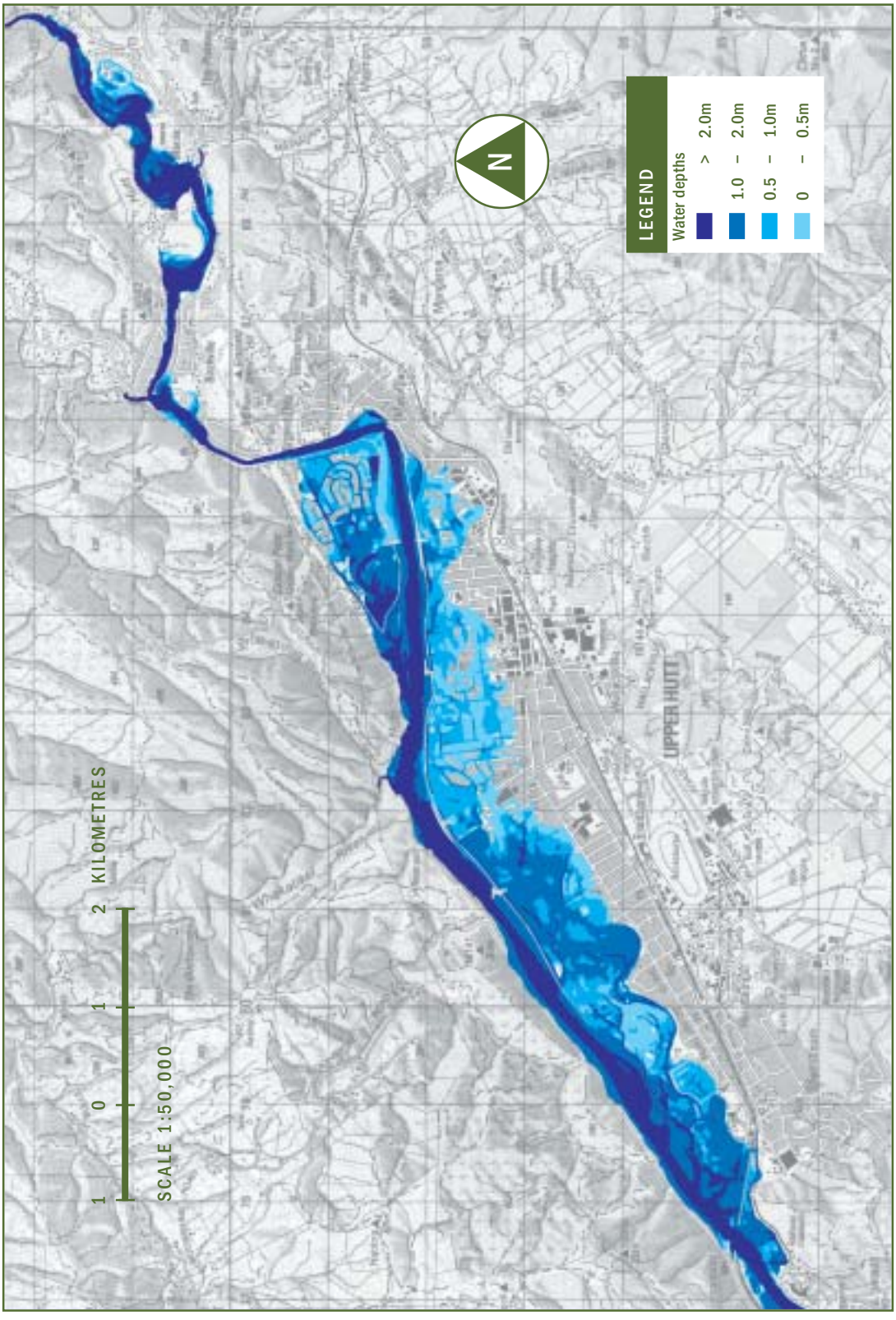
2300 cumec flood extent (440-year-event) with breaches, under the upgraded flood protection system.

FIGURE 3: FLOOD EXTENT MAP (WITH NO BREACHES) - LOWER HUTT



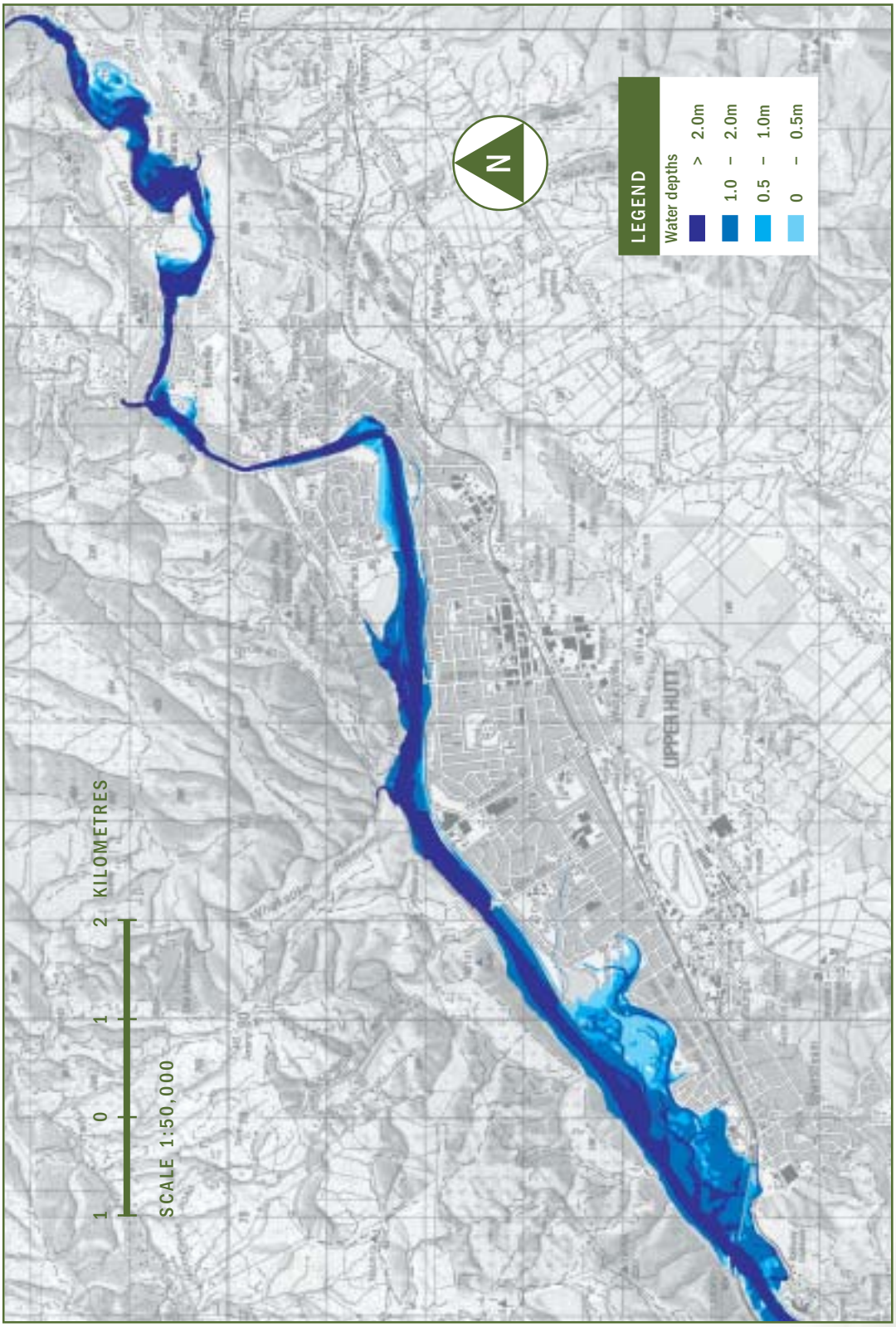
2300 cumec flood extent (440-year-event) with no breaches, under the upgraded flood protection system.

FIGURE 4: FLOOD EXTENT MAP (WITH BREACHES) - UPPER HUTT



2300 cumec flood extent (440-year-event) with breaches, under the upgraded flood protection system.

FIGURE 5: FLOOD EXTENT MAP (WITH NO BREACHES) - UPPER HUTT



2300 cumec flood extent (440-year-event) with no breaches, under the upgraded flood protection system.

FLOODPLAIN MANAGEMENT PLANNING – IT MAKES SENSE

What it Tries to Achieve

Floodplain management planning is an internationally recognised approach and process that provides a comprehensive long-term strategy for managing flood hazard. It aims to achieve sustainable development in flood-prone areas without imposing unacceptable limitations or costs on future generations.

Floodplain management planning emphasises a balance between keeping people away from floodwaters and keeping floodwaters away from people. It recognises *residual risk*: the idea that flood defences can fail, leaving an additional or 'left over' risk for flood-prone communities to manage. It also emphasises communities better preparing themselves to cope with floods.

A Changing Approach

Over the last 20 years floodplain management around the world has moved away from a full reliance on engineering structures to prevent flooding. A modified approach encourages catchment-wide solutions, the principal goal being to avoid building costly flood defences (structural measures), while encouraging stronger emergency management and more appropriate land use (non-structural measures). Underlying this modified approach is a recognition that:

- structural defences can fail in large floods
- new development should avoid flood-prone areas
- communities need to be better prepared to cope with flooding.

The balance between *structural* and *non-structural* measures will be influenced by practical considerations, such as how developed the floodplain is and whether the river's natural pathway has been confined. As a rule of thumb – the greater and more valued the development, the higher the community's expectation will be to protect it using structural flood defences.

Embracing Modern Ways

The modern approach requires a widespread appreciation of flooding risks, and community understanding of the options available to manage those risks. New development is strongly discouraged in flood-prone areas, particularly where flood defences are limited. Instead, uses not adversely affected by flooding are encouraged, including passive recreation, habitat rehabilitation and other less intensive land uses.

For existing development in flood-prone areas, effort is put into raising flood awareness and preparedness, which should reduce flood damage, and the trauma and stress associated with flooding.

1.3 PREPARING A FLOODPLAIN MANAGEMENT PLAN FOR THE HUTT VALLEY

As we have seen, flooding from the Hutt River is a major environmental management issue facing every resident of the Hutt Valley. The Hutt River Floodplain Management Plan (the Plan) provides a comprehensive strategic approach to managing the Hutt Valley's flood hazard problems over the next 40 years.

Preparing this Plan has involved the combined efforts of the Hutt and Upper Hutt City Councils, the Regional Council and tangata whenua, with input from other public agencies, local business, community groups and the general public. These efforts have played a major role in determining the appropriate mix of measures for the Plan. At the same time, the very process of developing flood management measures has updated our collective understanding of the flood hazard.

This Plan must be able to adapt to the:

- changing social and economic needs of successive generations living in the Hutt Valley
- understanding of flooding and its impacts
- relationship between flood mitigation measures, us and our environment.

Thus the Plan is a living document and it will be formally reviewed every 10 years. It culminates four planning phases involving technical investigations, evaluating options and selecting measures. These are described in Figure 6.

Lower Hutt, 1920s. Photograph from the W. Thornley Collection, Alexander Turnbull Library, Wellington.

1.4 MEASURES TO REDUCE FLOODING RISK

There are many ways to reduce flooding risks. Some are more viable than others, depending on the community's vulnerability to flooding, the extent of existing development and available funding. This Plan uses two types of risk reduction methods: structural measures and non-structural measures.

Structural measures involve constructing physical works designed to contain floods and limit erosion from the river. These are the more traditional tools for reducing flood risk. Until recently the Hutt Valley relied heavily on building structural flood defences – such as stopbanks, rock linings and vegetation buffers – to reduce flood risks.

Non-structural measures include land-use planning regulations and voluntary actions, and steps that floodplain residents, groups, businesses, and utility and emergency services can take to prepare for floods. These measures aim to keep people, possessions and development out of floodwater – or better still, away from flood-prone areas. They also improve the community's ability to respond to and recover from floods. In a nutshell, non-structural measures enable a community to be more resilient to flooding through flood awareness, preparation and sensible land use.

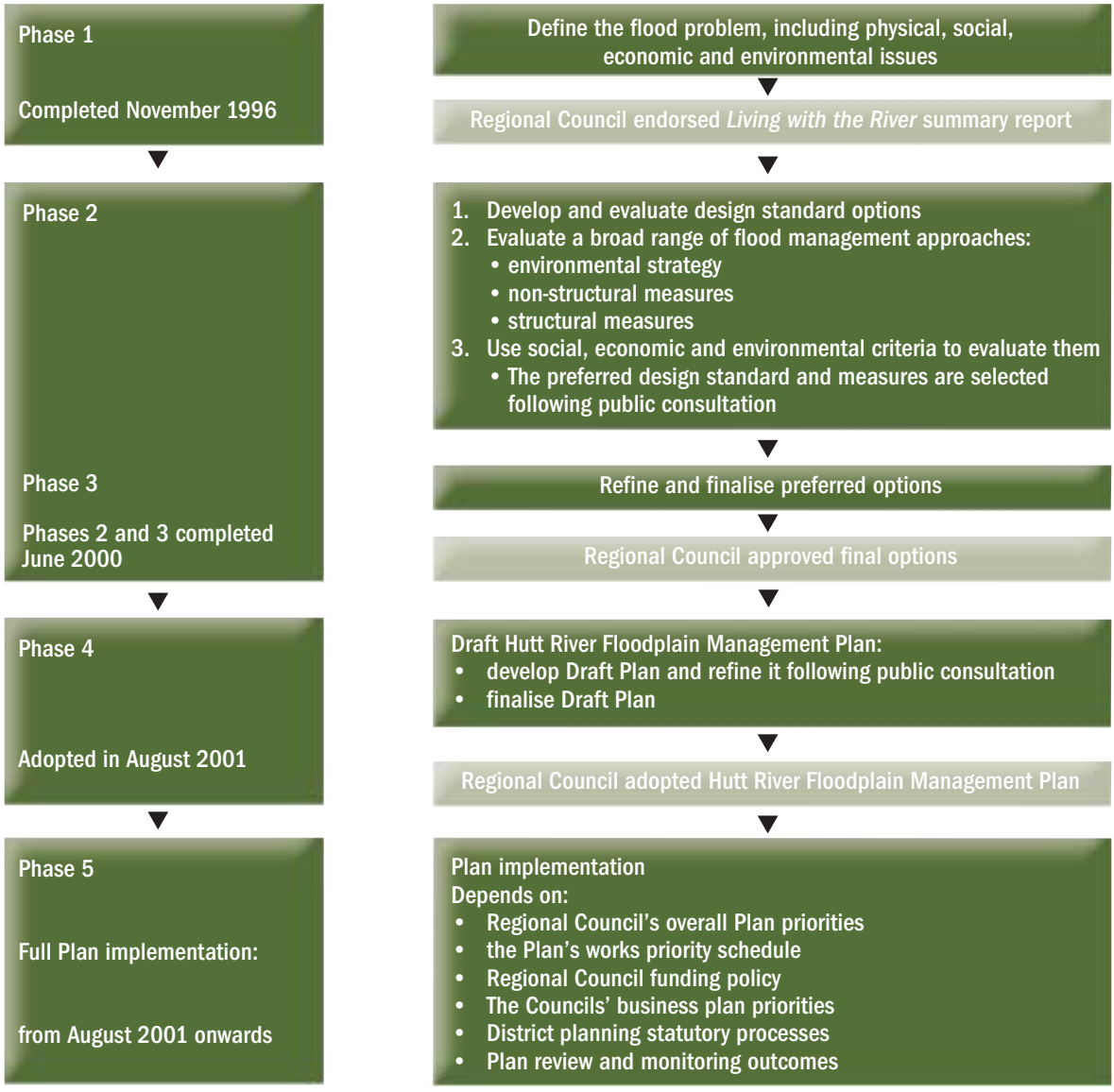
Structural and non-structural measures are equally important management approaches for the Hutt Valley. The Plan uses both in an integrated way to reduce flood hazard effects.

1.5 THE REGIONAL COUNCIL'S FLOODPLAIN MANAGEMENT APPROACH

Floodplain Management Planning Phases

Formulating and implementing this Plan follows five phases, described in Figure 6. The approach illustrated was adopted by the Regional Council to ensure that a viable, economically acceptable, socially appropriate and balanced set of measures was adopted to manage flood risks on the Hutt River floodplain.

FIGURE 6: REGIONAL COUNCIL FLOODPLAIN MANAGEMENT PLANNING APPROACH



Each step involves public and Hutt River Floodplain Management Advisory Committee participation in preparing the recommendations submitted for Council approval.

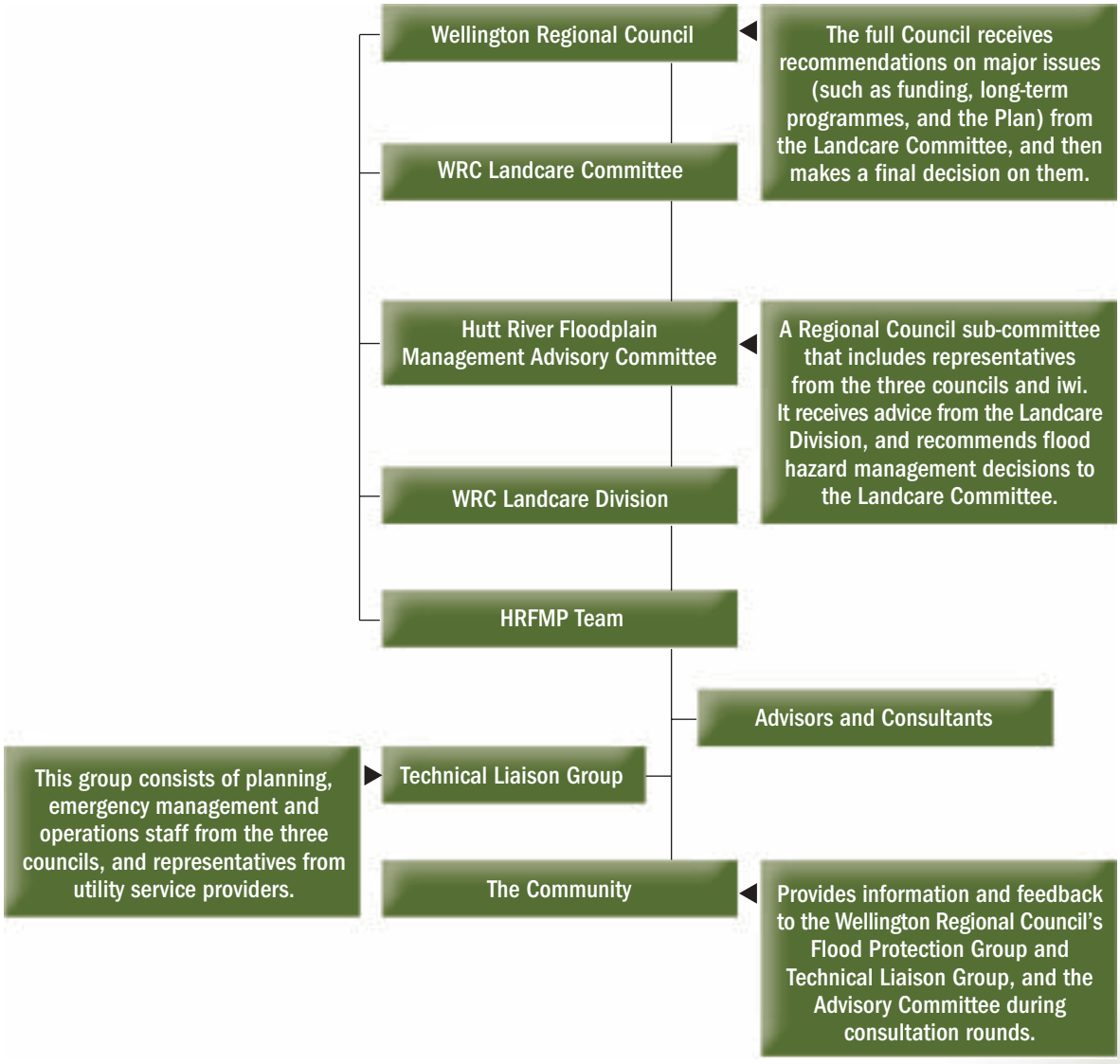
Decision-making Under this Plan

Who made the decisions in all of this? Obviously there needed to be input from a variety of sources, and this input had to be co-ordinated. The best way to do this was to create a decision-making framework, which provided the process to:

- consider and select acceptable flood mitigation measures
- develop an environmental strategy
- prepare a management plan for implementing measures and the strategy.

This framework also defines who is responsible for preparing, evaluating and deciding on measures to reduce flood risks.

FIGURE 7: THE DECISION-MAKING FRAMEWORK AND ROLES



1.6 DETERMINING ISSUES AND DEVELOPING PLAN OBJECTIVES

The Plan objectives describe the main results and outcomes the Plan needs to achieve.

Key Floodplain Management Planning Requirements

A variety of issues were raised during public consultation on the Phase One investigations in 1996. These were the things the public thought were important about flood management in the Hutt Valley. Further input by the Technical Liaison Group enabled a broad list of floodplain management requirements to be assembled, including:

- minimising risks to life, health, safety and property
- providing clear advice about the flooding risk and the responsibilities for managing that risk
- maintaining and upgrading existing flood defences, and building new ones, to reduce flood risk to an acceptable and affordable level
- reinforcing non-structural measures to manage the residual, or flood risk left over once structural measures are in place
- balancing the reduction in potential flood damage, community disruption and trauma against the costs of flood mitigation measures
- considering timeframes for implementing improvements
- protecting the river's ecology from the adverse effects of river management activities
- recognising the river environment as an environmental asset, and actively maintaining and enhancing this environment
- providing for further assessment of small stream and stormwater flooding
- providing for tangata whenua to exercise kaitiakitanga
- providing adequate opportunities for the public and affected parties to evaluate options and influence decisions made
- facilitating a partnership between the three participating councils in developing the Plan.

Developing Plan Objectives

The key requirements above provided the basis for developing the Plan's objectives. These define the Plan's scope, decision-making needs and processes, floodplain management outcomes (what we hope to achieve), and ongoing community involvement. The objectives were agreed by the Hutt River Floodplain Management Advisory Committee after consultation with the three councils and the public.

The Plan's Objectives

Improving Floodplain Management

- Selected floodplain management measures constructed or established to an agreed standard are in place within the life of the Hutt River Floodplain Management Plan.
- Solutions for floodplain management that balance benefits and costs to the community are put in place.
- The selected measures account for a level of residual risk, which is acknowledged and accepted by the community.
- The mitigation of the current flood risk from floodplain tributaries is recognised and provided for by the appropriate authorities.

- A long-term programme is provided for achieving the outcomes of the floodplain management plan process in a manner generally acceptable to all stakeholders.

DO YOU WANT TO KNOW MORE ?

Ref 6: Drafting of Objectives

Ref 49: Living with the River

Also:
Newsletter No. 2

Involving the Community

- Clear advice and accurate information about responsibilities and risks of flooding are provided to the community.
- Sufficient information on the flood hazard is provided to enable agencies and the wider community to improve preparedness of their response to flooding and its adverse effects.
- There is no reduction in the quality of public access to and along the river and opportunities are taken to enhance public access.

Providing for Cultural Values

- The exercise of *kaitiakitanga* by tangata whenua is recognised and provided for.

Enhancing Environmental Values

- An Environmental Strategy that identifies measures necessary to maintain and enhance the environmental quality of the river and its corridor is an essential component of the Plan.

Incorporating Governance

- A partnership approach between Wellington Regional Council, Hutt City Council and Upper Hutt City Council is facilitated to manage the flood hazard through the annual plan and statutory planning processes.
- The active involvement of stakeholders is recognised and provided for in the decision-making processes.
- All interested and affected parties generally support the objectives of the Floodplain Management Plan.

1.7 THE MANDATE FOR FLOODPLAIN MANAGEMENT PLANNING

We have already outlined the decision-making framework, which tells you who is involved in making the decisions about floodplain management. But if they are to be acted upon these decisions need to be in line with national, regional and local legislation, regulations and policy, and they also ought to take heed of international best practice in floodplain management.

Having the authority to undertake floodplain management planning is called the legal mandate. Two pieces of legislation, the Resource Management Act 1991 and the Soil Conservation and Rivers Control Act 1941, provide the general mandate to produce and implement floodplain management plans. We take a brief look at these Acts, and other key legislation, below.

Taken together, the legislation, regulations and policy form a policy framework within which the decision-making must occur. Figure 8 summarises this framework and gives an overview of the additional key 'tools' involved in implementing the Plan's outcomes.

Floodplain Management Plans as Non-statutory Plans

The Regional Council's floodplain management plans and strategies are non-statutory plans. This means that its policies and flood mitigation methods have no legal standing as regulations. However, they will have considerable weight in any decision-making for two main reasons:

1. the public process followed to form floodplain management plans.
2. the Council's responsibility for flood protection in the region.

Resource Management Act 1991: Setting Flood Management Policy

Regional Policy Statement – sets regional approach

As part of its responsibilities under the Resource Management Act 1991, the Regional Council has prepared a regional policy statement. This provides an overview of resource management issues, and sets objectives, policies and methods for managing natural and physical resources.[6] It states that the Regional Council is principally responsible for setting policies to manage the flooding hazard. It also assigns primary responsibility to the district and city councils to provide rules for managing the effects of natural hazards on land[7] . This provides the basis for the city councils to develop non-structural land use planning regulations.

The Regional Council's role is not confined to setting policy. It also includes actions that the Council can take to manage floods. These responsibilities highlighted in the Regional Policy Statement support implementing floodplain management planning measures. They include

- identifying the risks of flooding
- assessing the impacts of flooding
- constructing structural measures
- providing information on the flood hazard.

Floodwaters subsiding near Alicetown, Lower Hutt, October 1998. R. Thomas©.

Regional and District Plans – provide policy and methods

The Regional Council and the Upper Hutt and Hutt City Councils also prepare regional and district plans, which must not be inconsistent with the Regional Policy Statement. These plans help the councils to carry out their resource management functions, including managing natural hazards and their associated effects. Objectives, policies and methods to manage flood hazards are developed to deal with the full range of floodplain management planning issues.

The Regional Freshwater Plan supports the Regional Council's development of floodplain management plans, and provides guidance for managing the development of flood prone areas.[8]

Upper Hutt and Hutt Cities' Proposed District Plans contain limited policies and methods for managing the flood hazard. This is mainly because the Hutt River Floodplain Management Plan, which contains information on local flood hazard effects, has been developed after the district plans were prepared.

6 *Relevant methods are contained in Section 11.7 (Natural Hazards) of the Regional Policy Statement.*

7 *This means land outside rivers, lake beds and the coastal marine area.*

8 *Relevant policies and methods are contained in sections 7.2 and 8.3 of the Regional Freshwater Plan.*

Soil Conservation and Rivers Control Act 1941: Doing Flood Protection Works

The Soil Conservation and Rivers Control Act 1941 gives the Regional Council the mandate to protect communities from flooding using the most appropriate methods.[9] This law also provides the Regional Council with the authority to undertake physical works (including structural measures) to mitigate erosion damage and protect property from flooding. This means that it is up to the Regional Council and the local community to determine those rivers requiring most attention and the nature of the works required. In the Wellington region, only rivers and larger streams of "regional significance" are managed by the Regional Council. City and district councils handle smaller urban streams and stormwater channels.

DO YOU WANT TO KNOW MORE ?

- Building Act 1991
- Civil Defence Act 1983
- Civil Defence Emergency Management Bill 2000
- Hutt City Proposed District Plan
- Local Government Act 1974
- Newsletter No. 5: Non-structural Measures
- Resource Management Act 1991
- Soil Conservation and Rivers Control Act 1941
- Upper Hutt City Proposed District Plan
- Wellington Regional Freshwater Plan
- Wellington Regional Policy Statement
- Wellington Regional Soil Plan

Other Legislation

Other legislation affects the Plan's implementation, including the Building Act 1991 and the Civil Defence Act 1983. The Civil Defence Act assigns the three councils with responsibilities for planning for and managing natural hazard emergencies and recovery from them. However, new civil defence and emergency management legislation is currently being formed, which will replace the Civil Defence Act.

The new legislation would add a wider focus on emergency management that includes

- managing the risks of natural hazards
- ensuring communities are more prepared to handle natural hazards
- encouraging more co-ordinated planning for natural hazard emergencies, between Councils, emergency services and utility services.

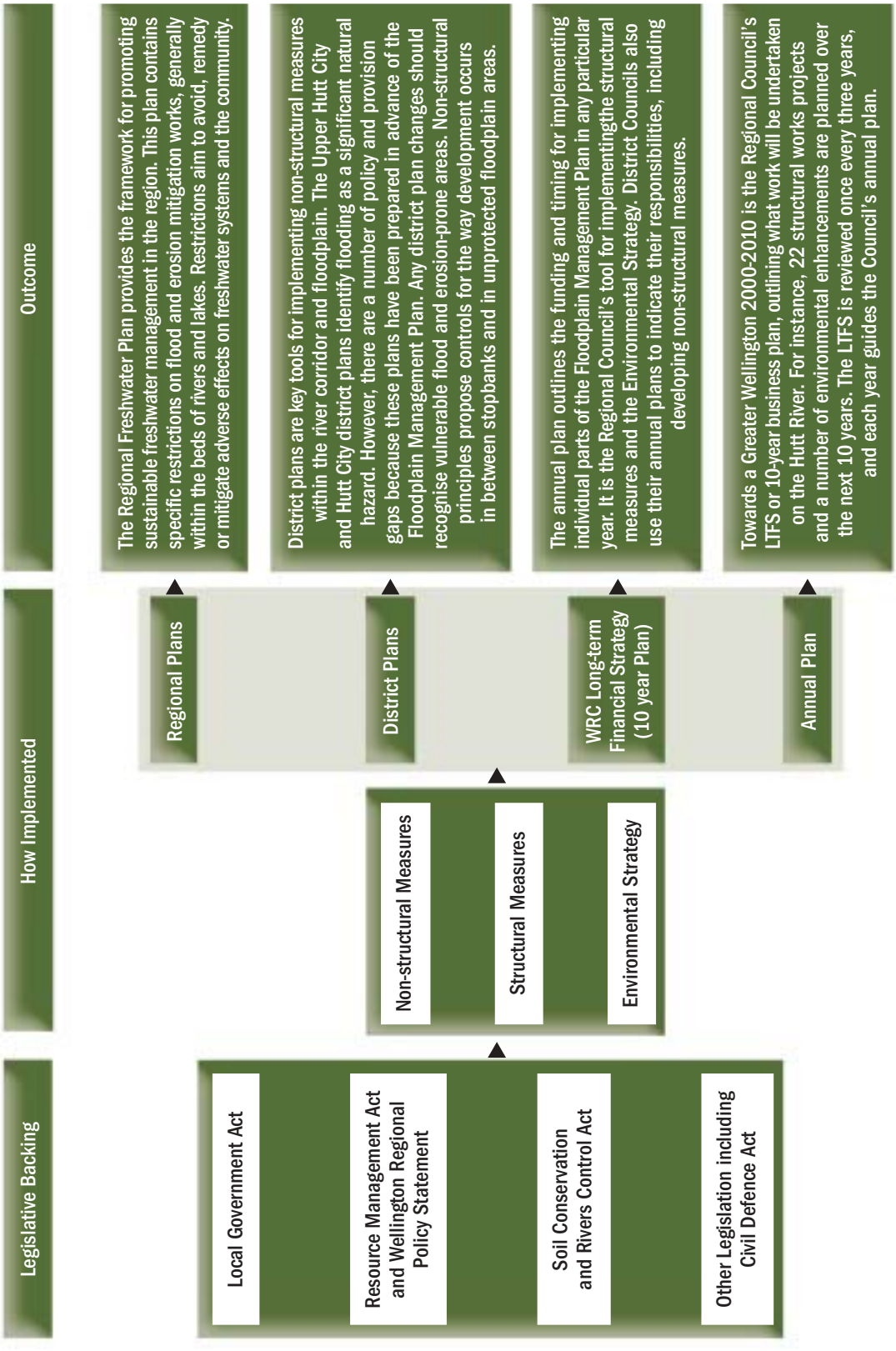
This means an overall approach based on the four Rs of risk reduction, readiness, response and recovery would be applied to emergency management in New Zealand. The Plan generally encourages a similar focus which, in relation to flooding in the Hutt Valley, is already part of the three councils' approach to flood emergencies.

The Building Act controls constructing, altering, removing or demolishing buildings. It contains provisions which require new buildings to avoid the flood hazard, and sets minimum floor level standards for new houses.

Go to **Appendix 2** for more information about regulatory responsibilities for managing natural hazards and managing the effects of flood protection activities on the environment. The appendix includes a discussion of the key sections of the Resource Management Act, Building Act and Soil Conservation and Rivers Control Act, and other tools used to implement floodplain management plans.

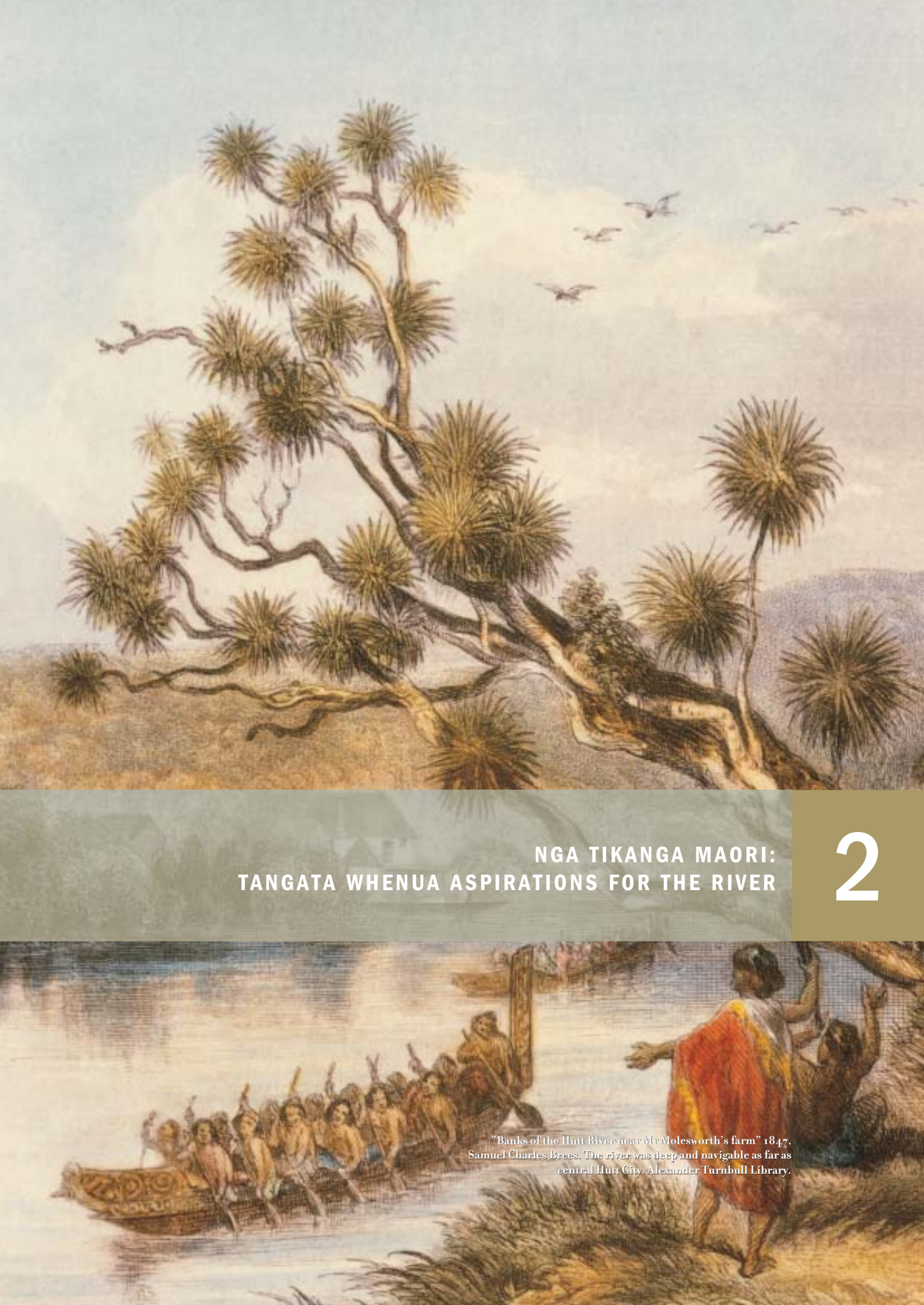
9 *This Act's mandate enabling regional councils to carry out wider floodplain management planning has been largely superseded by the provisions of the Resource Management Act 1991.*

FIGURE 8: POLICY FRAMEWORK FOR FLOODPLAIN MANAGEMENT PLANNING



NGA TIKANGA MAORI: TANGATA WHENUA ASPIRATIONS FOR THE RIVER

2



"Banks of the Hutt River near Mr Molesworth's farm" 1847, Samuel Charles Brees. The river was deep and navigable as far as central Hutt City. Alexander Turnbull Library.

TE TAIAO

"In Maori tradition, all elements of the natural world are related through whakapapa (genealogy). The Maori world was created through the union of Ranginui (the sky father) and Papatuanuku (the earth mother). In the beginning, these "primal" parents lay clasped together, and bore many sons. The first son, Tane, grew tired of living in the dark cramped space between his parents. With his feet placed against Rangi and his hands placed against Papa, he forced them apart, creating the space between earth and sky. He and his brothers, including Tangaroa, Tawhirimatea, Tumatauenga, Haumia and Rongo then escaped into Te Ao Marama (the world of light).

Following the separation of their parents, the brothers began to fight for dominance. Tangaroa became the god of the sea. Tawhirimatea decided to remain with his parents and punished his brothers by creating the wind. Tumatauenga became the god of war and Haumia and Rongo became the gods of wild and cultivated foods.

Tane set about creating his own dominion in the form of trees, birds, insects and other living things. He then sought to create human life, and succeeded by combining elements of both Rangi and Papa. He fashioned a female figure from earth, and breathed life – mauri – into her nostrils.

This view of creation embodies both the spiritual and physical elements of the created world: the earth representing those beings that are transitory, and the sky the realm of the undying.

Traditional Maori attitudes to the natural world reflect the relationships created through Rangi and Papa: all living things are their descendants and are thus related. Further, the sense of inter-relatedness between people and nature creates a sense of belonging to nature, rather than being ascendant to it as humans are born from "mother earth" and return to her on their death. In the traditional Maori view, everything in the natural world possesses mauri (the physical life force) which is protected by a Kaitiaki (spiritual guardian) or atua (deity). Humans possess mauri-ora, which is of a higher order than mauri but confers of humans a certain responsibility towards other living things. Preservation of the mauri of any element of the natural world is essential for its survival.

In Maori tradition, human action with respect to natural resources is regulated through the concepts of tapu and rahui. The modern translation of tapu as "sacred" fails to capture the full essence of tapu. Tapu implies a prohibition which, if violated, would have calamitous consequences, quite possibly death. Rahui is a temporary form of prohibition used to preserve birds, fish or any natural product. In many instances the rahui is indicated by a pou rahui, or post, which warns people against trespassing into the area of the rahui. A person's tapu can increase when they die. Rahui is used therefore when a person is drowned in a river. Even if their body is recovered immediately, gathering of fish is prohibited for a period sufficient for the remains of the person to be absent from the food chain. The system recognises the need to balance human need with the survival of a species or resource (the protection of its mauri).

The authority, or mana, to exercise these rules is delegated by the atua to chosen representatives through whakapapa (for example, to members of senior families). These representatives are rangatira (chiefs). Mana is reinforced by the people, providing the rangatira can fulfil their responsibilities. Rangatiratanga is the process of exercising mana."

From *Maori Values and Environmental Management,* Natural Resources Unit of Manatu Maori (Dept of Maori Affairs), 1991.

2.1 INTRODUCTION

This chapter describes *tangata whenua* values and aspirations for the Hutt River and its environment. The discussion builds on the work undertaken with tangata whenua during the development of the Hutt River *Environmental Strategy*. This Strategy is a key component of the Hutt River Floodplain Management Plan. This chapter identifies:

- the relationship between tangata whenua and the river
- known sites important to tangata whenua, including *waahi tapu*
- policy outcomes and methods for achieving tangata whenua aspirations.

2.2 AHI KAA ROA[1]

Te Ati Awa / Taranaki ki te Upoko te Ika Maui hold *manawhenua* over the Hutt River and Te Whanganui a Tara (Wellington harbour). Manawhenua can mean the customary authority exercised by an *iwi* or *hapu* in an identified area or the tangata whenua that hold this customary authority.

Tangata whenua are those who whakapapa to the original owners of the New Zealand Company (Wellington) Tenths Trust and to hapu lands in the Port Nicholson purchase block. This block was awarded by W.A. McCleverty in 1847 to residents of the several *pa* and *kainga* of Te Atiawa / Taranaki nui tonu. These original Tenths owners and hapu awardees belonged to Ngati Tawhirikura, Ngati Waiponga, Ngati Te Whiti, Ngati Hamua / Te Matehou, Ngati Puhoromanga, Ngati Tama, Ngati Mutunga, Ngati Tupaia and Ngati Haumia.

Manawhenua are today represented by the Wellington Tenths Trust. Te Runanganui O Taranaki Whanui ki te Upoko o te Ika Maui is another representative organisation. There are three remaining tangata whenua *marae*: Te Tatau o te Po, located at 437 Hutt Road, Lower Hutt; Pipitea at Thorndon Quay, Wellington; and Waiwhetu at Riverside Drive, Lower Hutt.

2.3 TANGATA WHENUA AND THE RIVER

Known today as the Hutt River, it is also known as Heretaunga or Te Awa Kairangi (literally, the river of greatest value or the highly esteemed river). The river is a *taonga* (treasure) to tangata whenua. Tangata whenua believe that all the elements of the natural world are related; the river cannot be separated from other parts of the environment. For tangata whenua, the mountains, the forests, the tributaries, the harbour, and the people are key components to consider in managing the Hutt River. Any plans for river management should recognise this holistic view of the environment.

Important associations between tangata whenua and the river with tupuna (ancestors), *mahinga kai* (food), and mana are found in the past settlements, gardens, marae and *urupa* along the river. These areas have special significance for tangata whenua.

The river has always provided transport and sustenance for Maori, including access to plants and birds found in the inland-forested areas. Sites along the river also provided other resources such as paru (a type of mud) for dyeing. Forest clearance and the 1855 earthquake radically altered the river, restricting river transport. Today, changes caused by modern settlement, particularly confining the river, have had a significant impact on traditional natural resource use.

1 *Literally, the long burning fires of occupation. See the Glossary for the definition of other terms or concepts italicised in this chapter.*

Kaitiakitanga is an essential part of the relationship between tangata whenua and the environment. Central to kaitiakitanga is successive generations' responsibilities to protect and nurture the mauri of their natural environment. The nature and form of kaitiakitanga is determined by tangata whenua and can change from area to area. Consequently, involving tangata whenua in activities affecting the Hutt River and its environment is essential to ensure their aspirations are met.

The river is still regularly used in summer by one or more waka, and for fishing. Tangata whenua maintain their right to take and manage resources from the river, and many still use this fishery. Fish such as kahawai, piharau, mullet, flounder, eels, and whitebait, as well as koura (freshwater crayfish) and watercress are harvested from the river. These rights are an essential component of kaitiakitanga.

2.4 WAAHI TAPU SITES[2]

In pre-European times, the whole of the river was important economically and spiritually to Maori. A combination of natural processes, and commercial and private development, has destroyed many important sites. This does not lessen their importance. There are a number of places that have special significance to tangata whenua today.

Important areas include waahi tapu (literally, *tapu* place or sacred place). Places can be tapu for different reasons. Some places, such as urupa, are extremely tapu. In some places tapu remains, even though the knowledge is not apparent. The discovery of taonga, or an unusual event, may indicate a state of tapu. Therefore, activities such as reclamation, earthworks or river works may result in a threat to, or the finding of, waahi tapu. The significance of a rediscovered site will invoke the kaitiaki responsibility of tangata whenua.

Two traditional Te Ati Awa urupa are still used on the floodplain. The Te Puni Street urupa in Pito One (Petone) contains tombstones sacred to the memory of Honiana Te Puni, paramount chief to Te Ati Awa. Te Kaeaea, a chief of Ngati Tama, is also buried at this site. The Owhiti urupa is in Seaview at the mouth of the Waiwhetu Stream and the Hutt River. Te Ati Awa people are also buried in other urupa that are not identified here.

Other significant sites are identified in the following tables.

Hitt River scene. Alexander Turnbull Library.

2 *The tables in this section are taken from information contained in G.L. Adkin, The Great Harbour of Tara – Traditional Maori Place Names and Sites of Wellington Harbour and Environment, Wellington, Whitcombe and Tombs, 1959.*

TABLE 2: SIGNIFICANT PLACES

PLACE	FURTHER INFORMATION
Pareraho Hills	The hills about Belmont on the western side of the Hutt Valley.
Te Pokai Mangumangu	A reference point on Te Ati Awa lands of the Wellington area.
Puke Tirotiro (peak)	A peak of the Maungaraki range, located by the trig station called Maori Point. The name indicates a Maori lookout point, meaning "hilltop commanding a wide view". This was a strategic viewpoint in times of war.

TABLE 3: PA SITES

PA SITE	FURTHER INFORMATION
Hikoikoi Pa	A stockaded Ngati Awa village at the mouth of the Hutt River, western side. Puwhakaawe was the chief of this pa.
Name unknown	This pa site is located by the Hutt River in Taita, on the landward side of Taita Drive.
Maraenuka Pa	A temporary pa built in 1841 and burned down in 1846, on the left bank of the Hutt River at the present site of the Lower Hutt sub station, off Connelly Street. Te Kaeaea or Taringa-kuri was the chief.
Motutara Pa	This pa site was on the east side of the Hutt river opposite the former Belmont railway station.
Owhiti Pa	At the mouth of the Waiwhetu Stream. The urupa at this site is still used.
Pito-one Pa	A stockaded pa of Te Ati Awa, situated about Te Puni Street, Pito-one. The chief, Honiana Te Puni, lived at Pito-one and was the Ariki or paramount chief of the Ati Awa people in occupation of the Wellington Harbour lands at the time of the arrival of the European settlers. After the arrival of the European settlers, the Maori occupants of Pito-one re-erected their village a little distance inland at a position on the Te Tuara-whati-o-Te Mana stream.
Pito-one Urupa	The Te Puni Street cemetery is on the eastern side of Te Puni street, Pito-one. It contains tombstones sacred to the memory of Honiana Te Puni and some of his descendants. Te Kaeaea or Taringa Kuri, the chief of Ngati Tama in the Wellington region at the time, was buried in this cemetery but his grave is not marked.
Ngutuihe Pa	On the end of a projecting spur of Puke-atua ridge below the existing Wainui–o-Mata road. Believed to have been a Ngati Ira pa. The name describes the beak of the garfish.
Te Mako	The place at Te Taitai (or Taita) where Wiremu Tako Ngatata lived, near the present Naenae railway station. The Te Ati Awa chief, Wiremu Tako Ngatata, selected the old site and lived there until the 1855 earthquake. The original pataka (storehouse) 'Nukutewhatewha' that Wiremu Tako Ngatata had built is currently located at the Dowse Museum.

Continued on next page

TABLE 3: PA SITES CONTINUED

PA SITE	FURTHER INFORMATION
Waiwhetu Pa	A Te Ati Awa pa on a sandy spit projecting into the estuary by the Waiwhetu River. It was occupied when Europeans arrived in 1840.
Puharakeketapu	Battle site on and close to the left bank of the Waiwhetu Stream. A battle took place between the allied tribes of Ngai Tahu and Ngati Kahungunu just before 1600AD when Ngai Tahu migrated to the South Island.
Paetutu Kainga	A Te Ati Awa kainga on the west bank near the Pipe Bridge. Originally it was built as a fortified pa site on an island in an area of swamp. Later it became an open village on firm ground on the right bank nearly opposite Lever Rexona.
Te Ahi-o-Manono Kainga	A former village near where British soldiers built Fort Redwood in 1854. It was located where Lower Hutt currently stands, immediately at the rear of the post office.
Hau-karetu	A Te Ati Awa village at Maoribank. The old kainga was probably located on the high terrace on the east side of the river, although it (or its cultivations) could have been on the low alluvial flats on the west.
Pa Whakataka	A Ngati Ira village (exact location unknown) but situated somewhere near the confluence of the Mangaroa and Heretaunga streams.

2.5 PARTNERSHIP

Te Tiriti o Waitangi, the Treaty of Waitangi, signifies a partnership between the Crown and Maori. The Courts have interpreted the principles of the Treaty as meaning that each party should act in good faith, in a reasonable and fair manner, and have an understanding of, and a willingness to accommodate, each party's views.

A good relationship with Te Ati Awa / Taranaki ki te Upoko o te Ika a Maui is essential for identifying and providing for Maori interests and values in managing the Hutt River and its environment. This includes providing input into managing the river and its environment.

Te Tuutohinga o te Whakaaetanga (The Charter of Understanding) provides the basis for the ongoing relationship between tangata whenua and the Council. The Charter exists within the context of the Treaty of Waitangi and the legislation that gives the Council its functions, duties and powers.[3]

The Plan will take into account Treaty obligations and acknowledges that the Hutt River is a taonga to tangata whenua. Incorporating kaitiakitanga into the river's management is consistent with the Treaty of Waitangi and the sustainable management of the Hutt River.

The following three sections outline the views of tangata whenua, the Regional Council and the methods to meet the aspirations of tangata whenua in the Plan.

3 *Te Tutohinga o te Whakaaetanga, The Charter of Understanding between the Tangata Whenua o te Upoko o te Ika a Maui and the Wellington Regional Council, Revised November 2000, p1.*

2.6 ASPIRATIONS OF TANGATA WHENUA

Tangata whenua believe that the management of the Hutt River and it's environment should aim to:

- stop the discharge of toxic and industrial wastes into the river, allowing flora and fauna to regenerate and be conserved (specifically, this should result in re-establishing watercress)
- re-establish swamps alongside the river to provide for flax and paru
- propagate native forest and plant species alongside the river
- provide adequate pest management strategies to protect native species.

The first three aspirations were identified in the process of developing the Hutt River Environmental Strategy with tangata whenua. The Environmental Strategy also identifies the traditional uses of the river and its environment, and Maori history of the river, as important.

Tangata whenua consider re-establishing native flora and fauna, and swamp areas, to be priorities. Many of the native species that once grew on the Hutt *floodplain* have cultural and historical significance. Some of these species are still present, but in low numbers. Opportunities exist to use species that are traditionally harvested, such as flax (*Phormium tenax*) and watercress (*Rorippa microphylla*). Increasing the number of species valued by tangata whenua is important for sustaining the traditional uses and values of these species.

Several traditional activities and rights are currently limited because of changes to the river environment and to the river's governance. The Hutt River Floodplain Management Plan needs to accommodate any such uses by tangata whenua and take into account traditional rights (for example, customary fishing rights and practices).

Hutt Valley history is not well known by many people. Significant cultural sites could be identified, if appropriate, with information boards describing their history. However, any interpretation of such sites requires expertise from tangata whenua regarding their cultural and historical values.

Korimako (Bellbird) feeding on harakeke (flax). Andrew Palmer 2001©.

2.7 POLICY OUTCOMES

This section, drawn from the Environmental Strategy, summarises the guidelines for ensuring that the needs and aspirations of tangata whenua are met in managing the Hutt River and its environment.

The long-term vision for Maori values identified in the Environmental Strategy is:

Protecting and enhancing the cultural values of the river and its margins.

The vision is supported by the following guidelines, which aim to:

- establish a mechanism for ongoing tangata whenua and community participation in the management of the linear park, ensuring tikanga is appropriately applied[4]*
- support Te Ati Awa to review the management of all existing sites and areas of cultural significance and prepare an action plan for their future management and protection*
- encourage tangata whenua to become involved in the interpretation of cultural values and sites, where appropriate
- protect sites and areas of cultural significance
- erect information boards at sites of cultural importance, where appropriate
- plant riparian margins and recreate wetland areas, where appropriate
- plant species of cultural importance, where appropriate
- allow for traditional uses of the river and its margins.

2.8 METHODS TO IMPLEMENT THE VISION

To meet the aspirations of tangata whenua, there need to be methods to implement the long-term vision and guidelines. Three broad areas, summarising the issues important to tangata whenua, are used to address these matters:

- safeguarding significant sites
- restoring native species
- including tangata whenua in managing the Hutt River.

A combination of the Hutt River Environmental Strategy, the Regional Policy Statement and the Regional Freshwater Plan is used as the basis for the following methods. All of these documents identify the relationship between tangata whenua and the river as an important consideration.

In addition, a joint project is proposed between tangata whenua and the Regional Council. This project would develop an implementation strategy to ensure that the requirements of tangata whenua are met.

Kereru (Wood Pigeon) basking. Andrew Palmer 2001©.

4 *The symbol * represents those guidelines identified in the Hutt River Environmental Strategy as having urgent priority.*

Safekeeping Significant Sites

The Regional Freshwater Plan identifies two methods to protect sites and areas significant to tangata whenua. These methods are developing protocols for sites, and plan changes to register sites. Identifying significant sites in the Environmental Strategy and in this Plan may also serve to educate and alert the public, potentially decreasing further damage to those sites.

A more formal way of protecting waahi tapu is to follow the heritage order process. A heritage order can be made to protect "any place of special interest, character, intrinsic or amenity value or visual appeal, or of special significance to tangata whenua" (RMA section 189). A heritage order means that the special character of the place cannot be disturbed without the consent of the relevant heritage protection authority.

Restoring Native Species

The Hutt River Environmental Strategy identifies potential areas for the restoration of native species. Although the Strategy is not directly funded, money is set aside from the Regional Council's operational and capital works budgets for planting native species along the river.

The possibility of recreating wetland areas is proposed in an area downstream of Totara Park. Several areas for planting natives have been identified, including the river mouth and estuarine reaches of the river, and upstream of Taita to Kaitoke Regional Park. Using ecological corridors as a way to further enhance the river and its environment underpins many of the proposals put forward in the Strategy for each reach of the river.

Using native species in plantings will increase the number of species culturally important to tangata whenua and better allow for traditional uses of the river. Increasing the native plants in an area will also enhance the habitat available for other native species, such as inanga (whitebait), kereru (wood pigeon) and tui, to re-colonise an area naturally.

Rata flower. R Lucas 2001©.

Including Iwi

Involving iwi in the wider implementation of the Plan is crucial to meet the aspirations of iwi and to fulfil the Regional Council's Treaty responsibilities. Iwi representatives are an integral part of the Hutt River Floodplain Management Advisory Committee, a steering committee that has had a critical role in developing both the Environmental Strategy and the Floodplain Management Plan.

The Environmental Strategy identifies the need for a mechanism to involve tangata whenua and the community in decision-making, reviews and implementation of the Strategy. The Strategy proposes that an over-arching management committee of tangata whenua representatives, officers and councillors from Upper Hutt and Hutt City Councils and the Regional Council investigate options and establish the preferred management framework.

The following proposed implementation project further seeks to include tangata whenua in the implementation, review and evaluation stages of the Hutt River Floodplain Management Plan.

Implementation Project

DO YOU WANT TO KNOW MORE ?

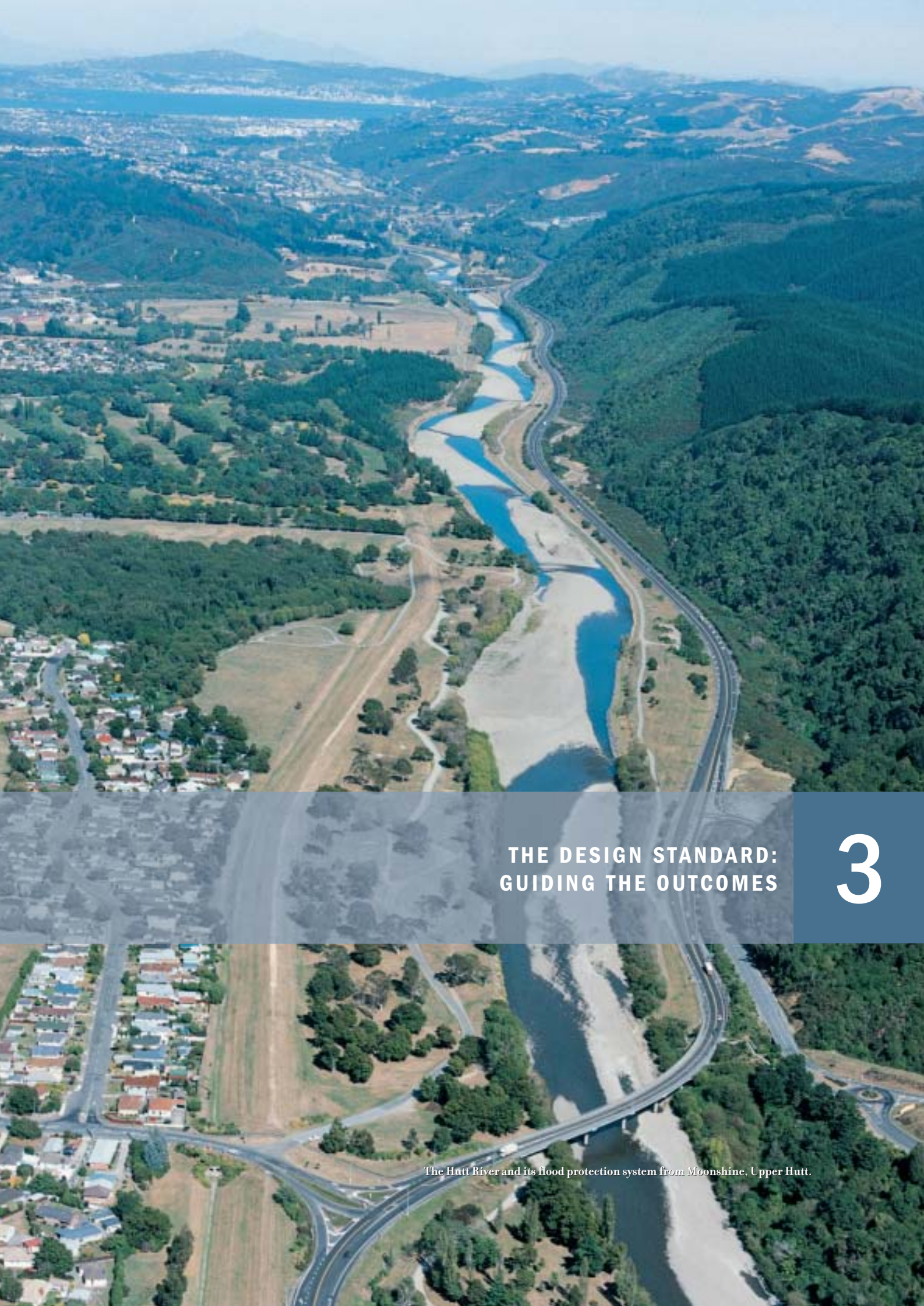
Contact the Wellington Tenths Trust for more information and further references.

The details and timelines for implementing the methods discussed above have not yet been determined. It is proposed that an implementation project be developed between iwi and the Regional Council that seeks to:

- identify current programmes involving the Hutt River and its environment, ensuring that an integrated approach to managing the river is adopted
- determine the most appropriate mechanism for including iwi in the Plan's implementation, review and evaluation
- develop appropriate protocols in future river management programmes, ensuring that the needs of tangata whenua are met and their aspirations addressed
- develop a realistic timetable to achieve the methods
- develop indicators to determine the success of the Environment Strategy and the Plan.

The implementation project would be ongoing throughout the life of the Plan, commencing in September 2001.

Kawau (Shags) in flight. Andrew Palmer 2001©.



THE DESIGN STANDARD: GUIDING THE OUTCOMES

3

The Hutt River and its flood protection system from Moonshine, Upper Hutt.

3.1 INTRODUCTION

When planning for flood protection we need to decide on the largest flood that our new and upgraded *flood defences* can safely contain. This is called the *design standard*, or design flood. The return period measures the chance of a flood occurring in any year (for example, a 1 percent or 100-year flood, which flows at 1900 *cumecs* in the Hutt River).[1]

The design standard not only gives us an indication of the maximum protection that our *structural* flood protection system can provide. It also influences the sorts of *non-structural measures* that may be appropriate.

Chapter Three discusses the design standard for the Hutt River, and the process and considerations that went into selecting it. It also provides policies supporting the design standard and wider principles of floodplain management planning. In many ways this chapter sets the scene for Chapters Four to Six, which cover the structural and non-structural measures, and the *Environmental Strategy*.

3.2 THE DESIGN STANDARD FOR THE HUTT RIVER

Risk-based 2300 Standard Selected

The agreed design standard for the Hutt River is a *risk-based 2300 cumec standard*. What does this mean? For a start, the risk-based approach applies varying protection standards to different areas in the *floodplain*, depending on how flood-prone they are. In other words, it treats the flood risk in a particular area on its merits. The 2300 cumec standard is the size of flood we are protecting against: one in which 2300 cubic metres of water flow past every second.

The risk-based standard for the Hutt River provides a 2300 cumec standard of protection to all floodplain areas except for small urban areas.[2] Its main features are:

- an emphasis on protecting existing urban floodplain areas
- upgrading all major *stopbanks*[3] to a 2800 cumec standard capacity (a rare flood), with remaining stopbank protection mostly to a 2300 standard (a 1 in 440-year flood)
- *bank-edge* and *berm protection* to a 1900 cumec standard (a 1 in 100-year flood) for isolated and small urban areas, and a 2300 cumec standard for main urban areas
- assistance for house raising
- replacing bridges at the end of their useful life, with new bridges and their associated floodways required to pass a 2800 cumec flood
- developing appropriate risk-based non-structural measures to complement the structural measures for the different flood-prone areas of the Hutt Valley (see Chapter Five).

How do we decide how much protection to give an area? The protection level chosen for each flood-prone area is mainly based on the:

- potential damage costs
- area and number of people affected
- area's vulnerability to flooding and erosion.

1 *A 100-year flood has a one percent chance of occurring in any year.*

2 *Small urban areas include Belmont and the Bridge Road – Gemstone Drive area of Upper Hutt.*

3 *Major stopbanks are those protecting the main urban areas of both cities.*

If you want to find out what level of structural protection will be provided for your area (or your *reach* of the river), a full discussion of each river reach and its proposed structural protection is provided in Chapter Four.

3.3 SELECTING THE DESIGN STANDARD

The Capacity of the Existing System

After the review of the Hutt River flood protection system in the late 1940s to 1950, it was decided that new works were required to contain a maximum flood of 100,000 cusecs[4] (approximately 2800 cumecs). Even then, this was regarded as a highly improbable flood.

Today, the capacity of the existing system is mixed. The stopbanks upstream of Kennedy-Good Bridge, except for a few reaches, are adequate to contain a 2800 cumec flow. However, the mix of bank-edge protection, berm widths and stopbanks lack the combined strength necessary to hold such flows. The reaches of the river downstream from Kennedy-Good Bridge have a much lower capacity and security. In fact, at the moment some sections of these stopbanks could breach during an event as small as a 50-year flood.

The existing bridges spanning the river corridor also influence the capacity of the existing system. They all have varying abilities to allow flood flows to pass beneath them. This information is presented in Table 4.

TABLE 4: HUTT RIVER BRIDGES – THEIR CURERNT FLOW CAPACITY

BRIDGE	PASSING 1900	PASSING 2300	PASSING 2800
Estuary	Yes	Yes	Yes
Ava rail	No	No	No
Ewen	Yes	Yes	No
Melling	Yes	Yes	No
Kennedy-Good	Yes	Yes	Yes
Pomare rail	Yes	Yes	Yes
Silverstream rail	Yes	Yes	Yes
Silverstream road*	No	No	No
Moonshine	Yes	No	No
Totara	Yes	Yes	No
Norbert Street foot	Yes	Yes	No
Akatarawa	Yes	Yes	No

** Flow for Silverstream road bridge excludes the floodway*

4 *A cusec is one cubic foot of water passing a given point every second.*

What Options Were Considered?

To begin with, several options based on uniform flood standards were developed, investigated and considered.

INITIAL OPTIONS		COST[5]
Option 1:	maintain status quo	
Option 2:	upgrade to a 1900 cumec standard (100-year flood)	$71 million
Option 3:	upgrade to a 2300 cumec standard (440-year flood)	$90 million
Option 4:	upgrade to a 2800 cumec standard (rare flood)	$107 million

Note: Ongoing costs to maintain and repair the flood defences are not included in the costs of the four options.

Option 1 would mean maintaining the existing system without any upgrade, but reinstating defences when damage occurs.

Option 2 would mean upgrading the system to provide acceptable flood security in a 1900 cumec (or 100-year) flood.[6] The 1900 cumec protection level is the minimum standard generally used for rivers in smaller and less developed floodplains throughout New Zealand.

Option 3 would mean upgrading the system to provide acceptable security in a 2300 cumec flood. This is the design standard used for the Ewen Floodway reach, including the bridge construction.

Option 4 would mean upgrading the system to provide security in a rare flood, represented by the 2800 cumec flood.[7] While rare, such a flood could occur in the Hutt River. This standard was seriously considered because major stopbanks in the floodplain's upper reaches are already constructed to the 2800 cumec flood. To provide an upper benchmark, the estimated *probable maximum flood* for the Hutt River is 7000 cumecs. In theory this is the greatest flood that could occur in the Hutt River, yet in reality having a return period of many thousands of years means it is extremely unlikely.

The Ewen Bridge and Floodway, located near the Lower Hutt CBD.

An additional yet vital consideration is that an upgraded system must be able to pass the design flood with acceptable security (that is, with a low chance of failure).

Developing Risk-based Options

Risk-based options were developed because the cost of the original blanket-approach options was too great. A risk-based approach allows each flood-prone area to be considered according to the flood risk and *hazard* it experiences, thereby combining appropriate protection with reduced overall costs.

5 *Costs are in 1999 dollars.*

6 *The flows associated with each option are measured at Taita Gorge in the Hutt River.*

7 *The 2800 cumec flow is 1.5 times greater than the 100-year flood flow. This is a common approach used in New Zealand's floodplain management planning to determine higher standard options for investigation.*

RISK-BASED OPTIONS		COST[8]
Option 1:	risk-based 1900 cumec standard	$54 million
Option 2:	risk-based 2300 cumec standard	$78 million
Option 3:	risk-based 2800 cumec standard	$85 million

Note: Ongoing costs to maintain and repair the flood defences are not included in the costs of the risk-based options.

Including Non-structural Measures

All design standard options assumed that non-structural measures governing land use and emergency management would form a major part of the overall approach to floodplain management planning in the Hutt Valley.

Evaluating Options

Having settled on a risk-based approach, and having identified the risk-based options, how did we go about deciding between them? Design standard options were compared using a number of criteria, which included:

- design constraints and uncertainties associated with higher design standards
- capital costs of the potential structural measures
- operational and maintenance costs over the design life of the structural measures
- expected flood damage repair costs to the system over the design life
- saved flood damages on the floodplain
- environmental effects of undertaking the physical works
- social effects (including benefits)
- economic benefits
- the community's willingness to pay.

Ewen Bridge in October 2000. It has the capacity to pass a 2300 cumec flood with added room for debris to move under the bridge.

The economic benefits of the options were evaluated by looking at:

- the saved flood damages minus the costs of measures (net present value)
- the ratio of saved flood damages to the costs of works (benefit/cost).

3.4 CONFIRMING THE RISK-BASED DESIGN STANDARD

The Hutt River Floodplain Management Advisory Committee considered detailed information on all the options. The Committee sought public feedback on the risk-based options in mid-1999 before agreeing on a design standard. The selected risk-based 2300 cumec standard is a mix of the Initial Options outlined above, representing the most cost-effective mix available.

The full cost of the risk-based 2300 standard is estimated to be $78 million – an increase on the original $72.5 million due to:

- raising major stopbanks to the 2800 standard
- financial assistance for house raising in the Belmont and Akatarawa areas
- additional edge protection at Belmont, Bridge Road and Gemstone Drive.

8 *Costs are in 1999 dollars.*

The 2300 Risk-based Standard Combines All Options

The risk-based standard selected provides a combination of structural works from the three initial options that maximises community safety and cost-effectiveness. For instance, for major urban areas the construction of 2800 stopbanks rather than the lesser 2300 standard provides a substantial increase in protection, which responds to:

- the potential impacts of climate change
- uncertainties about flood behaviour
- eliminating additional future environmental disruption by doing the work only once
- cost considerations – the additional cost of the higher stopbanks is only $4 million.

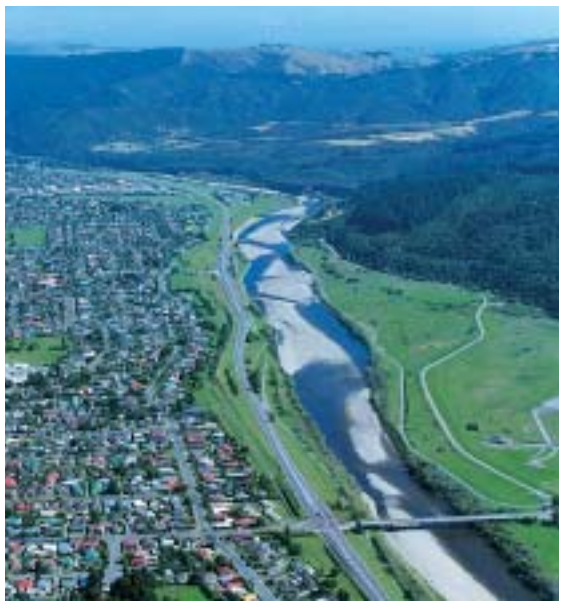
At the other end of the scale, providing stopbank protection to small local areas like Belmont and Bridge Road is neither cost-effective, practical, nor desired by these communities. Instead, 1900 standard bank-edge protection will be provided.

What Was Rejected?

For the major floodplain areas the 1900 cumec standard was rejected because:

- the likelihood of failure over a 100-year period is too high[9]
- ongoing recovery required from more frequent overtopping or breaching would not be practical
- damages and disruption following any failure are likely to be significant.

Alternatively, it was not cost-effective to apply the 2300 cumec standard throughout the valley. The 2800 cumec standard, while providing substantial protection, is considered far too costly, and would represent excessive protection for some flood-prone areas.



The Whakatikei to Moonshine reach, Upper Hutt, was progressively straightened between the 1950s and 1980s.

Risk-based Approach Applies to Non-structural Measures

Because structural and non-structural measures are interdependent, the risk-based approach chosen also applies to developing the non-structural measures for the Plan. This means a risk-based approach can be used to develop non-structural measures for the different floodplain areas.

9 *A 63% chance of flooding with the current climate, and up to 87% under a 35-year climate change scenario. See the Glossary for a full description of the 1900 cumec flood.*

3.5 POLICIES SUPPORTING THE DESIGN STANDARD

This section covers the specific policies that support the design standard – the issues and reasoning behind the standard. The policies have been derived from:

- the decisions that were made about the design standard
- the issues that arose during its development
- the wider principles of floodplain management planning.

DESIGN STANDARD POLICIES – QUICK REFERENCE	
Policy 1:	Ensuring Floodplain Management Planning Serves the Community
Policy 2:	Providing an Upgraded Flood Defence System
Policy 3:	Reinforcing the Selected Design Standard and Individual Measures
Policy 4:	Maximising Community Benefit by Prioritising Works
Policy 5:	Using Non-structural Measures to Manage Residual Risk
Policy 6:	Structural Measures Not Intended for Greenfield Areas
Policy 7:	Clarifying Floodplain Management Planning Roles

Policy 1: Ensuring Floodplain Management Planning Serves the Community

Issue

The Hutt River floodplain faces a substantial flooding hazard, which directly affects 106,000 residents of the Hutt Valley, including all 75,000 floodplain occupants (estimated 2000), and up to $6 billion of public and private property. The risk of severe damage and social disruption from a large flood to the Hutt Valley community is significant, with major implications for the regional economy.

While the nature of the flooding problem may appear massive, the floodplain management planning process can significantly reduce the flood hazard effects and associated impacts. It can do this in a variety of ways, including:

- improving public understanding of the flooding hazard and the ways people can prepare for flooding
- minimising risk to life, health and safety by implementing structural and non-structural measures
- providing opportunities to enhance the river corridor environment in a co-ordinated and strategic way
- ensuring the community is involved in determining and implementing flood mitigation methods.

Policy

The Regional Council, Hutt and Upper Hutt City Councils will:

- ensure the community recognises that flooding is a natural process and cannot always be fully prevented or controlled
- ensure careful planning and consultation with the community take place before flood mitigation methods are implemented
- avoid or reduce adverse flooding effects through carefully managing and timing the implementation of flood mitigation methods, minimising any resulting inconvenience to the community
- maintain community awareness of the flood hazard, and provide people with opportunities to improve their preparedness, which will enable them to cope better in a flood
- ensure the community understands the distinction between stormwater and river-based flooding
- ensure that the community is given adequate warning of an impending flood
- provide opportunities for community groups, iwi, businesses, the councils, other agencies and utility service providers to enhance the river environment through an environmental strategy.

Explanation

Implementing these policies will depend on each council's floodplain management planning responsibilities. Many policies presented above involve non-structural measures. Non-structural measures policy, discussed in Chapter Five, helps to clarify these responsibilities further.

Policy 2: Providing an Upgraded Flood Defence System

Issue

In many Hutt Valley floodplain areas the state of existing flood defences means that significant flooding could be life-threatening. In other areas the risks posed by large floods are not likely to be life-threatening.

Policy

The flood defence system will be upgraded to provide an appropriate protection level by minimising, as much as practicable, any significant threat to life. New stopbank defences are not necessary for areas where risks are not considered life-threatening. In those cases, the normal cycle of redevelopment will provide opportunities to protect flood-prone areas using non-structural measures at little cost to the wider community.

Explanation

A new or upgraded flood defence system must target communities at risk. Determining appropriate protection for any floodplain area requires a risk-based assessment of the threat to life. In some parts, including less undeveloped locations, the threat to life is minimal because significant flood impacts would be isolated to small flood-prone areas, and emergency management procedures could be highly effective. In those unprotected areas, non-structural measures will be relied on to improve safety and lessen potential flood damages. These measures – such as building higher floor levels and strengthening buildings – do not impose significant costs on the community.

Policy 3: Reinforcing the Selected Design Standard and Individual Measures

Issue

Specific issues about flood risk, climate change, environmental and social impacts, costs and economics influenced selecting a risk-based design standard. These included:

- increasing safety and reducing the potential damage, particularly for more populated areas
- recognising saved damage costs compared to the costs of structural measures
- recognising that the Hutt Valley's existing flood protection system is structurally based, and cannot be easily changed
- accounting for potential climate change scenarios that predict an increased frequency of larger floods
- avoiding repeated environmental impacts on larger urban areas as the result of a future increased design standard, because new stopbanks will already be in place
- accepting the relatively moderate additional costs of constructing higher stopbanks to protect larger urban areas.

The community's preference is the risk-based 2300 design standard as a minimum protection standard.

Policy

The Regional Council has endorsed the risk-based 2300 cumec design standard containing the following main features:

- major stopbanks protecting larger urban areas upgraded to the 2800 cumec standard
- 2300 cumec bank-edge protection to maintain the preferred river alignment and protect major stopbanks
- minor stopbanks protecting smaller urban areas (Manor Park, Totara Park and Whirinaki Crescent) upgraded to the 2300 standard, with associated bank-edge protection to the same standard
- 1900 cumec bank-edge protection, and financial assistance for raising houses to the 1900 standard, for smaller urban areas (Bridge Road and Belmont) where there are no stopbanks
- a 1900 cumec flood wall or assistance for house raising in the Gemstone Drive area, and a 1900 cumec stopbank and bank-edge protection for Gemstone Drive itself
- new and replaced bridges and associated waterways to pass a 2800 cumec flow.

Explanation

This policy reinforces the design standard's main features influenced by flood risk, climate change, environmental and social impact, costs, and economics. These in turn are directed by the community's preference, and political judgement and input.

Policy 4: Maximising Community Benefit by Prioritising Works

Issue

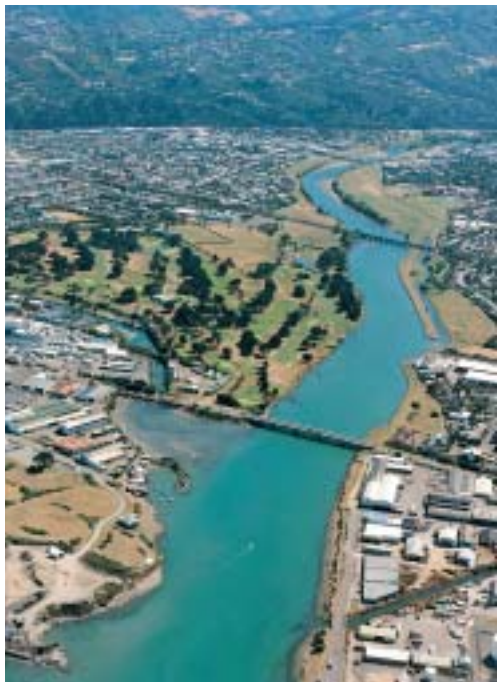
Upgrading the flood defence system can impose considerable social, economic and environmental costs on the community. For all works, the overall community benefit provided by each set of proposed structural works must be considered.

Policy

A strong benefit to the community should be achieved by prioritising the order of structural works to be carried out along the river. At the same time, the cost of constructing structural measures needs to be affordable to the community.

Explanation

Community benefit can be measured in a number of ways. This Plan has included a range of factors to determine overall benefit and established a priority order for completing structural works along the river.



Looking north from the Hutt River mouth. Structural works are planned to commence soon in the lower reaches of the river.

Calculating overall benefit for each set of works is strongly weighted towards potential saved damages, the number of people affected, and the significance of the threat to life. Measuring benefit also includes environmental and social factors such as reduced longer-term impacts on the river. There is an economic benefit when the saved damages over the design life of the structural measures exceed the costs of constructing and maintaining those works.

The extent of the community benefit has determined the priority of structural works along the river, and this has been detailed in Table 6 (Chapter Four).

Policy 5: Using Non-structural Measures to Manage Residual Risk

Issue

A residual or 'left over' risk still exists, regardless of the protection level selected. Regular flooding world-wide reveals that structural measures may fail or overtop, and alone do not adequately reduce flooding impacts.

Policy

Non-structural measures will be employed to help manage the residual risk and, in some cases, the full risk where no structural measures are proposed.

Explanation

Combined with structural measures, non-structural measures provide for integrated flood hazard management. This means the Plan recognises that a holistic and catchment-wide approach is needed to manage the flood hazard effectively.

Policy 6: Structural Measures Not Intended for Greenfield Areas

Issue

New development in greenfield and rural areas can ultimately place pressure on the wider community to provide flood and erosion protection.

Policy

The structural measures for the existing scheme, or additional works provided for under this Plan, will not be extended to protect new or greenfield development. Appropriate non-structural measures should be an integral part of new development.

Explanation

Structural works limit a river's natural processes by confining the river channel and potential flooded area, and they are highly costly to construct and maintain. Past development and channel realignment have created the current need for the substantial structural measures already in place. However, it is unreasonable for future development to be provided with the same structural flood protection, and this Plan does not provide for new works to protect greenfield sites.

Non-structural measures are generally a more suitable way to manage new development in greenfield areas because they avoid or limit exposure to the flood hazard and place costs on the developer and landowner rather than on the wider community.

Policy 7: Clarifying Floodplain Management Planning Roles

Issue

The Regional Council has a primary responsibility to facilitate floodplain management planning, as determined by the Regional Policy Statement, Soil Conservation and Rivers Control Act 1941, and Resource Management Act 1991. The city councils also share this responsibility, primarily determined by the Resource Management Act and the Regional Policy Statement.

Policy

The Regional Council will, together with the Hutt and Upper Hutt City Councils, facilitate floodplain management planning for the Hutt Valley. This will involve:

- preparing and implementing a management plan for the Hutt floodplain that will minimise the risk to life and property resulting from a flood
- constructing new and upgraded protection works to construction standards necessary to meet the design standard
- implementing catchment-wide non-structural measures to manage both primary and residual risk
- developing an environmental strategy to enhance the river environment
- periodically reviewing information collected from monitoring, and revising the Hutt River Floodplain Management Plan where the need arises
- clarifying the split in responsibility for managing stormwater and river flooding.

Explanation

The shared responsibilities stated above are discussed in Chapter One and Policy 19. While the Regional Council is the prime driver of the Plan's structural measures, the city councils provide input on the Plan's direction and design standard selection. The city councils' main role in the Plan is to implement non-structural measures.

3.6 ABOUT THE NEXT THREE CHAPTERS

In this chapter we have talked about the design standard. This is the big decision made, because it sets the framework for the sorts of flood mitigation measures and environmental projects that will be carried out.

The full Plan outcomes described in the next three chapters (Chapters Four to Six) are a combination of structural and non-structural measures together with an environmental strategy, and they will be implemented over the next 40 years. Figure 9 summarises the types of measures covered by this Plan.

DO YOU WANT TO KNOW MORE ?

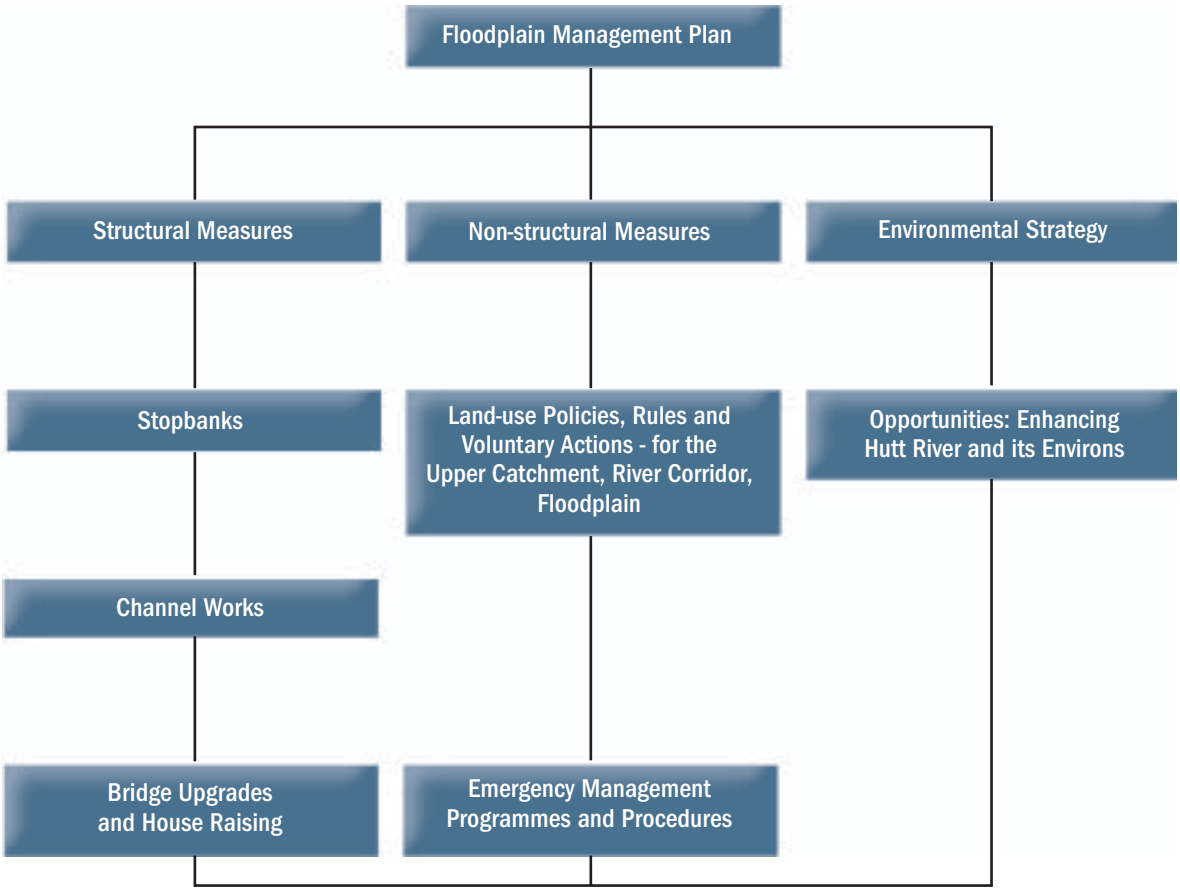
Ref 8:	Flood Frequency Update
Ref 10:	Flood Protection Business Plan
Ref 20:	Hutt Flood Defences Evaluation
Ref 28:	Hutt River Design Standard Process
Ref 29:	Hutt River Environmental Effects
Ref 30:	Hutt River Environmental Investigations
Ref 32:	Hutt River Flood Damages
Ref 35:	Hutt River Hydraulics
Ref 36:	Hutt River Mitigation Measures
Ref 37:	Hitt River Model Update
Ref 40:	Hutt River Phase 2/3 Completion
Ref 45:	Hutt River Risk Assessment and Hydraulics
Ref 49:	Living with the River
Ref 56:	Regional Council 10 Year Plan
Ref 57:	Regional Council Annual Plan
Ref 59:	Risk Assessment Review

Also:
Newsletter Nos 2 & 3: The Design Standard

Policies backing the three sets of Plan outcomes for the Hutt River are also presented in each chapter. The policies emphasise critical elements of the future floodplain management planning process, and the decisions and selected measures that have come from the floodplain management planning process so far, including:

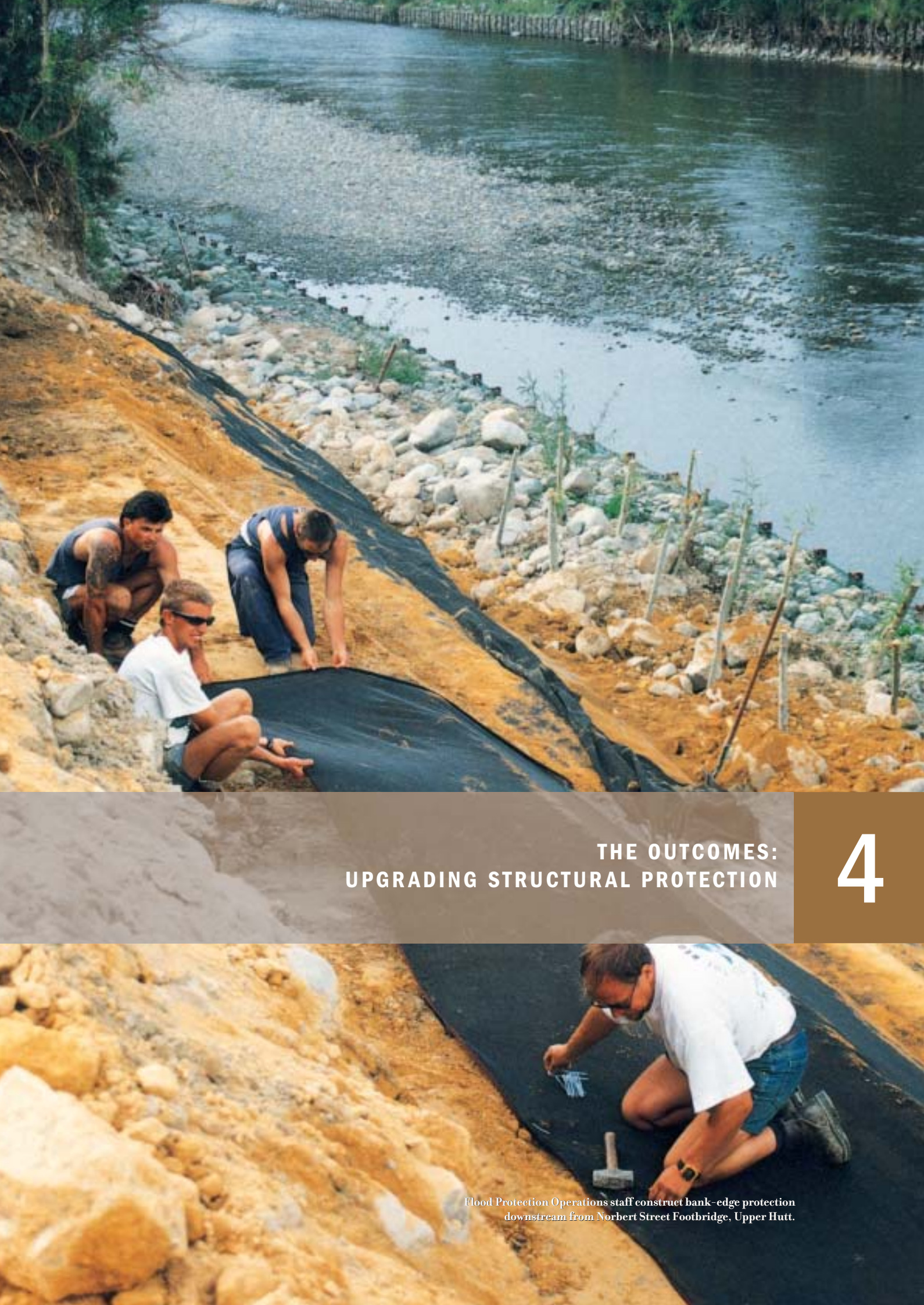
- the selected design standard
- the processes used to select flood mitigation measures and the Environmental Strategy
- key aspects of the selected measures and the Strategy, including general flood hazard and environmental requirements
- important aspects of operating practice
- the framework for implementing the Environmental Strategy
- city council, iwi and community involvement, decision-making and technical investigation processes – all essential for implementing the Plan
- city and regional council responsibilities
- key environmental and engineering requirements and standards.

FIGURE 9: SUMMARY OF FLOOD MITIGATION MEASURES



THE OUTCOMES: UPGRADING STRUCTURAL PROTECTION

4



Flood Protection Operations staff construct bank-edge protection downstream from Norbert Street Footbridge, Upper Hutt.

4.1 INTRODUCTION

Structural measures are what people usually first think about when it comes to flood protection. They are the physical flood protection structures and *channel management works* required by the Plan as the first defence against the *flood hazard*. Structural measures are designed to keep flood waters away from existing development. In the past, the Hutt Valley community has relied on this physical protection, which means that structural measures remain the dominant way of managing the flood hazard today.

Stopbanks are the most obvious examples. But if they are to be effective, these flood defences need to be protected from erosion by the river. This is done using bank-edge works and active channel management. *Rock linings*, vegetation buffers and groynes are *bank-edge works* and river *berms* which protect flood defences like stopbanks by maintaining the channel's position. Active channel management methods include *bed and beach re-contouring* and gravel extraction. They are used occasionally to reduce the opportunity for the river to erode its banks and damage structural works. Finally, bridge upgrades improve flood capacity and avoid the risk of debris dams forming, again helping to preserve a secure flood protection system.

This chapter describes the structural flood mitigation measures selected for the Plan, and presents policies that support these measures. It allows you to see what sorts of physical flood protection measures will be carried out in your area.

4.2 STRUCTURAL MEASURES

Structural measures are designed to protect people and assets from flooding up to a specified standard. For the Hutt River that standard is the *risk-based 2300 cumec design standard*, described in Chapter Three. A risk-based standard means that work done will be based on the specific flood risk of each area, which is the most cost-effective way to offer the best protection.

Specific Structural Measures

Under the proposals in this Plan, major *floodplain* areas that could suffer significant flood damages will gain upgraded and new stopbanks to the 2800 cumec capacity. These stopbanks will be protected by 2300 cumec standard river-edge and *berm* protection. Major floodplain areas include all urban areas except for Totara Park, Manor Park, Heretaunga (at Whirinaki Crescent), Belmont and Akatarawa (at Gemstone Drive and Bridge Road).

Minor floodplain areas, or locations where development is sited close to the river's edge, will gain either stopbank protection to the 1900 or 2300 cumec standard, or assistance to raise houses to the 1900 cumec standard. Figure 10 compares a typical existing and upgraded stopbank profile, to provide an indication of the differences in shape, height, width and position on the river berm.

Here is a brief summary of the specific measures for the different areas of the Hutt Valley.

Lower Valley:

- major stopbanks to the 2800 standard, with associated bank-edge protection to 2300[1]
- Manor Park stopbank to the 2300 standard
- Belmont edge protection to the 1900 standard, plus assistance for house raising to 1900.

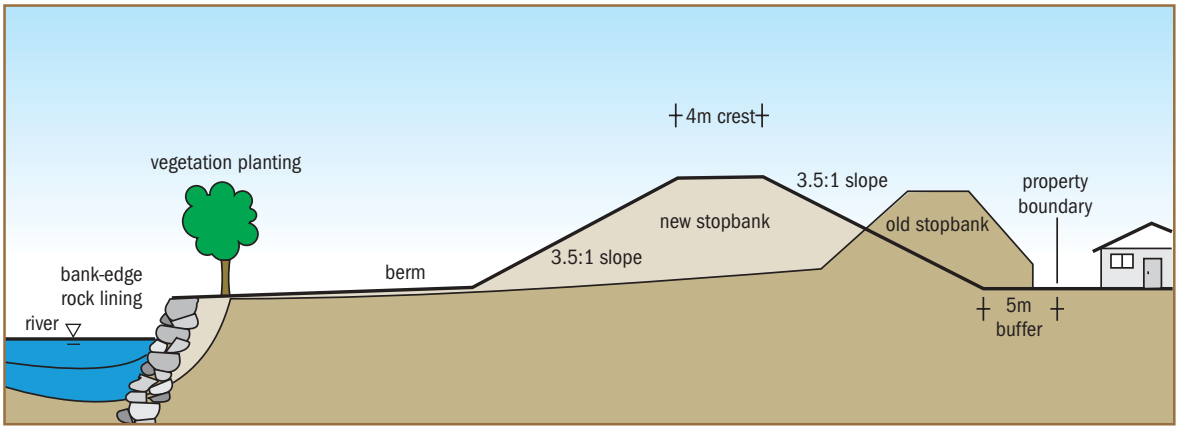
Upper Valley:

- major stopbanks to the 2800 standard and associated edge protection to 2300[2]
- Whirinaki Crescent stopbank to the 2300 standard
- Bridge Road edge protection to the 1900 standard, plus assistance for house raising to 1900
- Gemstone Drive stopbank and edge protection to the 1900 standard, plus floodwall to 1900 or assistance for house raising to 1900
- Totara Park stopbank to the 2300 standard.

Undertaking these works will inevitably create some disturbance to surrounding areas, but people need not worry that the bulldozers will simply turn up one morning. As structural works are completed over the next 40 years, the community will be consulted during the design and resource consent application stages. Ongoing consultation will ensure that we achieve the required protection level in an appropriate way.

The river downstream of the Hutt Gorge at Te Marua has been divided into *reaches*, and a reach-by-reach description of the structural measures follows shortly ('Structural Measures by Reach'). The descriptions include reach plans, works detail, and the cost and timing of works. More information about the process that determined the structural measures is provided in 'What the Policies Cover' later in the chapter.

FIGURE 10: COMPARING EXISTING AND UPGRADED STOPBANKS



1 *East side: Estuary Bridge to Pomare Bridge. West side: Estuary Bridge to Melling Bridge.*

2 *Trentham Memorial Park to Maoribank on the east side.*

What Process was used for Developing Structural Measures?

Measures were developed in the following way:

1. Estimate the flood characteristics and flood levels for the *design flow* considered.
2. Determine stable channel alignments and minimum berm widths.
3. Develop bank-edge protection measures for the design flow considered.
4. Identify deficiencies in the existing river alignment and stopbank system.
5. Identify sections of stopbanks where overtopping or breaching can occur.
6. Develop solutions for raising, strengthening or reconstructing stopbanks where necessary.

Other methods for reducing flood flows and flood levels in the river were also considered. They included constructing reservoirs to detain flood waters in the *upper catchment*, and methods for reducing the flood levels on the floodplain in the event of a failure. However, these measures were not selected (see Policy 16).

Programmed Works Until 2010

Structural works have been programmed until 2010 under the Regional Council's Long-term Financial Strategy (LTFS). These works are shown in Table 5, and described in more detail in 'Structural Measures by Reach'.

TABLE 5: PROGRAMME FOR STRUCTURAL WORKS PROJECTS UNTIL 2010

	COMMENCES	FINISHES
Ava to Ewen river realignment and stopbank upgrade	2000/01	2009/10
Ava railway crossing waterway improvements	2000/01	2007/08
Melling Bridge waterway study	2001/02	2001/02
Moonshine Bridge waterway study	2002/03	2002/03
Belmont edge-protection works	2002/03	2003/04
Belmont house-raising opportunities	2003/04	2006/07
Bridge Road house-raising opportunities	2003/04	2006/07
Bridge Road edge-protection works	2004/05	2004/05
Akatarawa Road flood defences / house-raising opportunities	2004/05	2004/05
Gemstone Drive stopbank upgrade	2004/05	2005/06
Whirinaki Crescent stopbank upgrade	2004/05	2005/06
Boulcott / Hutt stopbank upgrade	2006/07	Next LTFS
Lower Hutt City Centre stopbank upgrade	2008/09	Next LTFS

All structural works projects will include preliminary design work and resource consent investigations. The locally affected communities will be involved in these investigations, providing feedback on design detail, associated environmental enhancements, and the effects of structural works. In most cases these preliminary investigations and the resource consent application process could take well over a year before construction work commences.

Structural Measures Priority Schedule

The Structural Measures Priority Schedule (Table 6) shows the level of potential benefit to floodplain areas provided by the structural works, and gives a guide to the priority of works to be undertaken. This means works further down the priority schedule are more likely to be completed later in the 40-year programme of this Plan.

How soon the structural work in your area should be carried out was decided on the basis of a number of weighted criteria (components). Works were ranked according to a number of simple indicators that made up each component. The components and weighting used are:

COMPONENT	WEIGHTING (%)
economic benefit	60
existing protection level in each reach	10
area and population affected	10
social benefits	10
environmental benefits	10

The approach used to measure priority is simple, certain and reasonably objective. The floodplain was divided into 13 reaches representing groups of common works, rather than ranking the 39 individual works. Rankings represent a comparison between today's situation and the potential benefits provided by the upgraded system for each reach area: the greater the benefits, the higher the score.

If you want more detail on this, Appendix 5 covers the method applied to develop the Structural Measures Priority Schedule, including the indicators and criteria used to measure the priority of works.

The priority of works set out in Table 6 are also presented reach by reach in 'Structural Measures by Reach'.

Modifying Works Priorities

The Regional Council's LTFS process modified the order of works up to 2010 by including works to protect smaller and relatively unprotected urban communities. The urban areas that will have protection works brought forward are vulnerable to more regular flooding and erosion from the river. These areas are:

- Belmont
- Bridge Road – Akatarawa
- Gemstone Drive – Akatarawa
- Whirinaki Crescent – Heretaunga.

The LTFS is produced once every three years, and allows the Regional Council and the community to review works, priorities and funding for the following 10 years. The next LTFS review will commence in 2002.

TABLE 6: STRUCTURAL MEASURES PRIORITY SCHEDULE

	PRIORITY RANKING	TOTAL COST (1999$)	AVERAGE ANNUAL FLOOD DAMAGES SAVED	FINANCIAL BENEFIT-COST RATIO	ECONOMIC BENEFIT	PRESENT LEVEL OF PROTECTION (RETURN PERIOD YEARS)
Weighted Value for Components					60%	
Ava to Kennedy-Good Bridge (LB)	1	19,207,300	3,004,100	2.53	0.47	50
Shandon Golf Course (RB)	2	4,478,000	1,361,300	5.05	0.45	100
Ava to Melling RB	3	14,795,100	1,793,700	2.01	0.32	50-100
Kennedy-Good Bridge to Pomare (LB)	4	2,649,000	402,400	2.54	0.23	>100
Whirinaki Street (LB)	5	471,500	110,500	4.03	0.29	50
Mouth to Ava (LB)	6	7,613,000	351,300	0.77	0.14	100
Bridge Road House Raising (RB)	7	180,000	8,000	0.76	0.09	50
Silverstream to Moonshine (LB)	8	2,736,600	136,700	0.84	0.11	100
Belmont House Raising (RB)	8	450,000	16,500	0.63	0.09	50
Moonshine to Totara Park (RB)	10	6,380,600	170,200	0.44	0.10	50-100
Whakatikei to Maoribank (LB)	10	3,764,000	116,500	0.52	0.10	>100
Gemstone Drive (LB)	12	1,508,900	40,500	0.46	0.08	50-100
Pomare to Silverstream (LB/RB)	13	2,326,600	3,500	0.03	0.06	100
Others (Land Purchase, etc.)		12,038,600				

PRESENT PROTECTION LEVEL	NUMBER OF PEOPLE DIRECTLY AFFECTED	AREA AFFECTED (HA)	POPULATION /AREA	SOCIAL BENEFITS	SOCIAL	ENVIRONMENTAL BENEFITS	ENVIRON-MENTAL	TOTAL VALUE
10%			10%		10%		10%	100%
0.10	25000	600	0.10	0.53	0.05	0.56	0.06	0.78
0.05	12000	350	0.06	0.27	0.03	0.63	0.06	0.65
0.08	16000	250	0.06	0.37	0.04	0.59	0.06	0.56
0.03	12000	450	0.07	0.41	0.04	0.43	0.04	0.41
0.10	700	13	0.01	0.02	0.00	0.00	0.00	0.40
0.05	8000	250	0.04	0.33	0.03	0.31	0.03	0.29
0.10	90	5	0.01	0.39	0.04	0.06	0.01	0.26
0.05	6000	170	0.03	0.17	0.02	0.36	0.04	0.25
0.10	200	6	0.01	0.39	0.04	0.06	0.01	0.25
0.08	3000	100	0.02	0.12	0.01	0.30	0.03	0.24
0.03	10000	300	0.05	0.11	0.01	0.53	0.05	0.24
0.08	300	15	0.01	0.05	0.01	0.18	0.02	0.20
0.05	250	15	0.01	0.05	0.00	0.07	0.01	0.14

4.3 STRUCTURAL MEASURES BY REACH

This section describes the structural works that will be undertaken in the different reaches along the Hutt River. We begin at the river mouth and work our way up the river. The works for each reach are shown on a plan diagram (Figures 11 to 21), and the priority of the works, their timing and cost are also provided.

Flood waters rise high on Silverstream road bridge, Upper Hutt, October 1998

MOUTH REACH: RIVER MOUTH TO ESTUARY BRIDGE *(XS 0003-0100)*

The mouth reach is where the river meets the sea, and is characterised by its wide, estuarine nature. The channel is bordered on the true left[3] by the Port Road reclamation, and on the true right by an estuary with boat moorings, the gravel extraction plant located on the sand spit, Hikoikoi Reserve and the Hikoikoi Pa site at the mouth of Te Mome Stream.

FIGURE 11

REACH 1 – River Mouth to Estuary Bridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
6	River mouth channel works (LB/RB)	3.65	Beyond 2010

Channel Works

Channel Management

Gravel extraction is the main channel management method used in this reach. Annual extraction of 50,000 cubic metres per year will continue. The extraction area is generally downstream of cross-section 0070, with a limit of 4,000 cubic metres per year between cross-sections 0030 and 0070 to help the recovery of bed levels in the vicinity of Estuary Bridge.

Design Channel Alignment

The bank edge of the Port Road reclamation defines the left bank edge of the *design channel* alignment. This alignment will continue to be maintained using a rock lining. The design channel alignment on the right bank differs from the *hydraulic line* alignment in that it tapers more sharply from the river mouth boat harbour to Estuary Bridge. The alignment requires removing up to a 45-metre width of material from the spit's eastern side along approximately 250 metres.

Stopbanks

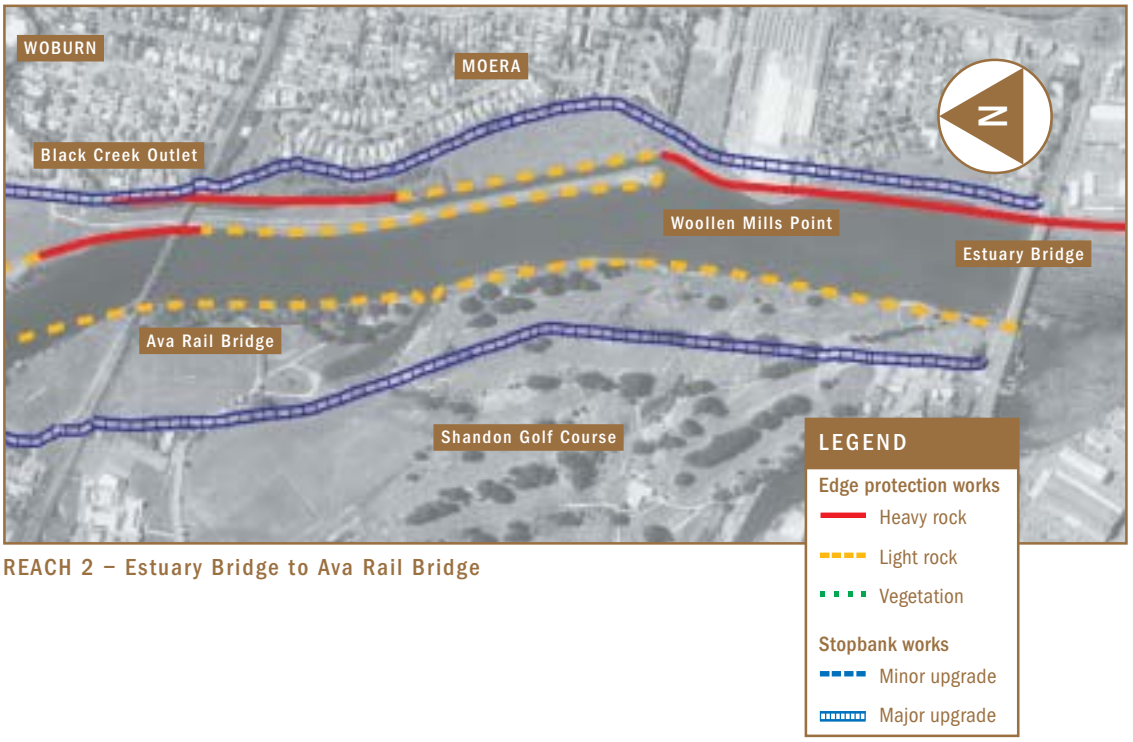
No new or upgraded stopbanks are proposed for this reach.

3 *The true left bank is the left hand side of the river when facing down stream.*

MOERA/PETONE REACH: ESTUARY BRIDGE TO AVA RAIL BRIDGE *(XS 0100–0210)*

The channel here is bordered on both sides by low-lying floodplains. Shandon Golf Course and Sladden Park are on the true right river bank. The Black Creek training bank occupies much of the left bank at the upstream end of this reach. Downstream and landward of the training bank there is light industrial and residential development. Community assets on both sides of the reach are protected by stopbanks.

FIGURE 12



REACH 2 – Estuary Bridge to Ava Rail Bridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
1	Ava rail bridge investigations	0.23	2000–2002
1	Ava rail bridge waterway improvements	4.77	2003–2008
2	Shandon Golf Course (RB) stopbank	1.72	Beyond 2010
2	Light rock protection works (Estuary to Ava rail bridge)	0.43	Beyond 2010
6	Woollen Mills (Estuary to Ava LB) stopbank	3.99	Beyond 2010
6	Relocation and rock lining (Estuary to Ava LB)	2.20	Beyond 2010

Channel Works

Channel Management

Dredging the Black Creek outlet channel will continue (assuming the outlet is retained).

Design Channel Alignment

The design channel alignment in this reach generally follows the existing channel. The only place where the alignment differs significantly is in the vicinity of Woollen Mills Point. Here the river and stopbanks will be realigned. This will involve:

- removing the end of Woollen Mills Point (setting back the bank edge by up to 20 metres) along approximately 90 metres, then reshaping the bank and building out the rock line by up to 10 metres along 280 metres downstream of the point)
- realigning the stopbank at Woollen Mills Point to provide a minimum 15-metre berm between the new stopbank toe and the top of the new river-bank rock line.

The design channel alignment assumes that Ava rail bridge and the Black Creek training bank will be retained in their current positions. However, the outcomes of investigations into improving the hydraulic capacity of the bridge, and the possibilities of removing the training bank, will determine if there is an opportunity to realign the design channel towards the true right bank. This will allow the bend through the railway bridge to be eased and the downstream reach to be straightened, and will also provide more berm area adjacent to the left bank stopbank.

Stopbanks

Right Bank

Stopbank upgrades are proposed for the entire reach, and as there are no space limitations the preferred stopbank profile can be provided. The preferred profile has a top width of 4 metres and 3.5 to 1 *batters*.

Left Bank

The stopbanks will be upgraded to the preferred profile, including a 5-metre access buffer where possible, and will join up to the realigned Ava to Ewen Floodway immediately upstream of the reach. At Woollen Mills Point a new stopbank will be constructed on a new alignment. Some property purchase will be required to complete this work (identified in Appendix 3).

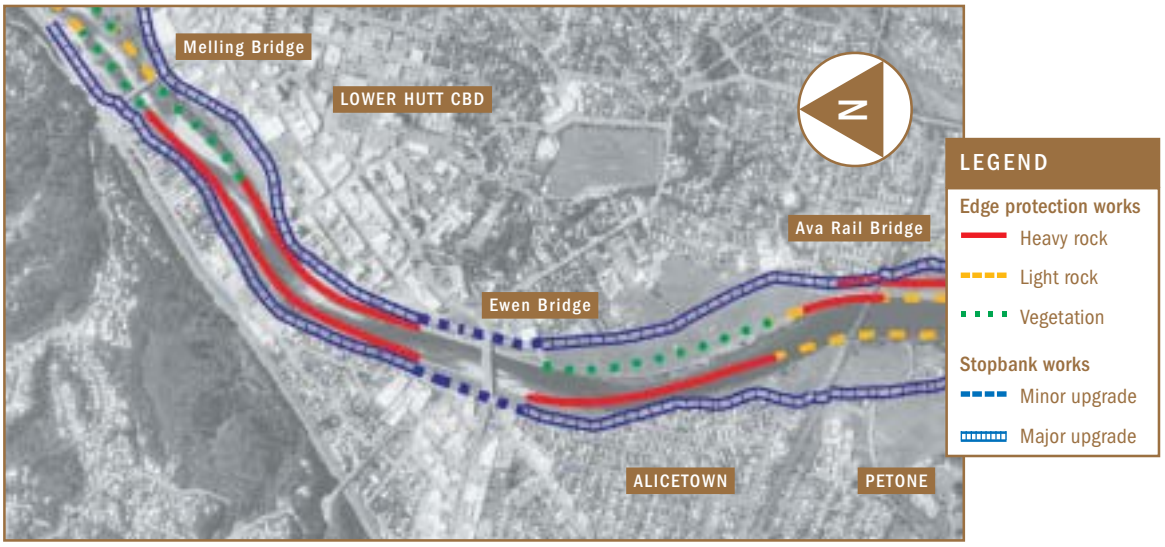
Ava Rail Bridge

Options for improving the Ava rail bridge to pass a 2800 cumec flood will be investigated. The Regional Council and Tranz Rail will jointly develop an acceptable bridge upgrade strategy by June 2002. The strategy is likely to cover improvement timing, bridge design standards, and impacts on adjacent flood protection works.

CBD/ALICETOWN REACH: AVA RAIL BRIDGE TO MELLING BRIDGE *(XS 0210-0440)*

This reach takes in a transition in the river. As it flows down the valley it moves away from its alignment along the Wellington Fault and adapts to the sea level control at its mouth. The reach is characterised by heavy residential and commercial development on the floodplain, protected by stopbanks that are often located very close to the river.

FIGURE 13



REACH 3 – Ava Rail Bridge to Melling Bridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
3	Melling Bridge investigations	0.06	2001–2002
3	Strand Park (Ava to Ewen RB) river realignment and land purchase	4.48	2000–2005
3	Tama Street stopbank upgrade (Ava to Ewen RB)	2.48	2000–2007
1	Strand Park stopbank upgrade (Ava to Ewen LB)	2.64	2000–2010
1	Daly Street (Ewen to Melling RB) stopbank upgrade and land purchase	4.61	Design starts 2008–2009
3	Marsden Bend (RB) channel works	1.91	Beyond 2010
3	Pharazyn Street (Ewen to Melling RB) stopbank	3.70	Beyond 2010
1	Riverside car park channel works (LB) and light protection works (Ewen to Melling LB)	1.78	Beyond 2010
14	Land for Melling Bridge upgrade (LB)	8.00	Beyond 2010

Channel Works

Channel Management

Gravel extraction is proposed between Ewen Bridge and Kennedy-Good Bridge. Annual extraction of 10,000 cubic metres from five or six beaches will be undertaken in the CBD and Boulcott reaches.

Design Channel

The design channel through this reach is a smooth transition from the narrow meander form upstream of Ewen Bridge (a 70-metre-wide channel with a minimum of 15-metre-wide berms), to the wider channel form downstream (a 90-metre-wide channel with a minimum of 20-metre-wide berms). Upstream of Ewen Bridge the design channel generally fits the existing channel. In this part of the reach, the only significant realignments required are on the left bank at the Riverside car park and the right bank upstream of Marsden Bend.

At the Riverside car park the bank edge will need to be taken back by up to 20 metres along a 270-metre stretch. The channel through Tama Bend between Ava and Ewen Bridges requires substantial realigning. Both channel banks will be reconstructed over a length of about 700 metres, gaining about 40 metres of berm on the right bank, and a maximum setback of about 50 metres on the left bank. Bank edges will be protected by substantial rock lining. Land purchase will be required.

Stopbanks

Right Bank

Upgrading the existing stopbanks by raising and straightening is proposed for this reach. They will be upgraded to the preferred[4] profile at the realigned floodway position. Buffer space is provided where possible, and no property purchase is required.

Crest walls or other arrangements adjacent to Ewen Bridge will be investigated. Next to Marsden Bend the existing stopbanks require a retaining wall on the street side to avoid purchasing property.

Left Bank

The existing stopbanks will be raised to the preferred profile and straightened, including a 5-metre buffer where possible. Some property purchase is required within the river corridor.

Crest floodwalls or other arrangements adjacent to Ewen Bridge will be investigated. The downstream toe of the stopbank extends into car parks in Daly Street. Tied retaining walls or an adjusted stopbank profile will be considered next to the car park.

Melling Bridge

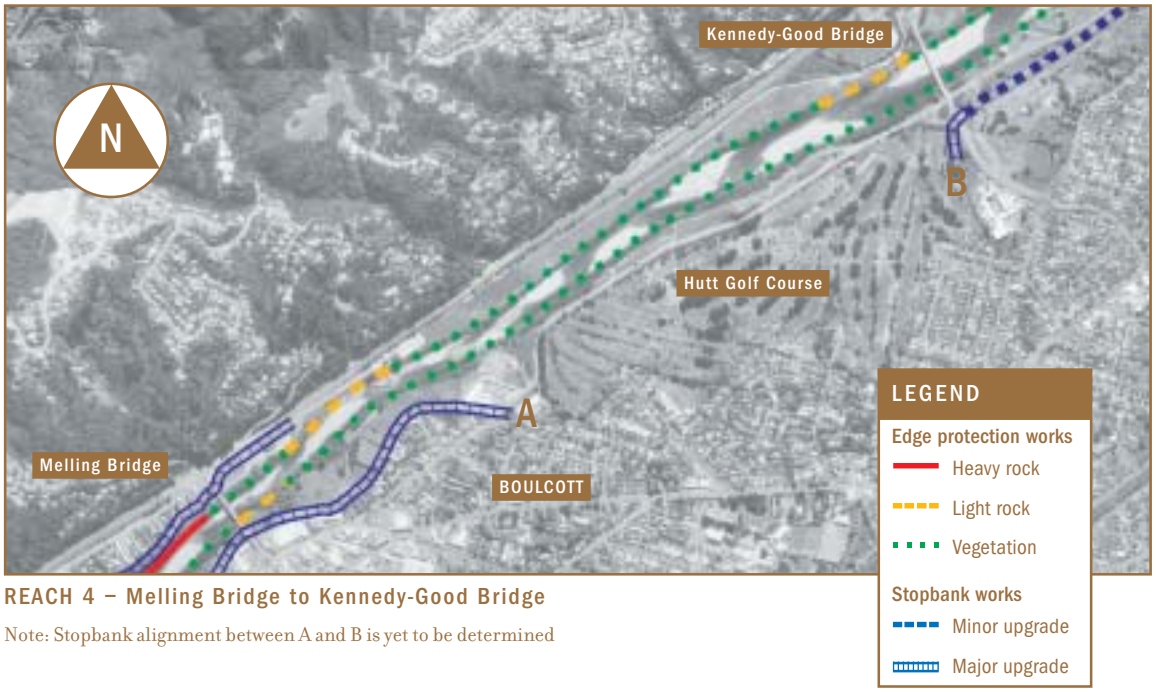
Bridge flood capacity requirements to meet the 2800 cumec design standard will be investigated.

4 *The preferred stopbank profile has a top width of 4.0m and 3.5 to 1 batters.*

BOULCOTT REACH: MELLING BRIDGE TO KENNEDY-GOOD BRIDGE *(XS 0440-0660)*

The main feature of this reach is the change in channel gradient in the vicinity of the Hutt Golf Club. This gradient change is represented by a decreased channel width extending downstream from the change in grade for approximately 1.5 kilometres. The reach is bounded by State Highway 2 on the right bank, and the Hutt Golf Course on the left.

FIGURE 14



REACH 4 – Melling Bridge to Kennedy-Good Bridge

Note: Stopbank alignment between A and B is yet to be determined

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
1	Boulcott Golf Course (LB) stopbank upgrade and land compensation	5.44	After 2005
1	Connolly Street (LB) stopbank and land purchase	2.33	Beyond 2010
1	Melling to Kennedy-Good Bridge channel works	1.11	Beyond 2010
3	Melling Bridge (RB) stopbank upgrade	0.26	Beyond 2010

Channel Works

Channel Management

The proposed strategy is gravel extraction between Ewen Bridge and Kennedy-Good Bridge. This will involve removing 10,000 cubic metres of gravel per year from five or six beaches in the CBD and Boulcott reaches. Upstream of Melling Bridge cross-blading will be continued to provide protection to existing and new bank-edge plantings.

Design Channel Alignment

The design channel through this reach will modify the existing channel form, and provide a minimum 25-metre-wide berm. The design channel changes from 90 metres wide at the upstream end to 100 metres wide next to the golf course, and back to 70 metres at the downstream end. Creating this will require some reclaiming of riverbed on the left bank immediately downstream of Kennedy-Good Bridge.

Stopbanks

Right Bank

A new section of stopbank will be constructed just upstream of the Melling Bridge. No buffer is provided.

Left Bank

The existing stopbank downstream of Connolly Street will be raised and strengthened to the preferred[5] profile, with a buffer being provided where possible. Some property purchase is required.

A retaining wall is proposed for the river bank next to Safeway Storage, with property purchase required. A new section of stopbank will be considered through Hutt and Boulcott golf courses to close the existing flood defence gap near Hathaway Avenue.

The chosen alignment will be determined through the design and consent process in consultation with Hutt and Boulcott golf clubs and affected residents. An alignment along Harcourt Werry Drive also requires further investigation. However, this option is not likely to be desirable as it may reduce the river corridor's flood buffering capacity, and would expose Lower Hutt to a higher risk of stopbank breaching.

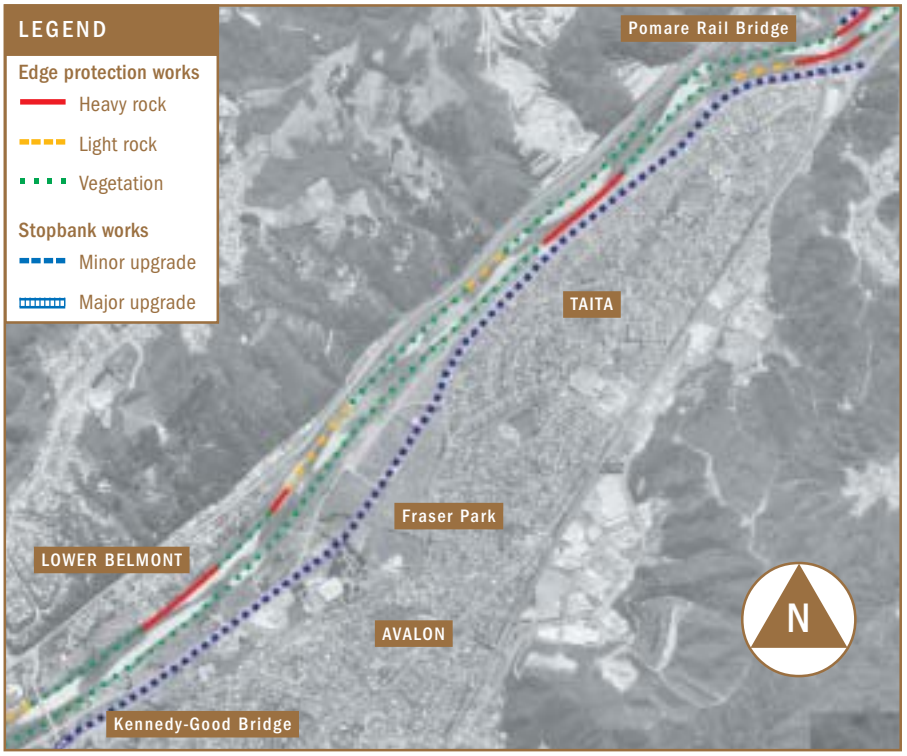
5 *The preferred stopbank profile has a top width of 4.5 metres and 3.5 to 1 batters.*

BELMONT/TAITA REACH: KENNEDY-GOOD BRIDGE TO POMARE RAIL BRIDGE *(XS 0660-1090)*

Above the Belmont residential area the river is constrained by the Western Hutt Road (State Highway 2) on the true right bank and Taita stopbank along much of the river's left bank. Major features of this reach are:

- the sharp bend and large rock groynes below Pomare rail bridge
- Taita Rock, which forms a major hydraulic and morphologic control in the river system (which is to say, it controls the slope and direction of the river)
- the Belmont residential area, located on the true right bank upstream of Kennedy-Good Bridge, where approximately 10 properties are located immediately next to the river channel.

FIGURE 15



REACH 5 – Kennedy-Good Bridge to Pomare Rail Bridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
4	Kennedy-Good Bridge to Pomare (LB) stopbank upgrade	0.86	Beyond 2010
4	Rock protection at Belmont, Nash Street and Pomare rail bridge (LB/RB)	1.42	Beyond 2010
14	Vegetation at Kennedy-Good Bridge to Pomare rail bridge (LB/RB)	1.63	Beyond 2010
8	House raising at Belmont to 1900	0.45	2003–2007

Channel Works

Channel Management

No gravel extraction is planned upstream of Kennedy-Good Bridge. Cross-blading will be continued to provide protection to existing and new bank-edge protection.

Design Channel Alignment

The design channel through this reach is 90 metres wide downstream of Nash Street, narrowing to 70 metres at Taita Rock. The design channel requires taking back the left bank berm by up to:

- 20 metres (along 500 metres of river bank) downstream of the Nash Street erosion site
- 20 metres (along approximately 300 metres of river bank) opposite the upstream end of Belmont.

The left bank berm next to the Australian Rules ground will be reclaimed by up to 30 metres (over a 350-metre length).

Stopbanks

Left Bank

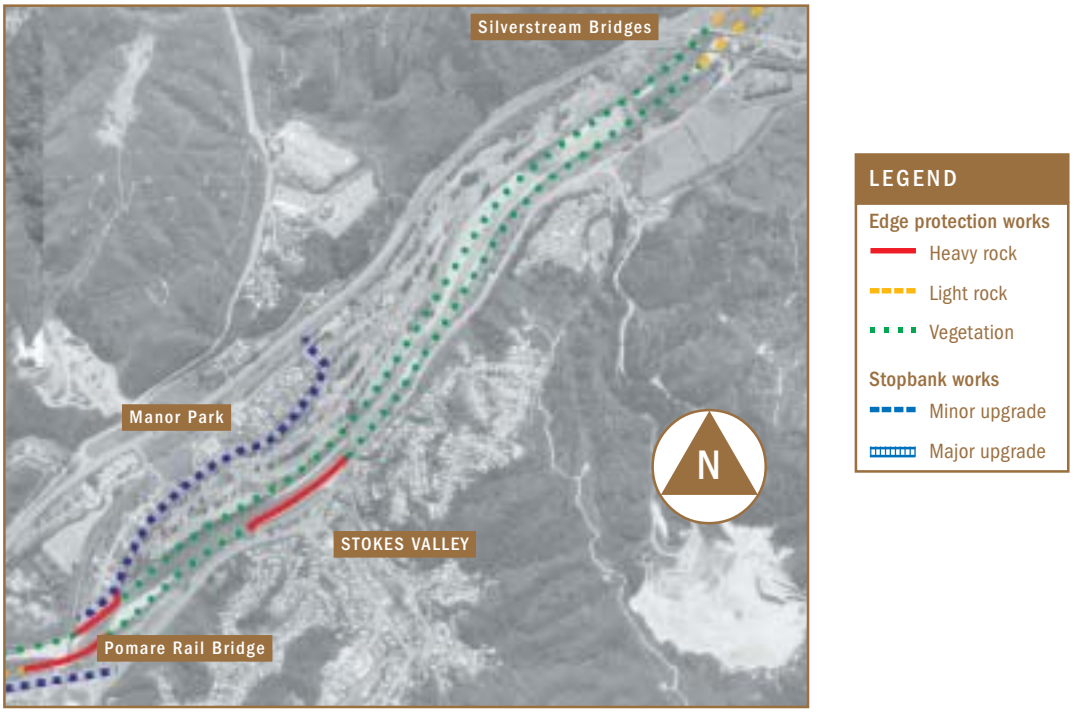
The existing stopbank is already well above the 2800 design level and will not be lowered during upgrade works. However, relocating services and other minor improvements to stopbank integrity will be considered.

A digger works to place gabion baskets and rocks against an eroding bank at Bridge Road, Upper Hutt. Residential homes sit just beyond the eroded river edge.

MANOR PARK REACH: POMARE RAIL BRIDGE TO SILVERSTREAM BRIDGES *(XS 1090-1400)*

The Taita stopbank and the Eastern Hutt Road (left bank), and the Manor Park Golf Course (along most of the right bank) contain the river in this reach. A wider channel at the Silverstream bridges changes to a narrow and incised form through Taita Gorge. The major feature is the Stokes Valley Stream confluence (where the stream joins the Hutt River) on the true left bank, approximately 800 metres upstream of Pomare rail bridge.

FIGURE 16



REACH 6 – Pomare Rail Bridge to Silverstream Bridges

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
13	Pomare rail bridge to Silverstream Bridge channel works (LB/RB)	1.34	Beyond 2010
13	Manor Park stopbanks to 2300	0.98	Beyond 2010

Channel Works

Channel Management

The general management strategy is to gradually work towards the design channel in this reach, while actively maintaining the current alignment. Apart from proposed structural works, ongoing maintenance is programmed under the Hutt River Asset Management Plan.[6]

Design Channel Alignment

The design channel will be 70 metres wide with 15- to 20-metre wide berms. This requires taking back:

- the left bank berm by up to 20 metres (along 550 metres) in the vicinity of the old Regional Council nursery at Silverstream
- the right bank (Manor Park Golf Course) by up to 20 metres (along 1.4 kilometres) through Taita Gorge.

Creating the design channel will also require reclaiming the right bank berm by:

- up to 45 metres (along an 800-metre length) at the upstream end of Manor Park Golf Course
- up to 25 metres (along 400 metres) immediately upstream of Pomare rail bridge.

Stopbanks

Right Bank

Manor Park stopbank will be upgraded to the 2300 cumec standard. No property purchase is required for this work.

Silverstream Road Bridge

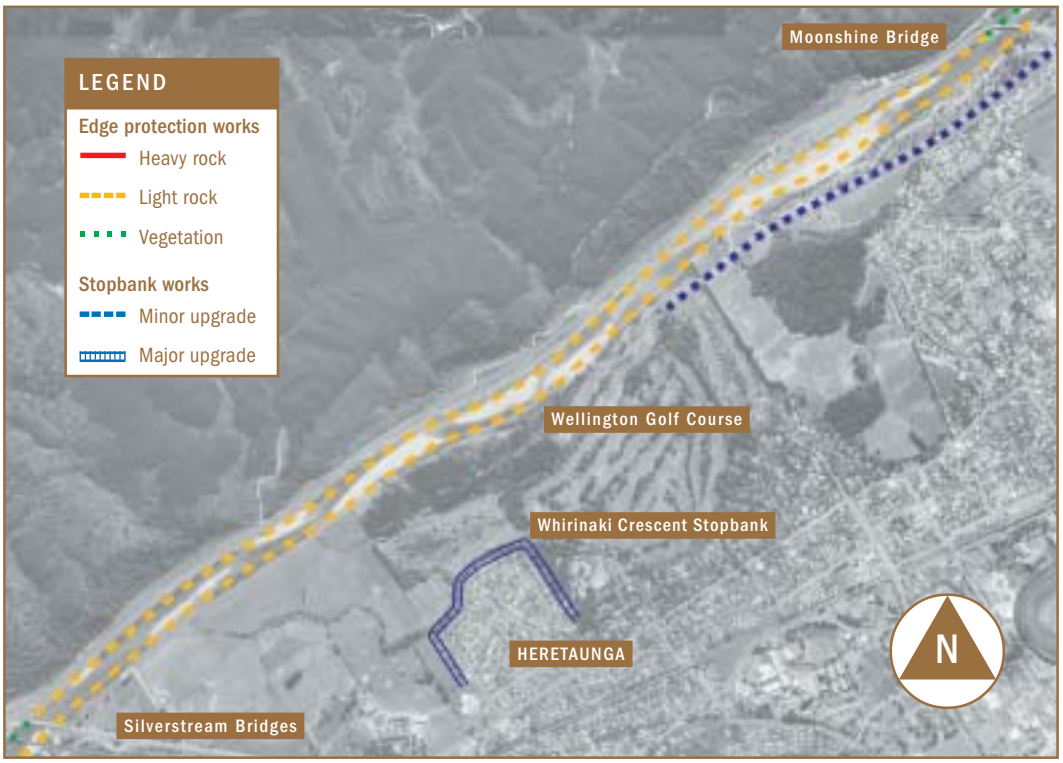
The capacity of the Silverstream road bridge is a five-year flood, with an allowance for passing debris. Without debris, the bridge capacity is for about a 40-year flood. However, a new bridge and its associated floodway could provide the required 2800 cumec capacity.

6 *The Hutt River Asset Management Plan guides how current and new flood protection structures must be maintained.*

HERETAUNGA REACH: SILVERSTREAM BRIDGES TO MOONSHINE BRIDGE *(XS 1395-1775)*

The river in this reach is constrained by State Highway 2 on the right bank and, in the upper part of the reach, the Upper Hutt stopbank on the left bank. The river banks in this reach are lined with extensive protection works with alternating willow buffers and rock lines. On the true right bank the willow buffers are generally reinforced with debris fences.

FIGURE 17



REACH 7 – Silverstream Bridges to Moonshine Bridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
10	Moonshine Bridge investigations	0.06	2001–2002
5	Whirinaki Crescent stopbank to 2300	0.47	2004–2006
8	Trentham to Whakatikei stopbank (part)	0.71	Beyond 2010
10	Moonshine Bridge waterway upgrade	3.31	Beyond 2010

Channel Works

Channel Management

The present channel management strategy in this reach, which focuses on extending rock linings in response to bank erosion, will be continued. However, rock groynes may be used in place of rock linings to prevent any further reduction in the natural character of the reach.

Some parts of this reach have become excessively wide and misaligned due to over-developed beaches. Beach ripping and clearing will be required periodically to control *aggrading* beaches and prevent the channel further misaligning. Eventually, realigning the channel to the design alignment should help correct this situation so that ongoing in-channel works will be reduced as much as possible.

Design Channel Alignment

The design channel width through this reach ranges from 70 to 75 metres. The design channel will be achieved by reclaiming the left bank berm by up to:

- 35 metres (along a 700-metre length) adjacent to Trentham Memorial Park
- 25 metres (along 600 metres) next to Heretaunga Golf Course.

The left bank berm will be taken back by 15 metres (along 600 metres) next to Heretaunga Park.

Stopbanks

The Moonshine to Trentham stopbanks are well above the 2800 design level, so no stopbank improvements are planned for this reach. However, relocating services and other minor improvements will be considered. The existing stopbank at Whirinaki Crescent will be upgraded. Property purchase may be required.

Moonshine Bridge

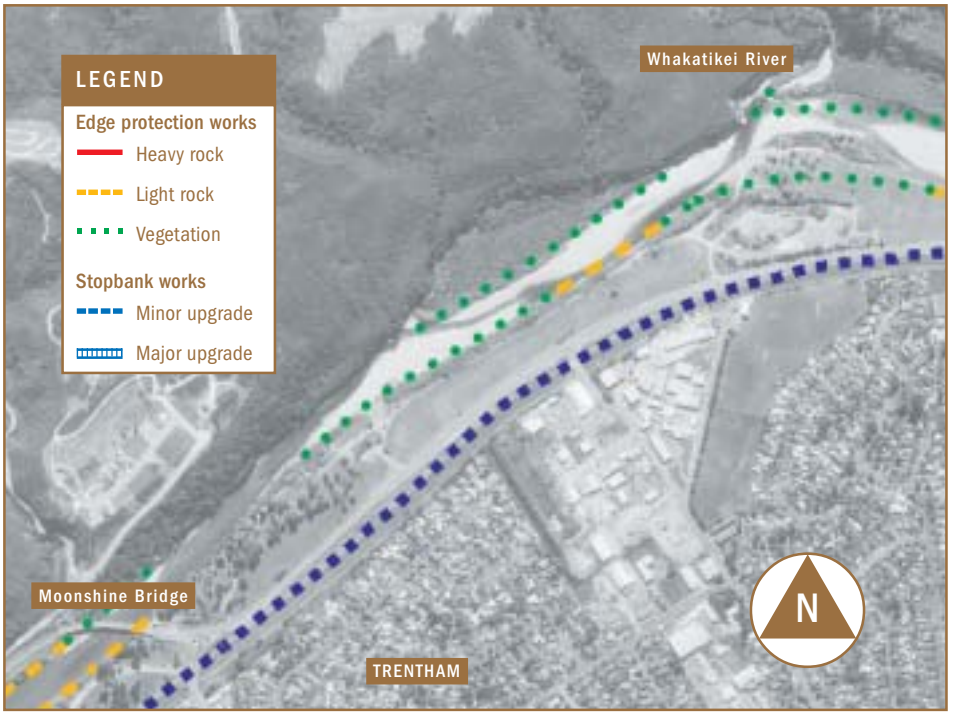
Feasible options for improving the Moonshine Bridge waterway to pass a 2800 cumec flood will be investigated. The Regional Council and Transit NZ together will define an acceptable bridge upgrade strategy, which is likely to cover improvement timing, bridge design standards, and impacts on adjacent flood protection works.

MOONSHINE REACH: MOONSHINE BRIDGE TO WHAKATIKEI RIVER *(XS 1775-1900)*

This reach is characterised by steep undeveloped bush land on the right bank, and a wide berm on the left. Major features include:

- bedrock outcrops in the channel throughout the reach
- the major bend and rock outcrop at the Whakatikei River confluence and the additional flow from the Whakatikei River.

FIGURE 18



REACH 8 – Moonshine Bridge to Whakatikei River

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
10	Moonshine to Maoribank (LB) channel works (part)	0.25	Beyond 2010
8	Trentham to Whakatikei (LB) stopbank (part)	2.00	Beyond 2010

Channel Works

Channel Management

Because of the reasonably stable and confined nature of the river through this reach, only limited management is required.

Design Channel Alignment

Channel stability and a gorge-type setting help control the river's alignment. Consequently a 60-metre wide channel has been chosen as the design alignment, requiring no major modification of the existing channel.

Stopbanks

Left Bank

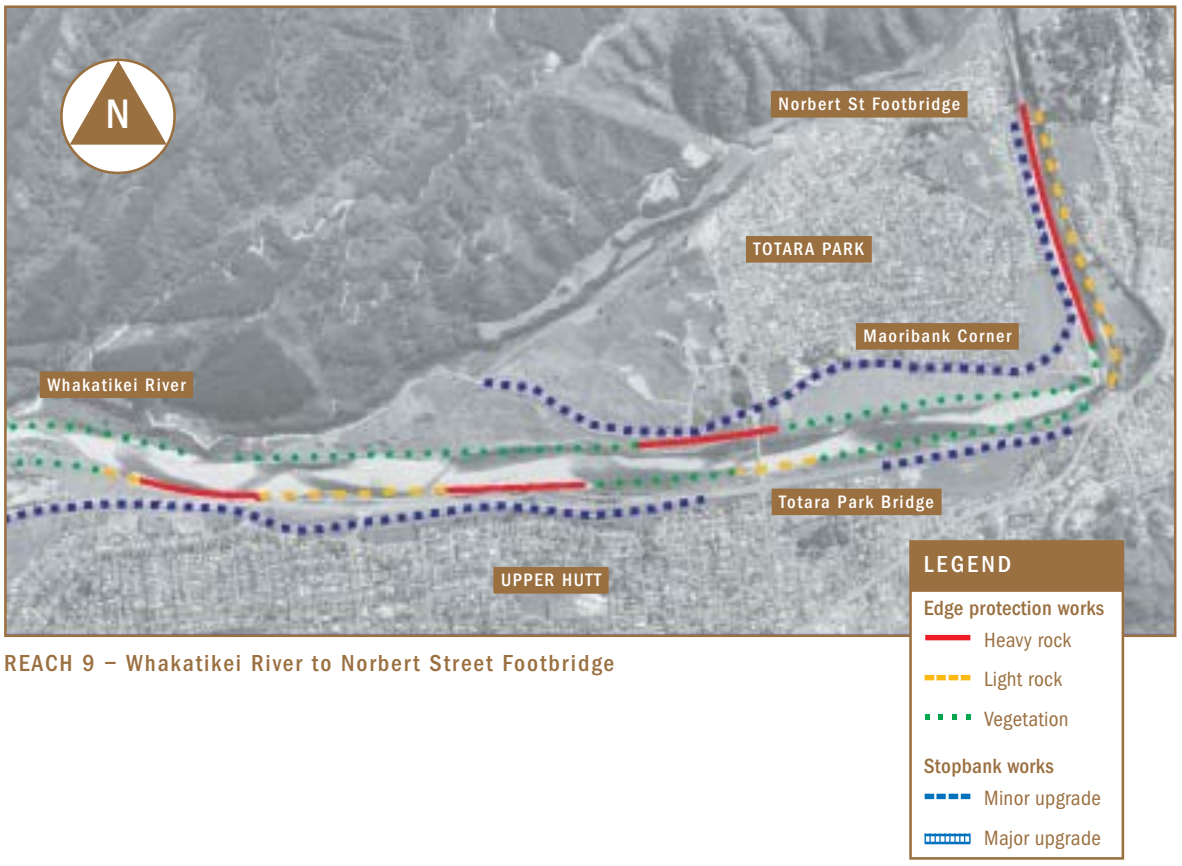
The existing stopbanks directly upstream of Moonshine Bridge will be raised and strengthened on their existing alignment. The remaining stopbanks are above the 2800 design level, and only minor improvements will be considered.

Careless use of vehicles has resulted in deep tyre ruts on the stopbank at Totara Park, Upper Hutt. Damage like this can seriously affect the flood defences' performance during a flood.

UPPER HUTT / TOTARA PARK REACH: WHAKATIKEI RIVER TO NORBERT STREET FOOTBRIDGE *(XS 1900-2390)*

Both ends of this reach are constrained by major hydraulic and morphological controls. The downstream end is controlled by the Whakatikei River confluence, and the top end by the 90-degree bend and major rock outcrops at Maoribank Corner. The upstream end of the reach adjacent to Ngati Tama Park is characterised by high gravel and silt banks on both sides. Both are fixed by rail-iron and *gabion basket toe-protection* works.

FIGURE 19



REACH 9 – Whakatikei River to Norbert Street Footbridge

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
10	Whakatikei to Maoribank (LB) stopbank	0.28	Beyond 2010
10	Moonshine to Maoribank channel works (part)	3.35	Beyond 2010
10	Totara Park stopbanks to 2300	1.42	Beyond 2010
10	Elbow Park channel upgrade	1.41	Beyond 2010

Channel Works

Channel Management

A wide design channel will be developed in this reach, which will require removing substantial amounts of berm material in the medium- to long-term. This will be done either through gravel extraction or by allowing the river to widen naturally. In either case, bank shaping and some rock lining protection and planting work will be needed once the required width is achieved.

The wide design channel will require ongoing in-channel maintenance to control any developing meanders, although the frequency of this work should be reduced. These activities will include beach ripping, clearing and shaping, as well as some cross-blading. The works should help to prevent the river damaging protection works (including willow plantings) and developing misalignments.

Design Channel Alignment

The design channel widens from 50 metres at Norbert Street footbridge to 135 metres downstream of Maoribank corner. The narrow channel width upstream reflects the river adjusting to the bend and bedrock control feature at Maoribank Corner. Changes to the channel include:

- taking back the right bank berm by up to 50 metres along 1.5 kilometres between cross-sections 2080 and 2240
- reclaiming the river and realigning an existing rock line on the left bank by up to 20 metres (along 500 metres) from cross-section 2010 to 2050
- taking back the left bank berm by up to 85 metres (along 800 metres) between cross-sections 1900 and 1970.

Modifications to the right bank berm will affect Awa-Kairangi Park, where between 30 and 50 metres of river berm will be lost over a 200-metre length.

Stopbanks

Right Bank

The existing stopbank is around the 2300 design level. Stopbank improvements are planned and they may extend the existing stopbank toe by up to 2 metres in some places, but no property purchase is required to accommodate this wider profile.[7]

Left Bank

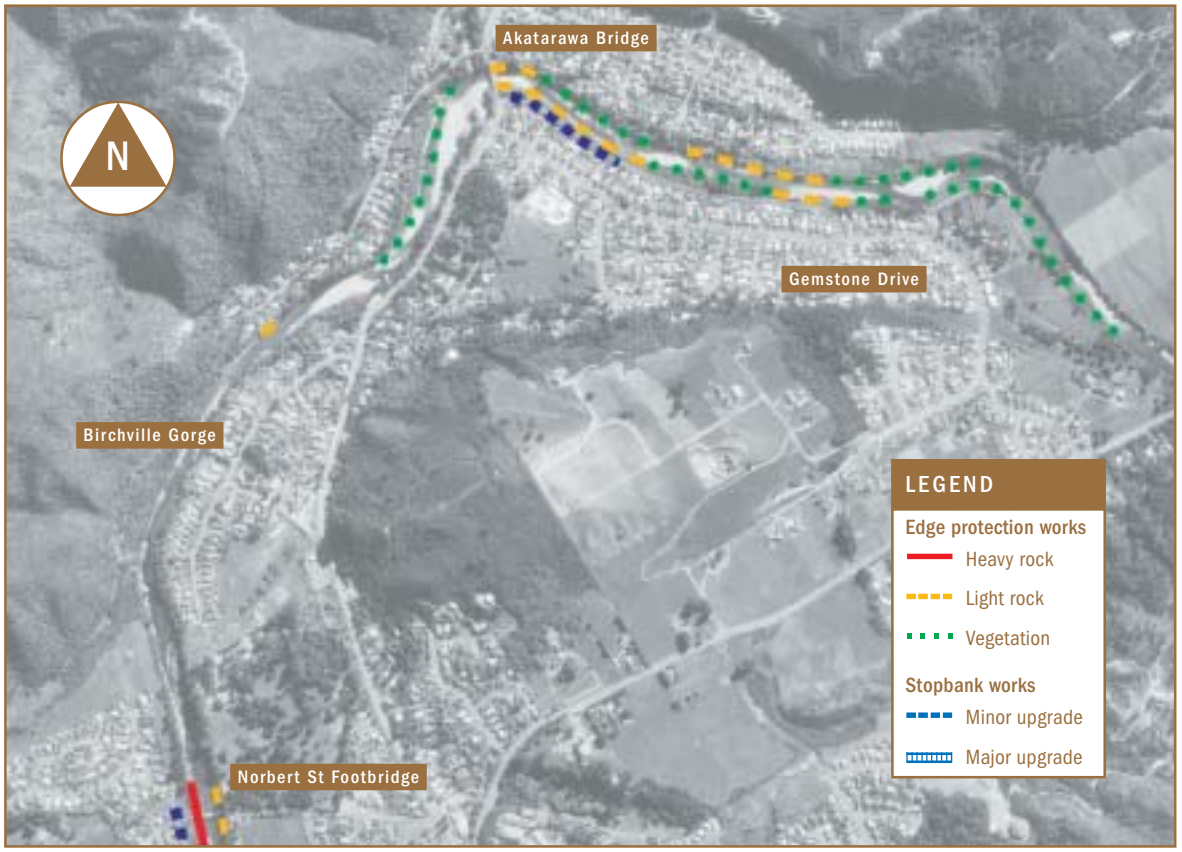
The existing stopbanks are above the 2800 design level, and only minor improvements will be considered.

7 *The preferred stopbank profile has a top width of 4.5m and 3.5 to 1 batters.*

AKATARAWA REACH: NORBERT STREET FOOTBRIDGE TO GEMSTONE DRIVE *(XS 2390–2690)*

This reach is characterised by its gorge-like nature: the channel is narrow and incised with bedrock outcrops. The Akatarawa River forms a control at the top end, where the river turns 90 degrees to flow south.

FIGURE 20



REACH 10 – Norbert Street Footbridge to Gemstone Drive

Proposed Measures

PRIORITY	DESCRIPTION	COST ($M)	WHEN
14	Norbert Street footbridge to Akatarawa channel works	0.34	2004–2005 (part)
12	Akatarawa Road (LB) floodwall at 1900	0.72	2004–2005
12	Gemstone Drive channel works to 1900	0.64	2005–2006
12	Gemstone Drive (LB) stopbank to 1900	0.15	2005–2006
7	Bridge Road house raising to 1900	0.18	2003–2007

Channel Works

Channel Management

Because of the reasonably stable and confined nature of the river, especially through Birchville Gorge, no specific management requirements are required for this reach.

Bank-edge protection proposed at Gemstone Drive and Bridge Road will be to a 1900 standard.

Design Channel Alignment

The design channel is generally 40 metres wide throughout the reach, and follows the existing river alignment.

Stopbanks and Other Measures

Left Bank

A 1900 floodwall may be provided on the river side of Akatarawa Road. If the floodwall option is not selected, other options are to raise Akatarawa Road, or to provide financial assistance for house raising to the 1900 design level. A decision on these options will be made by 2004, after feasibility investigations have been completed, which will include consultation with local residents.

The existing Gemstone Drive stopbank will be strengthened to meet the 1900 standard. Property purchase is not required.

Right Bank

No stopbanks will be provided, although assistance for house-raising to the 1900 design standard will be available for Bridge Road residents.

TE MARUA REACH: GEMSTONE DRIVE TO THE HUTT GORGE *(XS 2690-3050)*

The main features between Gemstone Drive and Te Marua Golf Club are the:

- over-wide channel
- high gravel terrace on the Teasdale property on the right bank
- flood diversion channel opposite Te Marua Golf Club.

Above the Te Marua Golf Club the reach is characterised by the Hutt Gorge's steeply rising hills, mainly on the right bank, with occasional bedrock outcrops.

FIGURE 21

REACH 11 – Gemstone Drive to the Hutt Gorge

Channel Works

Channel Management

The Regional Council does not actively manage the river channel upstream of Gemstone Drive. The ultimate responsibility for channel management will remain with the affected landowners. However, the Regional Council will provide advice on protection work designs and placement when requested by landowners. The advice will be aimed at works that maintain the design channel alignment. A subsidy of up to 30 percent of costs for approved river works is available to landowners.

Design Channel

The design channel width extends from 30 metres at the Hutt Gorge to 40 metres upstream of Te Marua Golf Club. Although a design alignment has been developed, the Regional Council has no specific plans to maintain it. As discussed above, landowners will be given appropriate advice for erosion protection work.

The design channel selected between the Mangaroa River confluence (cross-section 2770) to the bedrock outcrop at Te Marua Golf Club (cross-section 2900) is 55 metres wide, narrowing to 40 metres at both ends of the reach.

DO YOU WANT TO KNOW MORE ?

Ref 20:	Hutt Flood Defences Evaluation
Ref 21:	Hutt Hydrology Report
Ref 22:	Hutt River Asset Management Plan
Ref 23:	Hutt River Channel Capacity
Ref 24:	Hutt River Channel Management and Protection
Ref 29:	Hutt River Environmental Effects
Ref 36:	Hutt River Mitigation Measures
Ref 37:	Hutt River Model Update
Ref 40:	Hutt River Phase 2/3 Completion
Ref 47:	Hutt River Structural and Geotechnical

Also:
Newsletter Nos 2 & 3: The Design Standard

4.4 POLICIES SUPPORTING STRUCTURAL MEASURES

What the Policies Cover

So far in this chapter we have looked at a wide variety of structural measures – including channel works, stopbanks and berms – that have been selected for the various flood-prone areas of the Hutt Valley. This section looks at the specific policies underlying the decisions made about the structural measures. In particular, it includes policies that allow the Regional Council to operate the flood protection system effectively with minimal impact on other activities, and considerations essential for constructing and managing structural measures.

The policies have been derived from issues raised by the community when structural measures were being developed, from what we have learnt through current operational practice, and from the history of flooding in the Hutt Valley.

STRUCTURAL MEASURE POLICIES – QUICK REFERENCE	
Policy 8:	Requiring High Flood Protection Standards
Policy 9:	Acquiring Land for Structural Works
Policy 10:	Minimising the Adverse Effects of Physical Works
Policy 11:	Managing the Channel to Protect River Alignments and Flood Defences
Policy 12:	Maintaining Flood Protection Assets Free from Encroachment
Policy 13:	Dealing with Undesirable Activities
Policy 14:	Protecting Regional Council Assets
Policy 15:	Replacing Bridges
Policy 16:	Considering Flood Detention Dams
Policy 17:	Managing Riverbed Levels
Policy 18:	Managing Gravel Extraction for Flood Protection
Policy 19:	Accounting for Stormwater Flooding
Policy 20:	Designing for Climate Change and Earthquakes
Policy 21:	Removing Existing Services
Policy 22:	Locating New Services in the River Corridor
Policy 23:	Rationalising Existing and New Stormwater Outlets
Policy 24:	Protection Benefits for Services
Policy 25:	Protecting Key Network Facilities
Policy 26:	Upgrading the Melling Substation
Policy 27:	Services Crossing the River Corridor
Policy 28:	Agreements for Managing Services

Policy 8: Requiring High Flood Protection Standards

Issue

By using high design and construction standards for new and upgraded flood protection structures, the threat to the safety and lives of Hutt Valley floodplain residents can be significantly diminished.

Policy

Flood protection structures must be built to the highest standards practicable, particularly in cases where the protected area cannot be evacuated and failure could lead to lives being lost. However, it needs to be recognised that failsafe structures are impossible to construct and there will always be a risk of failure.

Explanation

This policy highlights the need to apply a risk-based approach to separate and distinct floodplain areas. Higher construction standards will be needed where lives can be lost, particularly for locations where emergency management procedures cannot be completely effective Some risk of breaching is more acceptable where failure of the flood defence is not life threatening.

Policy 9: Acquiring Land for Structural Works

Issue

In some instances the Regional Council will need to acquire land for structural works.

Policy

The Regional Council will acquire management rights to all public land needed for structural works, preferably at no cost (other than conveyance costs). Some privately owned land will also be needed. Land may be gained through land exchange, and will be purchased only as the final option.

Explanation

Most land marked for structural works is in public ownership, which enables land exchange to take place more readily. Privately owned land may need to be purchased including land around Shandon, Boulcott and Hutt Golf Courses, Woollen Mills Point and Strand Park.

Repairing a stopbank and constructing new bank-edge protection at Manor Park, Lower Hutt.

Policy 10: Minimising the Adverse Effects of Physical Works

Issue

Constructing structural works can result in a range of short- to long-term adverse effects on the river environment. Physical construction works or the presence of completed structures may cause these effects. Effects can be managed using a number of tools.

The finished product. Grass takes hold on the repaired stopbank and berm at Manor Park.

Policy

Physical works will be appropriately managed to ensure that adverse environmental effects are minimised. Requirements for managing construction works will include:

- planning and employing sensible and environmentally responsible construction methods
- setting environmental performance standards from the resource consent process
- monitoring the effects of physical works to improve practices, where it is possible and practical to improve them.

Opportunities to enhance the river environment, to compensate for unavoidable negative effects, will be taken when the Regional Council carries out any structural works. This will largely be driven by the Environmental Strategy for the Hutt River.

Explanation

As a responsible environmental manager, the Regional Council will plan physical works so that they have the least-possible impact on the river environment. Where physical works are planned, they will have to go through the resource consent process, which will ultimately determine how the community wants adverse environmental effects to be managed and monitored.

But it is not just a case of minimising negative impacts. Structural works provide opportunities through the Environmental Strategy to promote and support projects that maintain or enhance ecological, recreational, cultural and landscape benefits for the river environment. These opportunities are likely to be over and above any resource consent conditions requiring the environmental effects of specific works to be appropriately managed. Policy relating to the Environmental Strategy is presented in Chapter Six.

Policy 11: Managing the Channel to Protect River Alignments and Flood Defences

Issue

Flood defences can only be effective if the river channel edge is maintained.

Policy

Bank edge works must be constructed to provide:

- a river alignment that can be maintained to permit the safe passage of floods
- protection to flood defences, such as stopbanks, and to nearby development.

Where practicable, bank-edge works and adjoining berm areas should be designed to be reasonably secure from erosion where:

- they protect the flood defence foundations
- failure of the flood defences could lead to lives being lost.

At times it will be necessary to carry out work in the riverbed to protect the river edge.

Explanation

A strong focus will be put on providing permanent channel-edge works to ensure the integrity (safety) of the flood defence system. This does not exclude temporary bed re-contouring and gravel extraction to help protect permanent works. Bank-edge protection works will need to perform well if they are to protect stopbanks and adjacent development adequately.

Policy 12: Maintaining the Flood Protection System Free from Encroachment

Issue

The Regional Council needs to be able to operate and maintain flood protection assets effectively, free from encroachment by unauthorised vegetation and structures.

Policy

The Regional Council will maintain the flood protection system free from encroachment by unauthorised activities. Practices and approaches to control encroachment include, but are not limited to:

- removing vegetation that affects stopbanks
- removing unauthorised structures from flood protection assets and river corridor land managed by the Regional Council.

Explanation

Along the Hutt River there are many instances where property owners have encroached on to Regional Council land and assets with trees, gardens and structures such as fences. This has created great difficulties for the Regional Council in managing flood protection assets (particularly stopbanks) and undertaking associated maintenance. Ultimately, maintaining the integrity and security of the flood protection system must always have priority over activities that interfere with the system.

Policy 13: Dealing with Undesirable Activities

Issue

The Regional Council needs to be able to deal with ongoing undesirable or nuisance activities that can have a significant effect on public safety, the river environment, and the Council's assets. Until now the Regional Council has had mixed results trying to control these activities.

Policy

The Regional Council will promote a range of tools to help curb undesirable activities, including using a river ranger and producing new by-laws. Undesirable activities include, but are not limited to, adverse vehicle use, vandalism, rubbish dumping and uncontrolled animals.

Explanation

This policy is geared to significantly reduce undesirable activities that compromise public and Council staff safety, degrade the river environment, or damage flood protection works. Activities such as vandalism, adverse vehicle use (particularly on berm areas), rubbish dumping and uncontrolled animals have a history of unacceptable impacts on the Hutt River environment and require greater attention. The Regional Council will consider using any tools that reduce the impacts of these activities. This policy is linked to Policy 37: Recreation.

Policy 14: Protecting Regional Council Assets

Issue

The Regional Council relies on certain tools to safeguard flood protection assets, including regional plan rules, notice boards, education, and owning land. Requirements set out in the *Hutt River Asset Management Plan*, and Utilities and Services policies contained in this Floodplain Management Plan, also reinforce the protection of assets.

Regional rules are a particularly effective and enforceable way of protecting assets. A number of land-use rules to protect flood protection assets are contained in the Regional Council's Transitional Regional Plan. The Transitional Regional Plan will eventually be revoked because provisions in the Regional Freshwater and Soil Plans largely supersede it. However, revoking the Transitional Regional Plan could partly remove the Regional Council's ability to help prevent flood protection assets from being illegally interfered with, excavated and vandalised.

Policy

The Regional Council will:

- review the repealed rules
- determine the scope within existing legislation to protect flood protection assets, including producing by-laws
- develop new by-laws or other effective approaches to protect flood protection assets, where the need arises
- look at alternative ways to manage this issue, such as targeted education campaigns and employing a river ranger
- look at the supporting role that asset management plans and other Plan policies can play.

Explanation

Certain legislation, such as the Local Government Act 1974 or the Soil Conservation and Rivers Control Act 1941, may provide ways to help the Regional Council protect its flood protection assets. By-laws are one possibility, but they would only be considered where they can act as effective and robust disincentives for illegal interference with these assets. As such, new by-laws would need to be weighed against the costs of developing them, their potential effectiveness, and alternative approaches that can achieve a similar outcome. However, depending on the circumstance, they could act as a useful fallback if other options prove fruitless.

Other tools, such as a public education and advocacy role, may also be effective. A river ranger could perform this role, and may be particularly useful where the Regional Council owns the land in question.

In terms of powers to make by-laws, this policy only relates to the Regional Council's powers and not to those of the city councils. There may be scope to consider powers for city councils to make by-laws where this is appropriate.

Policy 15: Replacing Bridges

Issue

Some bridge crossings do not have the floodway capacity to pass the design standard flood, nor the ability to withstand high flood debris loads.

Policy

Bridges, and their associated floodways, must be improved to pass a 2800 cumec flood when the bridge owners decide to replace them. The early replacement of substandard bridge waterways will be actively encouraged through joint venture proposals, whereby the Regional Council facilitates the river works improvements in the vicinity of any bridge. This policy also applies to new bridge crossings, but excludes Akatarawa Bridge.

Explanation

If there is not enough room for the flooded river to flow under a bridge, this can cause a flow bottleneck and debris trap, which creates substantial weaknesses for the flood protection system. This policy aims to eliminate these weaknesses by requiring replaced bridges and their associated floodways to be upgraded to the 2800 standard. The 2800 capacity provides leeway to the community if a decision is made in the future to raise the design standard for the Hutt Valley.

The policy also recognises that early bridge replacement can impose tremendous costs on the community. Satisfactory floodway capacity can be gained by making waterway improvements adjacent to the bridges, provided that the safety of the flood protection system is not compromised. The nature of any such improvements will be determined by methods stated in the Plan. All bridge owners need to be advised of bridge waterway standards, and a mechanism is needed to ensure future bridge owners also understand these requirements.

Policy 16: Considering Flood Detention Dams

Issue

Flood detention dams in the upper catchment would have the potential to reduce peak flood levels. However, dams also produce indirect flood protection costs and effects for the wider community downstream, which were considered during the development of structural measures for the Hutt Valley.

Policy

Detention dams will not be included as a flood mitigation measure in the Plan. Dams should be considered only if their net economic benefits are significantly greater than those for other measures that manage the flood risk within the affected community. Any benefit must also be weighed against the indirect costs.

Explanation

Dams must be effective and failsafe during a major flood. The Regional Council has investigated potential dam locations in the Hutt River catchment, but none of the sites provided the necessary capability to alleviate the downstream effects of a large flood.

Also, the benefits resulting from detention dams could well be outweighed by significant potential impacts; for example, the adverse amenity effects and impacts on natural ecosystems associated with constructing a dam in undeveloped reserve areas. This policy's emphasis on showing significant overall benefit also applies when considering other structural measures.

Policy 17: Managing Riverbed Levels

Issue

The Hutt Valley community has conflicting views on how the Hutt Riverbed levels should be managed. Opinions range from a belief that disturbing the riverbed should be minimised for environmental reasons, to a wish to see the return to wide-scale gravel extraction to increase the river's flood capacity. These views co-exist despite good riverbed monitoring information being made available to the public.

Policy

The Regional Council will produce riverbed level management guidelines for the Hutt River. The guidelines will influence how the Council manages bed levels on a day-to-day basis.

The Regional Council will also seek to improve the public's understanding and awareness of:

- how gravel extraction and bed levels relate to river bank erosion
- how gravel extraction affects river ecology
- riverbed monitoring information, including regularly publicising monitoring results.

Explanation

This policy emphasises the need to make sure the public are better informed about the balance between flood capacity, gravel extraction and bank erosion. The riverbed level management guidelines, together with monitoring information and gravel survey analyses, will help determine how much gravel needs to be extracted along the river. They will also provide a good way to inform the public about riverbed processes and the reasons behind gravel extraction decisions.

Policy 18: Managing Gravel Extraction for Flood Protection

Issue

Gravel extraction, including that done at the Hutt River mouth, remains an important method to reduce potential flooding effects on floodplain occupants.

Policy

The Regional Council will use gravel extraction as a flood management method where:

- continuing aggradation (gravel build-up) in the lower river mouth area is likely to cause significant increases in upstream river flooding levels
- significant localised riverbed aggradation is occurring.

Extraction can only be realistically considered where adverse effects on the community and environment will not be significant.

Explanation

This policy supports undertaking gravel extraction where the positive effect of reducing flooding impacts on the community outweighs:

- the potential for increased erosion of river margins that may threaten the safety of stopbanks
- adverse environmental and social impacts caused by extraction.

Policy 19: Accounting for Stormwater Flooding

Issue

Flooding from stormwater systems and small streams is a common occurrence in floodplain areas. Some areas can experience more significant and frequent stormwater flooding than others, and damages over time can be substantial.

Residents need to know more about stormwater and river flooding, in terms of both how they differ and how they are connected. There is also some confusion in the community regarding the roles of the regional and city councils in managing stormwater flooding.

The behaviour of stormwater flooding can be very complex because of the urban environment's highly modified nature, and the councils are still improving their own understanding of stormwater floods.

Policy

The Regional Council will give technical assistance to the city councils, where requested, to help upgrade their understanding of stormwater flooding.

The Regional Council will also continue to provide the public with information on stormwater and river flooding, including:

- the differences between river and stormwater flooding
- how storm events can simultaneously cause river and stormwater flooding
- how river and stormwater flooding can affect each other.

Explanation

When there is prolonged heavy rain, roads and properties can flood. This can be due to the failure of either the stormwater system to carry water away quickly enough, or the river flood protection system, or both. This policy recognises that the city councils have primary responsibility for managing stormwater flooding, including:

- predicting the flood extent and effects
- providing and maintaining stormwater discharge networks
- providing information about stormwater flooding and preparedness measures to the community.

The Regional Council can assist the city councils by providing river flooding data and minor technical support. This policy also supports the public receiving better information about the councils' responsibilities, and the nature and effects of stormwater flooding.

Policy 20: Designing for Climate Change and Earthquakes

Issue

The flood protection system will, on average, be designed to withstand floods that have a 1 in 440-year frequency. The system must also be designed to withstand natural hazards and other phenomena that occur on a similar time-scale, or even more frequently. Earthquakes and climate change are two phenomena that can significantly and dramatically affect the flood protection system. Climate change scenarios for the next 35 years, provided by the National Institute of Water and Atmospheric Research, predict that:

- flooding will occur more frequently
- equivalent flow return periods may halve (for example, a 1 in 100-year flood may become a 1 in 50-year event)
- the sea level will rise between 0 and 0.5 metres.

These changes could substantially lessen the flood protection system's effectiveness in the future.

A major earthquake on the Wellington Fault, bordering the Hutt Valley, will occur on average once every 500 years. A major quake could cause wide-scale land subsidence or uplift throughout the Hutt Valley, affecting the relative height of flood defences in relation to the river and sea levels. Ground shaking from such an earthquake could seriously damage stopbanks and other protection works. Both effects may render the flood protection system less effective.

The last major earthquake to affect the Hutt Valley occurred on the Wairarapa Fault in 1855. It caused land in the lower valley to rise downstream of Taita Gorge, and shifted the Hutt River mouth about 2 kilometres east to its present position.

Policy

The Regional Council will account for climate change and the earthquake hazard by:

- supporting the Institute of Geological and Nuclear Sciences to investigate fault rupture on the Wellington and Wairarapa faults, and at the Pacific and Australian plate boundaries
- incorporating earthquake investigation outcomes into flood protection work designs, where appropriate
- incorporating climate change scenarios by designing major stopbanks to 2800 construction standards
- providing the city councils and the public with information about the potential effects of climate change and earthquakes on the flood protection system.

Explanation

The potential impacts of earthquakes and climate change on the flood protection system should not be underestimated. Avoiding all impacts is impossible, but the Regional Council will, where reasonable, improve engineering designs to lessen some effects considerably. However, any design changes must balance improved flood protection safety against additional construction costs and environmental effects.

4.5 POLICIES FOR MANAGING UTILITIES AND SERVICES IN THE HUTT RIVER CORRIDOR

Why Have Policies ?

The integrity of the current flood protection system is uncertain in some areas, due to the large number of services contained in stopbanks. Additionally, existing, relocated, upgraded and proposed services in the river corridor can be affected by flooding and erosion.

Utilities and services policies are needed to:

- ensure that the Hutt River flood protection system provides the level of protection expected by the community
- ensure that the utilities and services located within the river corridor provide the level of service expected by the community
- provide utility or service owners with an understanding of the level of protection their assets in the river corridor could receive from the Plan's structural works
- help utility or service owners to plan for future management of their assets.

Responsibilities

Utility and service owners are responsible for protecting their own services in the river corridor. Where the proposed flood protection upgrade works affect utilities or services, the Regional Council will involve utility and service owners early in the process. At the same time, utility and service owners will involve the Regional Council if they propose to upgrade existing services, or wish to install new services in the Hutt River corridor.

Policy 21: Removing Existing Services

Issue

Services in stopbanks or the river corridor can increase the chances of the stopbanks failing and river berms being eroded during floods.

Policy

Existing services will be removed from stopbanks and, where possible, relocated outside the river corridor during stopbank, river corridor or service upgrading.

Explanation

Services and utilities located in flood protection assets create the following problems:

- Deterioration, failure of the service or substandard installation, can weaken flood protection assets, and initiate their failure during floods
- Excavation and back-filling of stopbanks carried out during maintenance and repairs to services can initiate failure
- Service-related structures (such as manholes) that protrude from the berm or stopbank could cause local scour.

The Regional Council will assist the utility or service owners to identify suitable routes for new services, where possible. Stormwater and sewerage services require special considerations. These would be negotiated under Policy 28.

Policy 22: Locating New Services in the River Corridor

Issue

Services in stopbanks or the river corridor can increase the chances of the stopbanks failing and river berms being eroded during floods.

Policy

New services will not be located in or under a stopbank. New services can be located in other areas of the river corridor (excluding stopbanks) only with the prior approval of the Regional Council.

Explanation

This policy is self-explanatory. Exemptions to this policy for services in the river corridor (excluding stopbanks) would only be considered if they did not put the flood protection system at risk.

Policy 23: Rationalising Existing and New Stormwater Outlets

Issue

Stormwater outlets can initiate failure of stopbanks, berms and bank-edge protection works. The risk of failure needs to be minimised.

Policy

The number, location and design of existing and new stormwater outlets should be rationalised during stopbank or stormwater service upgrading.

Explanation

The presence of a large number of stormwater outlets crossing the stopbanks will increase the risk to the flood protection system. The number of stormwater and sewerage outlets should, where possible, be decreased to reduce this risk. They also need to be rationalised when new stormwater systems are needed.

Illegal rubbish dumping on the river berms. A major ongoing problem for the three councils.

Rationalising stormwater outlets means altering the stormwater network so that outlets pass through the stopbank at a limited number of locations. Rationalised outlets would also provide opportunities for stormwater pumping, potentially benefiting large areas when the stormwater system is overloaded.

Policy 24: Protection Benefits for Services

Issue

Service assets within the river corridor are at risk of damage from floods. The flood protection system does not directly provide for their protection.

Policy

The structural measures are constructed to provide flood protection for the Hutt Valley community. Any protection this provides to utilities or services is secondary, unless individual agreements with service owners provide for a specific protection benefit.

Explanation

Utility owners should have a clear understanding of the flood protection works that will be provided under the Plan, the timing for their implementation, and the level of additional protection they may provide to service assets. The Plan's structural measures will be carried out in the order and programme required to meet the flood protection priorities endorsed by the community. These priorities are not driven by the need to protect a particular service.

Any agreement between the Regional Council and a service owner for additional protection will have cost implications for the owner. Alternatively, utility and service owners can provide a higher level of protection to their assets if they desire, so long as this protection does not compromise the safety of the flood protection system.

Policy 25: Protecting Key Network Facilities

Issue

Key utility network facilities within the river corridor could experience flood damage, which may put their ongoing functioning of related services in jeopardy during a flood.

Policy

Key utility network facilities should be protected to a 1900 cumec standard and have contingency plans to cope with the loss of their services in a major flood.

Explanation

Key network utility facilities are those parts of a utility service critical for ongoing function. Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired. Examples are electricity transformers and water-pumping facilities.

During the development of the principles for non-structural measures, the community indicated that it requires key utility facilities to be protected to a 1900 cumec standard. Principles for their ongoing operation are presented in Chapter Five.

Utility owners should have a clear understanding of the flood protection works that will be provided under the Plan, and the timing of their implementation, so that they can plan appropriate protection for key facilities.

Policy 26: Upgrading the Melling Substation

Issue

The Melling Substation is located in the river corridor, which exposes it to a high risk of flooding and erosion.

Policy

The Melling Substation is a special case, and a strategy for maintaining and upgrading this facility within the river corridor has been agreed with the owner.

Explanation

It is accepted that the relocation of Melling Substation and its network infrastructure would impose excessive costs on its owners. Transpower have produced a strategy to eventually relocate the key components of the substation beyond the 80-metre alluvial erosion hazard area. The strategy will be implemented over an indefinite period of time, and will be linked to the life of existing equipment at Melling. It should be noted that Policy 28 relates to Transpower's strategy. Any other work on the Melling Substation, and associated infrastructure and network, are not exempt from other policies in the Plan.

The Regional Council has granted resource consents to extend part of the substation. The consents and supporting correspondence fully describe details of the strategy.

Policy 27: Services Crossing the River Corridor

Issue

Service crossing points produce a weakness in stopbanks, and can initiate their failure during floods.

Policy

Services will only cross the river at approved or designated service crossings.

Explanation

This policy is aimed at ensuring that services in the river corridor do not affect the flood protection structures and maintenance works.

Services in or under stopbanks increase the risk to the flood protection system. Therefore, designated crossing points will need to be at road crossings or other locations where the risk of stopbank failure risk is limited. Service installation will be designed to minimise the risk and interference to the flood protection system. For example; a water pipe crossing a stopbank should be laid on the stopbank surface rather than deep in the stopbank. Crossings will also need to meet more stringent installation standards than in the past.

Experience has shown that it is difficult to control the quality of the construction and maintenance of a service crossing. Well-engineered, dedicated crossings reduce the risk to the flood protection system and are preferred. However, any benefit arising from multiple crossing points will be considered at the design phase of any structural works. Issues associated with large-diameter pipes will also be considered at the design phase of works. The Regional Council will assist service or utility owners to identify suitable routes for new services, where they need to enter the river corridor.

Policy 28: Agreements for Managing Services

Issue

Individual agreements between the Regional Council and individual service providers governing how services will be managed are needed.

Policy

The Regional Council will negotiate individual agreements with service providers, governing how services will be managed. The agreements will be made during the design phase of the Plan's major structural works, or during service upgrades or new service installation.

Explanation

This policy will be the main way to ensure the security of the flood protection system and certainty for the service providers. This includes setting appropriate standards for construction and maintenance. The policy also provides an opportunity to locate all utilities and services appropriately, including lighting for public security and safety.

In negotiating the specific agreements for new, upgraded or rationalised stormwater or sewerage systems and other utility services, benefit-cost analysis, design constraints and adverse effects will be recognised. The benefits to the service owner and the Regional Council will, where possible, be reflected in the agreement.

The Regional Council will discuss common issues with affected owners and representative groups, such as Lifelines and the Wellington Utility Operators Group, during the design phase of any structural works under the Plan.

THE OUTCOMES: IMPROVING NON-STRUCTURAL MEASURES

5

Sand-bagging at the Boulcott Stopbank in Lower Hutt, helping to slow water leakage through the bank during the 1998 October floods.

5.1 INTRODUCTION

Non-structural measures are less obvious aspects of flood protection. Rather than building structures to keep the river away from people and property, they focus on keeping people away from floodwaters and helping the community to cope when flooding occurs. In this sense they are a recognition that *structural measures* are not enough, and that we need to encourage more sustainable uses of the floodplain to minimise the damages and disruption from flooding. Non-structural measures are vital when flood defences fail, exposing protected and relatively safe communities to the full forces of the *flood hazard.*

Non-structural measures may be used to influence the way land is used and buildings are constructed, or they may seek to improve the community's preparedness and response to flooding. They are the most cost-effective flood mitigation approach because they can prevent considerable flood damages at little cost to the wider community.

How people use land and build on the floodplain can be influenced in two main ways: by encouraging voluntary actions, or by enforcing planning policies and rules (regulatory methods). We can prepare ourselves for an emergency by various emergency management procedures and programmes, part of which again involves asking the community to help themselves. Figure 22 shows how the different non-structural approaches link together.

This chapter differs from the one on structural measures (Chapter Four) in an important way. The Regional Council has the primary responsibility for the flood protection system, so the emphasis in Chapter Four is on the actual measures that are proposed for the Hutt River. In contrast, the responsibility for deciding on the non-structural measures mainly rests with Upper Hutt and Hutt City Councils. As a result, in this chapter the emphasis is on providing policy guidelines, in the form of what we are calling *non-structural principles*. These principles are what the Plan requires the three councils to consider when developing possible land-use controls and emergency management measures to reduce the flood hazard. They are influenced by the way the flood hazard affects the Hutt River's upper catchment, river corridor and floodplain, and these are discussed first.

We also look at practical suggestions for the way non-structural measures could be implemented. This is the outcomes section. Finally, we look at the policies that back the way the non-structural measures are to be developed.

When Do We Use Non-structural Measures?

In this Plan, non-structural measures complement and are applied in conjunction with the structural measures. Both types of measures combine to provide a highly effective flood-protection system. Non-structural measures are also used as stand-alone measures where:

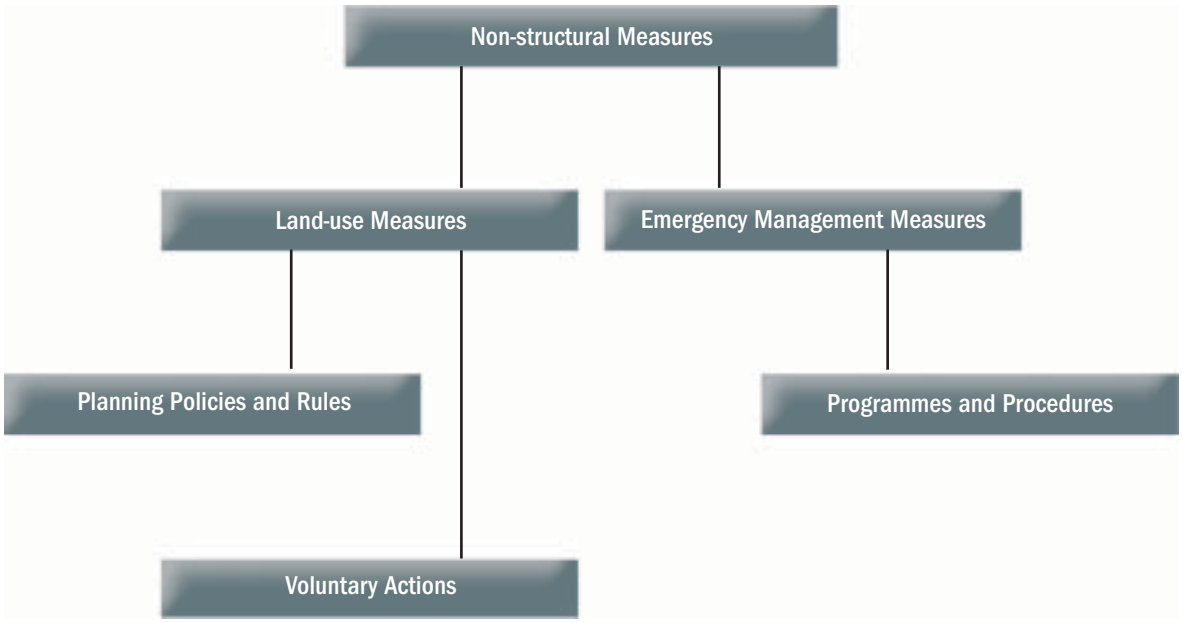
- no structural measures are planned
- development guidelines and controls for undeveloped flood-prone areas are required
- a flood exceeds the design standard, so that we have to rely almost entirely on emergency management procedures.

Types of Non-structural Measures

Various types of non-structural measures can be used in flood hazard mitigation. In this Plan we concentrate on two:

- *land-use measures*
  - policies and rules: councils regulate the kinds of activities that are carried out in various flood-prone areas through district plans
  - voluntary actions: those living and working on the floodplain voluntarily take steps to lessen flooding effects on themselves and their properties
- *emergency management*
  - procedures and programmes for dealing with flooding emergencies based on the four Rs:
    - reduction of risk
    - readiness
    - response
    - recovery.

FIGURE 22: DEFINING NON-STRUCTURAL MEASURES



5.2 FLOOD HAZARD AREAS

Obviously the kinds of measures we use will vary depending on how susceptible an area is to flooding – in other words, according to the flood hazard. In this Plan we will be looking at how measures governing land-use will be applied to three geographical areas:

1. *the upper catchment*
2. *the river corridor*
3. *the floodplain*.

Figures 23 to 27 show the extent of these areas. The proposed measures for each area are described below:

The upper catchment of the Hutt River. Its extensive native bush system 'soaks-up' rainfall, helping to reduce run-off and flooding downstream. Robin Blake 2001©.

1. The Upper Catchment

The upper catchment comprises the five contributing catchments within the Upper Hutt City area:

- Hutt (upper and alpine sections)
- Pakuratahi
- Mangaroa
- Whakatikei
- Akatarawa.

FLOOD HAZARD EFFECTS IN THE UPPER CATCHMENT

What happens in the upper catchment has a major influence on the extent of flooding of the Hutt River, and its associated impacts. Human activities play a part here. For example, inappropriate land-use practices can introduce sediment and debris to the Hutt River system and increase run-off during storms.

Figure 23 shows the upper catchment areas, including the type of vegetation cover or land-use.

2. The River Corridor

The river corridor is that land immediately adjacent to the river. Because of its location, the river corridor represents a significant flooding and erosion hazard to both people and structures (including the flood defences) sited in the corridor.

Extent of the River Corridor

The river corridor extends from the river mouth to the Hutt Gorge. The outside (landward) toe of all *stopbanks* determines the width of the corridor in most places. Where there are no stopbanks, the corridor width is set by:

- geological features, including the valley walls, and cliff-top features; *or*
- the extent of a 2800 cumec flood (except where erosion hazard areas lie outside the 2800 extent); *or*
- the riverside margin of existing houses at Belmont and Bridge Road, Akatarawa, where those properties extend into erosion hazard areas.

FIGURE 23: HUTT RIVER CATCHMENT LAND COVER

Land-uses are shown for all five major river catchments and the smaller watercourses.

Bank erosion threatens a residential area at Belmont, Lower Hutt, following the October 1998 floods. Even small to moderate sized floods can substantially erode river banks and berms.

The area upstream of Gemstone Drive, Upper Hutt (the top of the Hutt River Scheme), is treated slightly differently because no structural works are proposed for this reach under the Plan. This means the river channel will not be maintained in a fixed position, as it is downstream. Consequently, a buffer zone between potential development and the river's edge, which can move with a migrating river channel (called the *moving erosion area*), defines the area affected by erosion.

Hazard Areas Identified for the Hutt River Corridor

Some areas of the river corridor are more prone to flood and erosion than others. Identifying these hazard areas allows us to target non-structural measures more effectively. The hazard areas shown in Figures 24 and 25 distinguish highly flood- and erosion-prone land from those areas least affected by flooding.

There are two sorts of hazard areas in the river corridor.

- the *primary river corridor* hazard area, including a:
  - baserock erosion area
  - alluvial erosion area
  - moving erosion area
  - core flooding area
- the *secondary river corridor* hazard area.

What distinguishes the two is the speed of flow and the potential for significant erosion. The primary river corridor is an area of fast-flowing water, whereas the water in the secondary river corridor is slower-flowing and often deeper. The primary river corridor has three erosion hazard areas: the *baserock* and *alluvial erosion areas*, which are fixed, and the *moving erosion area*, which (as the name suggests) moves with the migrating river channel, upstream of Gemstone Drive. The *core flooding area* is where the flood waters will move quickly, but the erosion risk is not significant.

Detailed reach-by-reach river corridor plans are presented in Appendix 4.

HAZARD EFFECTS IN THE RIVER CORRIDOR

Flooding in the primary river corridor can cause substantial impacts, including:

- extreme danger to occupants
- severe damage to structures
- erosion and loss of land to the river
- substantial depositing of flood debris.

Areas of high-velocity flood waters, known as *overflow paths*, are typically associated with flooding in the primary corridor.[1]

The secondary river corridor is dominated by *ponding* and slower-flowing flood waters, so the erosion and flow risks are heavily reduced. Ponded waters can still pose a danger to people and cause substantial damage to building interiors.

[1] The border between the primary and secondary river corridor areas occurs where the product of water depth and velocity is estimated to equal 1.0. The primary river corridor represents those areas with a product equal to or greater than 1.0.

Figures 24 and 25 show the separation between the two major hazard areas of the river corridor.

FIGURE 24: HUTT RIVER CORRIDOR HAZARD AREAS (UPPER VALLEY)

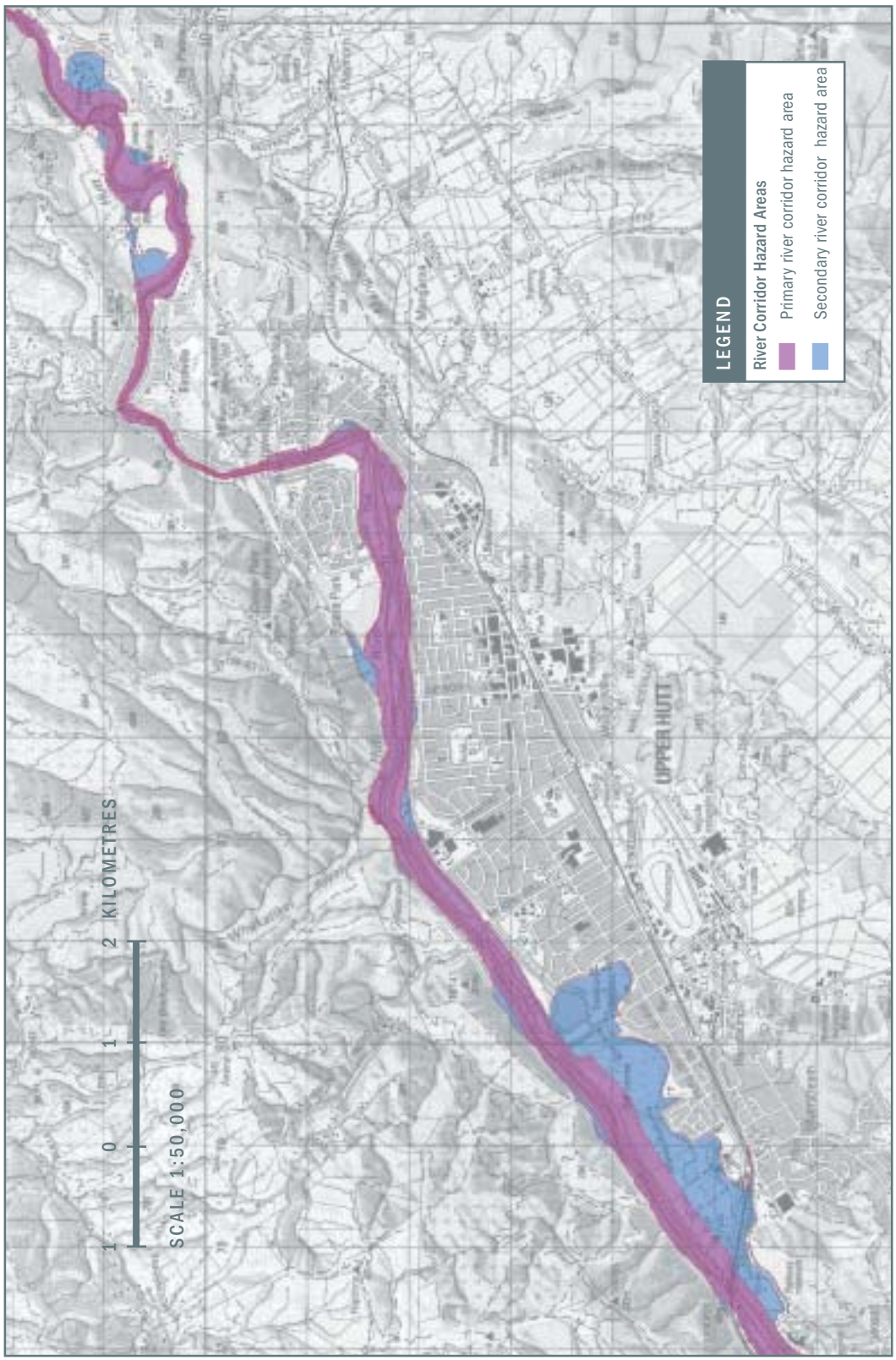
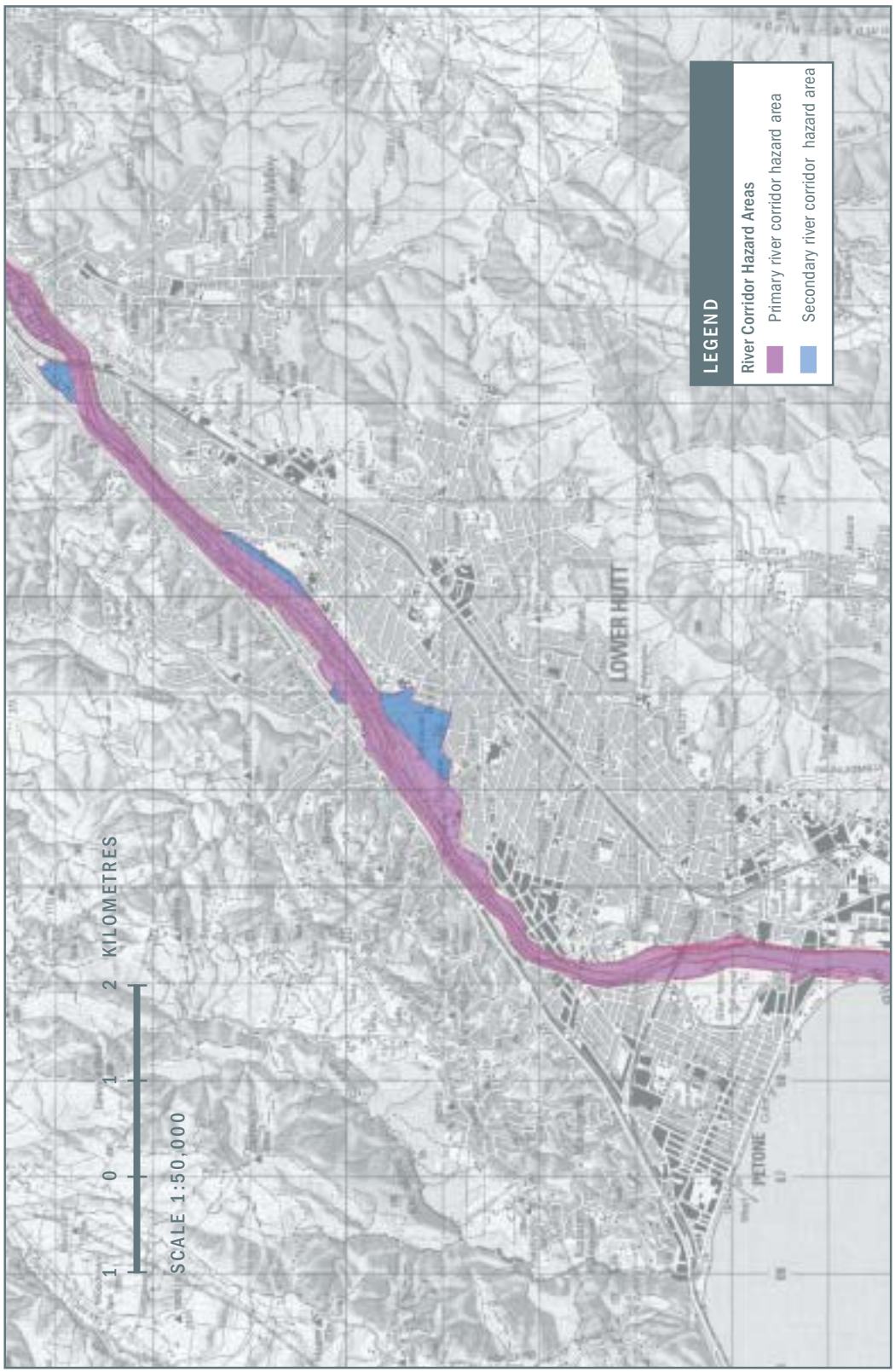


FIGURE 25: HUTT RIVER CORRIDOR HAZARD AREAS (LOWER VALLEY)



3. The Floodplain

The floodplain is all of the remaining flood-prone area outside the river corridor. It extends over much of Lower and Upper Hutt's urban areas, representing the extent of a 2800 cumec flood. A flood of that size could exceed the floodplain's major upgraded stopbanks.

Hazard Areas Identified for the Floodplain

The floodplain area can be divided into:

- higher-risk floodplain hazard areas (not protected by stopbanks)
- moderate-risk floodplain hazard areas (protected by 1900 or 2300 stopbanks)
- lower-risk floodplain hazard areas (protected by 2800 stopbanks).

Higher risk means the risk of major damage to property and buildings is high and life-threatening situations can easily develop. Fortunately, higher-risk floodplain hazard areas are only a small proportion of the entire flood-prone area. They include existing developed residential areas at Belmont and Birchville, which lie beyond the river corridor extent or are landward of erosion hazard areas. Seaview is also a high-risk area.

Moderate and *lower risk* means property damage is not likely until the structural standard is exceeded (when damages would be higher), and life-threatening situations may develop where water is deep. Moderate- and lower-risk areas extend over much of the floodplain.

Measuring predicted flood levels on a house in a 'higher-risk' flood-prone area.

HAZARD EFFECTS ON THE FLOODPLAIN

If flooding occurs in developed floodplain areas, roads will tend to form overflow paths of fast-flowing water, while built-up areas tend to become slow-flowing and sometimes deep-ponding areas. Both can be dangerous for people. While fast-moving waters can sweep people off their feet, deep-ponding areas have their obvious dangers.

A large flood could inundate much of the floodplain. Unprotected areas will be affected just as severely as some river corridor areas. In protected locations, any breaching or overtopping of the stopbanks is likely to cause severe disruption, stress and trauma to floodplain occupants. A large breach may result in substantial damages to assets on the floodplain.

Figures 26 and 27 show the potential extent of flooding in a 2800 cumec flood with stopbank breaches. They also show the floodplain divided into higher-, moderate- and lower-risk floodplain hazard areas.

FIGURE 26: HUTT FLOODPLAIN HAZARD AREAS (UPPER VALLEY)

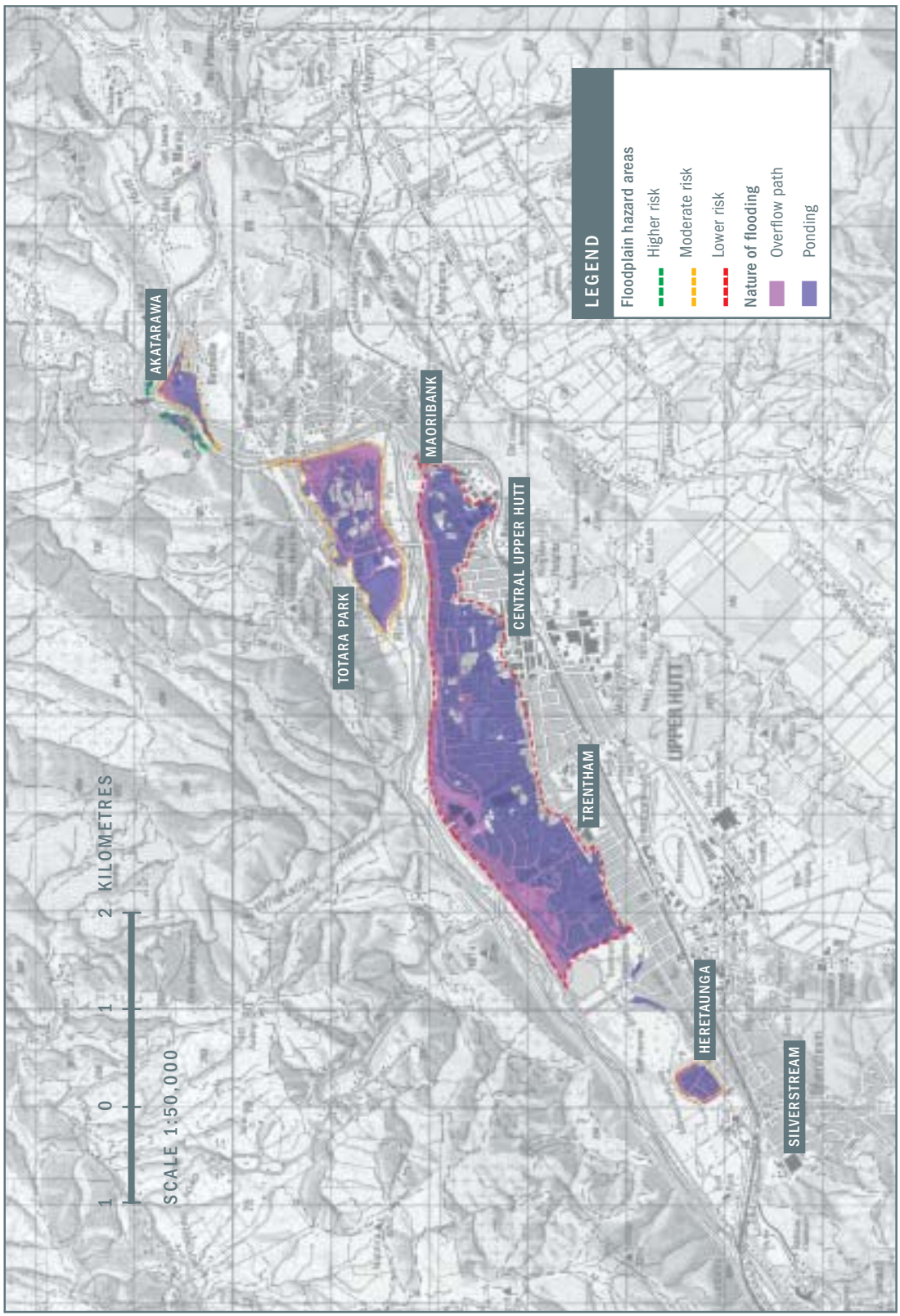
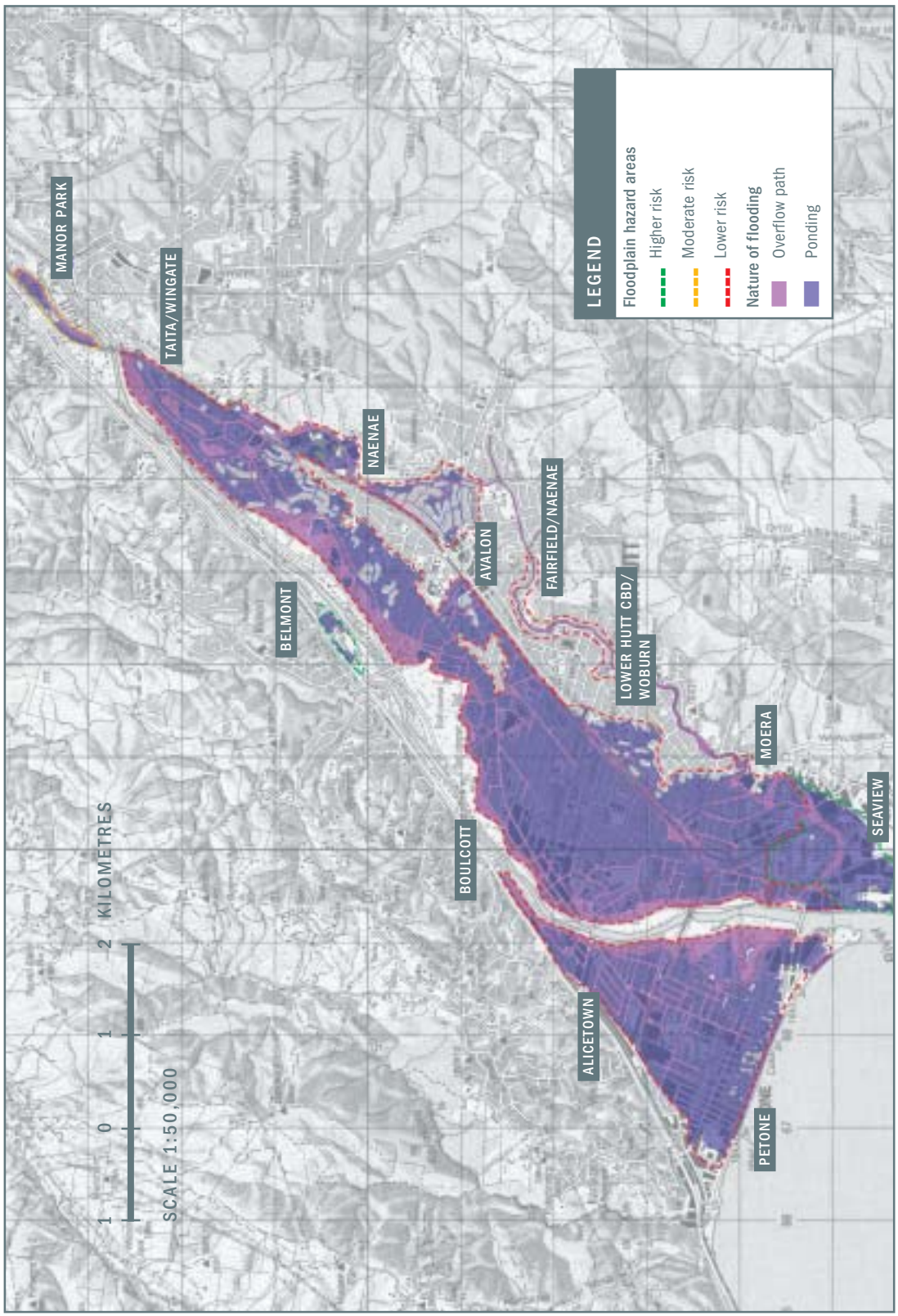


FIGURE 27: HUTT FLOODPLAIN HAZARD AREAS (LOWER VALLEY)



Voluntary Actions

Unlike regulatory land-use measures, voluntary actions apply to all Hutt catchment areas – everybody needs to become involved. They include providing the community with hazard information, and technical and practical advice on ways to avoid the flood hazard or reduce damages. The city councils are the main 'shop front' for information and advice. The Regional Council's main role is to provide information and advice to the city councils.

DO YOU WANT TO KNOW MORE ?

Ref 3: Creating Flood Disasters

Ref 27: Hutt River Corridor Assessment

Ref 51: National and International Procedures

Ref 53: Non-structural Procedures

Ref 63: Upper Catchment Investigation

Also:
Newsletter No. 5: Non-structural Measures

5.3 DEVELOPING NON-STRUCTURAL PRINCIPLES

So far we have looked at the kinds of areas that are at risk from flooding or erosion, and the magnitude of that risk. We now need to decide on the sorts of land use that are appropriate in these areas, and the extent to which they could be regulated or left to voluntary action.

The principles for the non-structural measures provide broad standards to guide the way *residual* flood hazard risk in the Hutt Valley needs to be handled. In other words, the way flood-prone land is managed, structures are constructed, and how the community prepares to cope with flooding.

As we have seen, the principles provide the framework for the types of non-structural measures to be implemented as:

- policies and rules of council district plans
- voluntary action, information and advice
- emergency management programmes and procedures.

As with the structural measures, a risk-based approach was used to guide the choice of possible non-structural measures, including the balance between the different sorts of measures. Once again, this means that the flood protection is targeted at areas according to need.

Developing these principles and outcomes concludes 18 months of work over 1998 and 1999, with input from Hutt City, Upper Hutt City and Wellington Regional Council officers, the Advisory Committee and the public. This does not mean that all the work is finished: we need to remain flexible to modify non-structural outcomes where it is practical and necessary to do so.

Why the Principles Have Been Developed

Land-use

Regulation: Planning Policies and Rules

The cities' district plans are key tools for implementing the land-use measures. However, both Upper Hutt and Hutt cities' proposed district plans were prepared before the non-structural measures principles were developed for the Plan. This has meant that very few flood hazard management policies and rules have been included in either district plan so far.

Voluntary Action

Voluntary action plays a crucial role in reducing flooding impacts. The availability of flood hazard information and practical advice from the three councils to support action has until now been limited.

Emergency Management

While existing programmes and procedures provide a broad coverage for the Hutt Valley, the need to upgrade them and improve co-ordination has been recognised.

5.4 PRINCIPLES FOR NON-STRUCTURAL MEASURES

The principles for non-structural measures guide the development of practical measures, which aim to improve the community's resilience to flooding by:

- ensuring the flood protection system is not compromised by development
- managing flood hazard effects appropriately
- discouraging certain new land-uses in the river corridor
- encouraging the more intensive land-uses to be sited in alternative locations, reducing exposure to the flood hazard
- encouraging appropriate land-use practices in upper catchment areas
- allowing flexible mitigation solutions
- providing the community with advice and information so it can be better equipped to cope with flooding
- ensuring emergency management programmes and procedures are comprehensive.

Above all, the principles had to be practical, common-sense proposals that take account of how the Hutt Valley has actually developed, what that means for flood risk, and, given this situation, how the community's resilience can be improved.

Proposed non-structural measures are considered under the following categories:

LAND-USE MEASURES	
1.	Measures for the upper catchment
2.	Environmental Strategy requirements
3.	Habitable buildings
4.	Accessory buildings and ancillary structures
5.	Buildings associated with strong community reliance
6.	Buildings adjacent to moving erosion areas
7.	Subdivision
8.	Earthworks
9.	Hazardous substances
10.	Critical facilities
11.	Capacity of new bridges
12.	River corridor land remaining in public ownership
13.	Information on property titles
14.	Voluntary actions

EMERGENCY MANAGEMENT MEASURES	
•	Principles for Emergency Management Programmes and Procedures

Land-use Measures

Principles for land-use measures, applying to the upper catchment, river corridor, and floodplain, are presented below.

A recent land slip in the Hutt River upper catchment

1. Measures for the Upper Catchment

Rate of Earthworks

UHCC will have the ability to control the annual rate of earthworks.

Policy in District Plans

Policy in the UHCC district plan will clearly recognise flood hazard management responsibilities of UHCC and WRC, and general effects of activities on the flood risk.

2. Environmental Strategy Requirements

Buildings in the river corridor need to be compatible with the predominant uses in the river corridor, including open space, recreation and rural activities. These uses are also generally consistent with the linear park concept, and the general vision for the river corridor area promoted through the Hutt River Environmental Strategy.

3. Habitable Buildings

All River Corridor Areas

New Buildings Discouraged and Alternative Sites Encouraged

Constructing new habitable buildings will be strongly discouraged in areas not currently zoned for that land-use, and they will not be allowed in other parts of the primary river corridor.

Exposing new habitable buildings to the flood hazard in high-risk areas represents unwise floodplain management planning. Selecting alternative sites away from the river corridor will be encouraged.

Mitigating Erosion Effects Adjacent to Erosion Hazard Areas

Constructing any habitable building on land currently zoned for residential purposes will require adequate 1900 (developed areas) or 2300 (greenfield areas) standard erosion protection to be provided.

The landowner or developer will provide erosion protection. The protection standard, buffer requirements, ongoing maintenance and ownership responsibilities, and costs will also need to be provided for.

Mitigating Other Flood Hazard Effects

Other than erosion protection, mitigating other effects of a 2300 standard flood will also be required.

No Adverse Effects to be Created

Constructing habitable buildings on any river corridor land will require any adverse flood hazard effects on other land or structures to be avoided or mitigated.

Higher-Risk Floodplain Hazard Areas

Mitigating Flood Hazard Effects

All new and significantly redeveloped habitable buildings will be required to mitigate the flood effects of a 1900 cumec flood.

Developers and landowners will be strongly encouraged to mitigate the effects of a 2300 cumec flood.

Low to Moderate-Risk Floodplain Hazard Areas

Mitigating Flood Hazard Effects

Developers and landowners protected by stopbanks will be encouraged to consider mitigating the effects of flooding from stopbank breaches or overflows.

4. Accessory Buildings and Ancillary Structures

All River Corridor Areas

No Adverse Flood Hazard Effects

Constructing accessory buildings and ancillary structures will require adverse flood hazard effects to be avoided or mitigated.

The setback distance from flood protection structures, and the dimensions and orientation of structures, will determine whether effects are likely to be minor.

Primary River Corridor and Higher-Risk Floodplain Hazard Areas Associated with Residential Zones

Building Permitted in Zoned Areas

Accessory buildings and ancillary structures will only be permitted in the primary river corridor and higher-risk floodplain areas currently zoned for residential purposes.

Mitigating Flood Hazard Effects and Alternative Sites Encouraged

Where practicable, developers and landowners will be encouraged to site accessory buildings and ancillary structures outside the primary river corridor. Where alternative siting is not possible or desired, encouragement will be given to:

- strengthen buildings/structures to withstand flood hazard effects
- elevate floor levels
- build relocatable buildings.

A series of small floods over several years eroded up to 20 metres of river bank and berm at Taita, Lower Hutt.

5. Buildings Associated with Strong Community Reliance

River Corridor

Mitigating Flood Hazard Effects

New buildings will not be allowed in the primary river corridor. New buildings constructed in areas currently zoned for that land-use will be required to mitigate the effects of a 2300 flood.

Encouraging Siting Outside the River Corridor

Exposing new buildings to the flood hazard in high-risk areas represents unwise floodplain management planning. Selecting alternative sites away from the river corridor will be strongly encouraged.

Higher-Risk Floodplain Hazard Areas

Mitigating Flood Hazard Effects

All new and significantly redeveloped buildings in currently developed higher-risk floodplain areas will be required to mitigate the effects of a 1900 flood.

Landowners and developers will be strongly encouraged to mitigate the effects of a 2300 flood.

Buildings with Less or No Measurable Community Reliance

Developers and landowners will be strongly discouraged from siting in the primary river corridor. They will be required to mitigate the effects of a 50-year flood for new buildings that concentrate people infrequently. Where appropriate, encouragement will be given to mitigate 2300 cumec flood effects. The setback distance from flood defences, and potential for cumulative adverse effects on the flood protection system, will determine whether the effects are likely to be minor.

Buildings with lesser community reliance include sports clubrooms.

6. **Buildings Adjacent to Moving Erosion Areas**

Adjacent to Moving Erosion Areas

Providing Erosion Protection

Landowners and developers may need to provide erosion protection, and ongoing maintenance of that protection, for buildings intended for sites adjacent to moving erosion areas. Erosion protection requirements are additional to mitigating other flood hazard effects.

The siting of individual buildings, such as habitable buildings, will be discouraged in these locations because it may not be feasible to provide erosion protection for single houses. Considerations for new erosion protection include:

- construction standards
- who owns and operates the structures
- who pays for ongoing maintenance and repair
- providing the ability to disperse ponded flood waters
- providing for residual risk.

7. **Subdivision**

River Corridor and Higher-risk Floodplain Hazard Areas

Primary River Corridor

Subdivision in the primary river corridor for the purpose of constructing new habitable buildings will not be allowed.

Restrictions Outside Existing District Plan Zones

Subdividing land intended for uses that are outside existing district planning zones will be non-complying, apart from minor boundary adjustments.

New Subdivision Discouraged

Subdivision will be strongly discouraged where the resulting land-uses expose people and assets to an increased flood hazard.

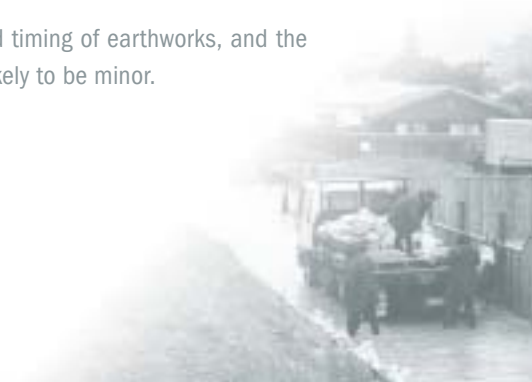
8. **Earthworks**

River Corridor and Higher-risk Floodplain Hazard Areas

No Adverse Flood Hazard Effects Caused

Earthworks, including filling and excavation, will be required to avoid or mitigate adverse flood hazard effects.

The setback distance from flood defences, the volume, dimensions and timing of earthworks, and the potential for cumulative effects will determine whether the effects are likely to be minor.



9. Hazardous Substances

River Corridor and Higher-risk Floodplain Hazard Areas

Existing Areas Zoned for Using Hazardous Substances

Stored hazardous substances must be secure in a 2300 cumec flood.

Additional Mitigation Encouraged

Developers and landowners will be given information on how they can mitigate the effects of a 2800 cumec flood.

New Associated Uses Discouraged

Intended new commercial and industrial land-uses that require hazardous substances as a key part of their daily operations will be discouraged from siting in the river corridor.

10. Critical Facilities

River Corridor

No New Healthcare Facilities and Emergency Services

New healthcare facilities and emergency services will not be established in the river corridor.

Key Network Utilities – Managing Flood Effects

The owners of key network utility facilities will be required to ensure they can operate in a 2800 cumec flood. Alternative siting away from the river corridor will be promoted.

Higher-Risk Floodplain Hazard Areas

Healthcare Facilities and Emergency Services – Managing Flood Effects

The owners of new in-patient healthcare facilities will be required to show they can operate services in a 2800 cumec flood.

The owners of new out-patient facilities and emergency services will be required to produce contingency plans detailing how they will manage a 2800 cumec flood.

Alternative Siting Encouraged

Alternative siting of healthcare facilities and emergency services away from higher-risk floodplain areas will be strongly encouraged.

Key Network Utilities – Managing Flood Effects

The owners of key network utility facilities will be required to ensure they can operate in a 2800 cumec flood. Alternative siting away from higher-risk floodplain areas will be promoted.

Moderate and Lower-risk Floodplain Hazard Areas

Emergency Services, Healthcare Facilities and Network Utilities – Managing Flood Effects

The owners of new and existing in-patient healthcare facilities will be required to show they can operate services in a 2800 cumec flood with breaches.

The owners of new and existing out-patient facilities, emergency services and network utilities will be encouraged to produce contingency plans detailing how they will manage a 2800 cumec flood with breaches.

11. Capacity of New and Replaced Bridges

Passing the 2800 Cumec Flood

New or replaced bridges and their associated floodways will be required to pass a 2800 cumec flood without adversely affecting any flood defences or raising upstream flood levels. Akatarawa Bridge (Birchville) is excluded from the 2800 cumec requirement.

12. River Corridor Land Remaining in Public Ownership

Land should remain in public ownership enabling:

- flood hazard effects to be more easily managed
- inappropriate land-uses to be actively discouraged from siting in the river corridor.

13. Information on Property Titles

Adding Hazard Information on New Property Titles

Hazard information will be placed on new property titles where proposed structural works would not protect those properties from:

- an identified river erosion hazard[2]
- a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas.

Adding Hazard Information for New Structures and Additions

Where practical and feasible, hazard information will be placed on existing titles when new buildings and major additions are constructed. Affected titles are those where proposed structural works would not offer protection from:

- an identified river erosion hazard[3]
- a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas.

Accessory structures and ancillary buildings will be excluded from these requirements.

2 *Uses sections 221(1) and 224(c) of the Resource Management Act 1991 to achieve this.*

3 *Uses sections 221(1) and 224(c) of the Resource Management Act 1991 to achieve this.*

14. Voluntary Actions

Upper Catchment

Voluntary actions in the upper catchment involving Upper Hutt City and Wellington Regional Councils will include:

- monitoring and investigating the effects of vegetation clearance and soil excavation in the upper catchment
- UHCC forwarding forestry development and harvesting notices to the WRC
- monitoring land-use changes
- monitoring rural subdivision
- WRC developing policy affecting WRC-owned upper catchment land
- WRC developing policy to manage flood hazard effects in the upper catchment.

River Corridor

Voluntary actions in the river corridor will include providing information to the community[4] for a range of flood scenarios to support:

- constructing ancillary structures and accessory buildings
- siting other buildings in alternative locations.

Floodplain

Voluntary actions in the floodplain will include:

- providing information for a range of flood breach scenarios affecting moderate- and lower-risk areas to support:
  - constructing buildings to manage flooding effects, including effects of ponding and flow
  - appropriate siting of emergency services
  - placing fill
- providing information for the 2300 cumec flood affecting higher-risk areas to support:
  - constructing ancillary structures and accessory buildings to withstand flow effects
  - constructing habitable buildings to manage flooding effects.

4 *Community in this sense not only includes interested residents, but also means businesses, public agencies, utility and emergency services, and developers.*

Providing Information to Support Voluntary Actions

If people are to undertake voluntary actions to prepare against the possibility of a flood, they need good, reliable information about the flood hazard in their area. The Regional Council will provide flood hazard information to Hutt and Upper Hutt City Councils, and directly to the community where this is appropriate. The city councils have the primary responsibility for passing information to the community.

Information will include:

- floodplain risk area maps
- river corridor plans
- flood extent maps
- more detailed depth and flow information for all flood-prone areas.

DO YOU WANT TO KNOW MORE ?

Ref 2:	Confirming Non-structural Measures
Ref 11:	HCC Civil Defence Plan
Ref 12:	HCC Corporate Emergency Plan
Ref 51:	National and International Procedures
Ref 53:	Non-structural Procedures
Ref 58:	Regional Council Civil Defence Plan
Ref 62:	UHCC Civil Defence Plan
Ref 63:	Upper Catchment Investigation
Ref 64:	WRC Hazards

Also:
Newsletter No. 5: Non-structural Measures

This information will be reproduced through *land information memorandums* (LIMs) and *project information memorandums* (PIMs)[5] as appropriate.

Flood hazard information should also be provided in brochures on flood risk, targeting localised areas. Ideally this would be supported by basic material covering emergency management, to provide a full round-up of non-structural measures. The extent, nature and form of the information is still to be decided.

The Regional Council intend producing an additional brochure series describing localised floodplain management planning measures, as support for the Plan document. The brochures would be limited in detail, however, so both Hutt and Upper Hutt City Councils would need to consider producing more detailed information in a promotional form.

Emergency Management Measures

What principles have been devised to cover emergency management procedures, and who is responsible? Emergency management is mostly handled by local government. The Civil Defence Act 1983 requires local and regional councils to plan and prepare for flood emergencies.

The Hutt City, Upper Hutt City and Wellington Regional Councils endorse the Four Rs of comprehensive and integrated emergency management and sustainable hazard management (see section 5.6). This is an 'all hazards' approach, and requires co-ordinated planning for managing events ranging from 'puddles to floods'.

The following are the key principles developed for emergency management programmes and procedures.

5 *LIMs and PIMs contain a wide range of information about a chosen parcel of land, including the presence of natural hazards, access easements or services such as stormwater drains. Including all publicly available hazard information is a statutory requirement*

Principles for Emergency Management Programmes and Procedures

Emphasising Individual Responsibility

Programmes and procedures will encourage Hutt Valley residents to manage themselves in a flood. A resilient community is one in which people are prepared to respond and recover.

Reviewing Measures Regularly

Regular reviews of all emergency management programmes and procedures will be conducted to ensure they are:

- relevant
- current
- appropriate.

Covering Extreme Floods

Measures need to adequately cover extreme floods beyond the design standard flood.

Programming Enhancements

Measures identified during the initial review of emergency management measures (December 1999 to March 2000) should be enhanced. Considerations include:

- options for enhancing measures
- timeframes for implementation
- funding and resourcing requirements
- expected outcomes.

Considering Timeframes for Structural Measures

People should be kept informed about timeframes, and when structural works are likely to take place. A focus should be on milestones for achieving significant improvements in the safety of floodplain areas.

Providing Information

The community needs to be provided with simple, visual, correct and accessible information.

Prioritising Communities at Risk

People in flood-prone areas should be receiving an acceptable level of emergency management information and advice. Residents in higher-risk floodplain areas would be given first priority for receiving new information and advice.

The last of many cars is removed from the rising waters in the riverside carpark, central Lower Hutt, October 1998. R. Thomas©.

Modifying Information According to Risk

Advice and information need to be modified to highlight differences in the risks and likely consequences of flooding in flood-prone areas.

Improving Connections with the Media

Improved links between the media and emergency managers are necessary to ensure the community has basic and accurate information during and after floods.

Improving Links with Emergency Services

Current emergency management co-ordination between the councils and emergency services will be improved.

5.5 OUTCOMES FOR LAND-USE MEASURES

In this part of the chapter we look at two main kinds of non-structural measures, and how they can be applied to flood mitigation in the Hutt Valley.

These measures were arrived at by working with the guiding principles presented earlier, which in turn were developed after a decision was made on the size of flood we wanted to protect against (the *design standard*). So, the reasoning goes: if we want to protect against *this* sort of flood, then we need to keep *these* things in mind (the principles) and consider carrying out *these* kinds of actions (the measures).

Tables 7 to 9 take the different geographical areas covered in this Plan (the upper catchment, river corridor and floodplain), and for each of these show the different kinds of land-use activities and the appropriate regulatory methods and voluntary actions that could apply to them. These represent the possible measures that *could* be derived by putting the non-structural principles into practice.

How to Read the Tables

The tables cover land-use and development activities in terms of:

- the type of activity (for example, constructing new buildings)
- a relevant hazard area involved
- whether the activity would require any form of regulatory control (policies and rules) in a district plan, or a voluntary action supported by the three councils
- the flood hazard effects being addressed, and the sorts of quality standards that may need to be met
- any transitional measures required.

A probable activity status is given, but only for potential permitted or non-complying activities. Other activities, which could be regulated, are represented by listed general standards or other requirements.

The regulatory status provided in the tables below reflects the principles for non-structural measures. It is an indication of how the principles *could* be applied and *should only be read as a general guide.* The eventual regulatory status of any activities will be determined during the formal district plan change development, consultation and hearing process.

Tables 7 to 9 only cover activities that reflect the non-structural principles in Section 5.4.

THE ACTIVITY STATUS

The activity status tells you whether an activity, such as subdividing land for new residential homes, needs a resource consent. If the activity does need a consent (is regulated in a Plan rule), then the actual status will determine how strongly the application could be scrutinised.

The level of scrutiny in turn generally depends on the level of adverse impacts on the environment or neighbours.

Table 7: Proposed Land-use Measures: Upper Catchment

ACTIVITY	REGULATE/CONTROL	VOLUNTARY ACTION
Earthworks	• Annual rate of earthworks – UHCC District Plan	• Monitor and investigate vegetation clearance and soil excavation in the upper catchment
General	• Policy in UHCC District Plan notices to WRC • Recognise flood hazard responsibilities between UHCC and WRC, and general flood hazard effects on activities	• Forward forestry development and harvesting notices to WRC • Monitor land-use changes • Monitor rural subdivision • Promote WRC policy covering WRC land management in the upper catchment land influencing the flood hazard • Promote WRC policy to manage the flood risk in the upper catchment

Forestry operations in the upper catchment. Sediment and debris could eventually be washed into the Hutt River, reducing its flood capacity and creating debris traps and dams. Policies promoting good practice that limits the movement of forestry debris and sediment into nearby watercourses will be encouraged.

Table 8: Proposed land-use measures: river corridor hazard areas

RIVER CORRIDOR ACTIVITY	PRIMARY RIVER CORRIDOR		SECONDARY RIVER CORRIDOR	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Habitable buildings	Resource consent required – e.g. for a non-complying activity for any habitable buildings		Resource consent required – e.g. for a non-complying activity for areas *not* currently zoned for that activity New buildings require mitigating 2300 flood effects – in greenfield areas currently zoned for that activity Erosion protection required for building adjacent to *moving erosion areas*	New habitable buildings will be discouraged
Accessory buildings and ancillary structures	Permitted activity – for residential zones, requires performance standards governing matters such as size and adverse effects to be met Otherwise a resource consent is required	Encourages: • siting buildings outside erosion hazard areas and flow paths • strengthening buildings • providing information for a range of flood scenarios	Same as for *primary river corridor*	Same as for *primary river corridor*
Buildings associated with strong community reliance *These are buildings that house important activities which the community or parts of it strongly rely on for their day-to-day functioning (e.g. work places)*	Resource consent required – e.g. for a non-complying activity for any buildings with strong community reliance		Resource consent required controlling: • mitigating effects for a 2300 flood – on land currently zoned for that activity (greenfield site) • mitigating effects for a 1900 flood – on land currently zoned for that activity (existing developed areas)	Encourage landowners and developers to mitigate effects of a 2300 flood, or, where practicable, to locate outside the river corridor

TABLE 8: CONTINUED

RIVER CORRIDOR ACTIVITY	PRIMARY RIVER CORRIDOR		SECONDARY RIVER CORRIDOR	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Buildings with lesser or no community reliance *(such as clubrooms, and also includes all other buildings)*	Resource consent required – e.g. for a non-complying activity for any building with lesser community reliance		Resource consent may be required controlling: • size and location in relation to flood defence structures • cumulative adverse effects	Provide information on a range of flood scenarios for: • constructing buildings to various flood standards (encouraging the 2300 standard) • siting away from flow paths, protecting key parts of the operation
Subdivision	Resource consent required – e.g. for a non-complying activity in areas *not* currently zoned for that activity Flood hazard information on new property titles where they would not be protected from erosion or flooding	Strongly discourage subdivision where the resulting uses expose people and assets to an increased hazard level	Same as for *primary river corridor*	Discourage subdivision for habitable use where new development is intended outside existing intensive development zones
Subdivision – minor boundary adjustments	Permitted activity		Permitted activity	
Earthworks	Permitted activity – required to meet performance standards governing volume, dimensions and adverse effects to be met, otherwise a resource consent is required		Permitted activity – requires performance standards governing adverse effects to be met, otherwise a resource consent is required	

TABLE 8: CONTINUED

RIVER CORRIDOR ACTIVITY	PRIMARY RIVER CORRIDOR		SECONDARY RIVER CORRIDOR	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Hazardous substances	Resource consent required – e.g. for a non-complying activity in areas *not* currently zoned for that activity	Information on how to mitigate effects of a 2800 flood will be provided	Permitted activity – requires securing storage in a 2300 flood, and other performance standards	Same as for *primary river corridor*
Critical facilities				
Healthcare and emergency services	Resource consent required – such as for a non-complying activity	Encourage alternative siting of new healthcare facilities and emergency services	Resource consent required – e.g. for a non-complying activity	Same as for *primary river corridor*
Key network facilities				
***Key network facilities** are those parts of a utility service critical for ongoing function. Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired.*	Resource consent required controlling new and redeveloped key facilities, ensuring they can operate in a 2800 flood	Promote alternative siting of key facilities away from the river corridor	Same as for *primary river corridor*	Same as for *primary river corridor*
***Critical facilities** are buildings and services where disruption to their associated activities would significantly worsen the potential impacts of a flood.*	Permitted activity – requiring new sewerage and water supply networks to be protected from erosion and scour effects to the 1900 standard	2800 standard contingency plans encouraged for existing facilities		
New and upgraded bridges	Resource consent required – bridges and their associated floodways must pass a 2800 cumec flood without adversely affecting any flood defences, or raising upstream flood levels *(Akatarawa Bridge is excluded from the 2800 requirement.)*			

TABLE 8: CONTINUED

RIVER CORRIDOR ACTIVITY	PRIMARY RIVER CORRIDOR		SECONDARY RIVER CORRIDOR	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Information on property titles	Hazard information will be placed on *new property titles* where proposed structural works would not protect those properties from: • an identified river erosion hazard • a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas		Same as for *primary river corridor*	
Transitional measures *These apply while programmed structural measures to improve flood protection are being completed.*	For land exposed to the flood hazard, place information on: • new property titles • new buildings and significant extensions (where practical and feasible) Flood hazard information equates to at least: • identified river erosion hazard areas • the extent of 1900 cumec flooding The river corridor boundary at Belmont will be modified after bank-edge protection works are completed		Same as for *primary river corridor*	

Table 9: Proposed land-use measures: floodplain hazard areas

FLOODPLAIN ACTIVITY	HIGHER-RISK AREAS		LOW-TO-MODERATE RISK AREAS	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Habitable buildings	Resource consent required controlling new buildings – mitigating 1900 flood effects in areas currently zoned for that activity	Encourage mitigating the effects of a 2300 flood Provide information for the 2300 flood to support constructing buildings to manage flood hazard effects (including flow effects).	*No controls recommended*	Encourage mitigating the effects of flooding from stopbank breaches or overtopping Provide information for a range of flood breach scenarios to support constructing buildings to manage flooding effects (including ponding and flow effects).
Accessory buildings and ancillary structures	Permitted activity in areas currently zoned for that purpose – requires performance standards governing matters such as mitigating effects of a 50-year flood, location near other structures, and adverse effects to be met, otherwise a resource consent is required	Provide information for a range of floods to support constructing buildings and structures to withstand flow effects	*No controls recommended*	Same as for *higher-risk areas*
Buildings associated with strong community reliance	Resource consent required mitigating 1900 flood effects – on land currently zoned for that activity	Discourage constructing new buildings in areas not currently zoned for that activity	*No controls recommended*	Encourage mitigating 2300 cumec flood effects
Buildings with lesser or no community reliance	Permitted activity in areas currently zoned for that purpose – requires performance standards governing matters such as location near other structures, and adverse effects to be met, otherwise a resource consent is required	Encourage mitigating 2300 cumec flood	*No controls recommended*	

TABLE 9: CONTINUED

FLOODPLAIN ACTIVITY	HIGHER-RISK AREAS		LOW-TO-MODERATE RISK AREAS	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Subdivision – for uses outside existing zones	Resource consent required – e.g. for a non-complying activity in areas *not* currently zoned for that activity New property titles tagged where they would not be protected from erosion or flooding	Strongly discourage where the resulting uses expose people and assets to an increased hazard level	*No controls recommended*	Same as for *higher-risk areas*
Subdivision – minor boundary adjustments	Permitted activity		*No controls recommended*	
Earthworks	Permitted activity – required to meet performance standards governing volume, dimensions and adverse effects to be met – otherwise a resource consent is required		*No controls recommended*	Provide information for a range of flood-breach scenarios to support placing fill appropriately
Hazardous substances	Permitted activity – requires securing storage in a 2300 flood, and other performance standards	Encourage mitigating the effects of a 2800 flood	*No controls recommended*	

TABLE 9: CONTINUED

FLOODPLAIN ACTIVITY	HIGHER-RISK AREAS		LOW-TO-MODERATE RISK AREAS	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Critical facilities				
Healthcare and emergency services	Permitted activity: • new in-patient services required to demonstrate ability to operate services in a 2800 cumec flood • new out-patient facilities and emergency services to produce contingency plans meeting the 2800 cumec standard Contingency plans are also required	Alternative siting of new and any existing healthcare facilities and emergency services will be encouraged	Permitted activity for new in-patient services – required to demonstrate ability to operate services in a 2800 cumec flood	New and existing out-patient healthcare facilities and emergency services will be encouraged to produce contingency plans detailing how they will manage a 2800 flood with breaches Provide information for a range of flood breach scenarios to support appropriate siting of emergency services
Key network utilities	Permitted activity: • new and redeveloped key facilities required to ensure they can operate in a 1900 cumec flood • new networks for sewerage and water supply to meet the 1900 cumec standard Contingency plans are also required		*No controls recommended*	New and existing network utility facilities will be encouraged to produce contingency plans detailing how they will manage a 2300 flood with breaches Provide information for a range of flood-breach scenarios to support appropriate siting of emergency services

TABLE 9: CONTINUED

FLOODPLAIN ACTIVITY	HIGHER-RISK AREAS		LOW-TO-MODERATE RISK AREAS	
	REGULATE/CONTROL	VOLUNTARY ACTION	REGULATE/CONTROL	VOLUNTARY ACTION
Information on property titles *Included as a transitional measure until new structural works are in place*	Hazard information will be placed on new property titles where proposed structural works would not protect those properties from: • an identified erosion hazard • a 2300 flood affecting greenfield areas, or a 1900 flood in existing developed areas			
Transitional measures *These apply while programmed measures improving flood protection are being completed.*	For land exposed to the flood hazard, placing information on: • new property titles • new buildings and significant extensions (where practical and feasible) Flood hazard information equates to at least: • identified river erosion hazard areas • the extent of 1900 cumec flooding		Same as for *higher-risk areas*	

5.6 EMERGENCY MANAGEMENT PROGRAMMES AND PROCEDURES

When a flood emergency happens, how well a community copes depends entirely on how well prepared it is, and this includes emergency services, public agencies, utility services, businesses and ordinary residents.

Emergency management under the Hutt River Floodplain Management Plan covers flooding caused by the Hutt River. The strategies encompass the entire Hutt Valley, including the upper catchment areas, the Hutt River corridor and the Hutt River floodplain. Emergency management targets communities at risk from flooding, but also aims to build an environment of self-help and mutual support within the wider community so that people are better able to manage their own emergency response.

Emergency management is provided by the emergency management departments of Hutt and Upper Hutt City Councils, and the Regional Council, with the assistance of the emergency services and many volunteers and voluntary organisations. A description of flood emergency management response and recovery procedures is provided in Appendix 1.

The Four Rs of Emergency Management

1. Reduction of Risk

Strategies that reduce the chances of a hazard occurring, or lessen the consequences when it does happen. Current risk reduction strategies include:

- flood hazard analysis
- flood modelling
- flood mapping
- economic assessments
- land-use measures (e.g. floor-level requirements for buildings)
- structural flood protection works
- hazard-related resource consent submissions
- disaster insurance (provided by EQC with additional insurance provided through private insurance companies).

2. Readiness

Strategies that prepare for emergency response. Current readiness strategies include:

- school education programmes
- community response training
- public education through displays, presentations and media campaigns
- mutual aid agreements for assistance
- council emergency plans
- training exercises
- emergency services co-ordination meetings
- emergency radio communication networks
- weather warnings
- headquarters staff training
- monitoring equipment for rainfall river alert levels
- emergency resource databases
- pre-emergency contractual agreements for service.

3. Response

Strategies for counteracting the emergency when it occurs. Current response strategies include:

- warning systems (sirens)
- response plan activation
- emergency operations centre activation
- co-ordinating the response of lifeline organisations
- 24-hour callout procedures
- sandbagging operations
- information release to the media
- emergency works
- evacuation procedures
- call centre activation
- civil defence centre activation
- welfare centre activation
- international assistance reception.

4. Recovery

Strategies to return the community back to how it was (or better than it was) prior to the emergency. Current recovery strategies include:

- appointing a recovery manager
- recovery plan activation
- mayoral relief fund
- central government assistance
- business continuity plan activation
- relocation plan
- emergency housing provision.

5.7 OUTCOMES FOR EMERGENCY MANAGEMENT MEASURES

The focus of the emergency management measures in this Plan is to increase the service or coverage provided by the councils for all people at risk from the direct or indirect effects of flooding. This doesn't mean that current emergency management measures are insufficient. It means we want to enhance the current systems to take advantage of new opportunities and innovations. As well as Council-led initiatives, the Plan also seeks to improve people's ability to help themselves.

Major recommendations arising from a joint council evaluation of current emergency management measures are presented in Table 10.

TABLE 10: GENERAL RECOMMENDATIONS FOR MAJOR PROJECTS

PRIORITY	TASK	AGENCY AND FUNDING
Urgent	• Seismic study of earthquake hazard in the Hutt Valley • Identify how this hazard may affect flooding and protection works	Conducted by the Institute of Geological and Nuclear Sciences – funded through EQC research grant or council contributions
High	• Develop co-ordinated council procedures for media management and utilisation in local and regional events	A joint venture with in-kind contribution from all councils
	• Investigate the value of real-time response information provided via the internet • Develop appropriate packages, if necessary, based on the investigation findings	UHCC, HCC and WRC internal investigations – implementation costs as required from within current budgets
	• Design a format for flood hazard maps and information suitable to provide to the public	A WRC project to meet the needs of HCC and UHCC
	• Investigate the effectiveness of siren systems in the Upper and Lower Hutt Valley • Upgrade the systems, if necessary, based on investigation findings	HCC and UHCC projects – funding for implementation will be sought if required
Medium	• Investigate landslide hazards in Upper Hutt that may add to flood hazard or damage flood protection works	UHCC project – requires funding
	• Investigate hazards on the floodplain that may be triggered by floods (e.g. hazardous substance spills)	HCC and UHCC projects – within current budgets
	• Investigate alternate method for distributing preparedness information (e.g. internet, visual methods, signage, etc.)	A joint project for all councils – within current budgets
	• Formalise plan for tracking evacuees who have left the floodplain	HCC and UHCC projects – within current recovery planning budgets
	• Develop and agree procedures for administering mayoral relief funds, applying after a flood	An HCC and UHCC project – within current recovery planning budgets
Low	• Assess wider economic impact of flooding for the lower valley	An HCC project to build on known economic effects of flooding
	• Investigate sustainable supplies of sand available for sandbagging in the lower valley	An HCC logistics project – within current budgets
	• Investigate appropriate alternatives for providing long-term accommodation for evacuees on or away from the floodplain	A joint project for all councils – within current recovery planning

Timeframes

How long will it take to carry out these tasks? Timeframes depend on the priority levels for the major projects, and on the long-term financial and annual planning requirements of the city councils. As a rough guideline:

TIMEFRAMES
Urgent tasks should be completed in 2002–2003
High priority tasks should be completed by 2004
Medium and Low priority tasks should be completed by 2006–2007

5.8 IMPLEMENTING NON-STRUCTURAL MEASURES

We have looked at a variety of proposals for non-structural measures, and have even indicated deadlines for completing them. So when do we start? Implementing non-structural measures from the principles contained in this chapter will begin immediately after the release of the Plan. Upper Hutt and Hutt City Councils are primarily responsible, although the specific timing and sharing of responsibilities with the Regional Council needs further discussion and agreement between the three councils.

DO YOU WANT TO KNOW MORE ?

Ref 2: Confirming Non-structural Measures

Ref 15: Heathcote River Economic Assessment

Ref 39: Hutt River Non-structural Economic Assessment

Ref 48: Kaikoura Floodplain Strategy

Ref 54: NSW Floodplain Manual

Also:
Civil Defence Act 1983

Civil Defence Emergency Management Bill 2000

Hutt City Proposed District Plan

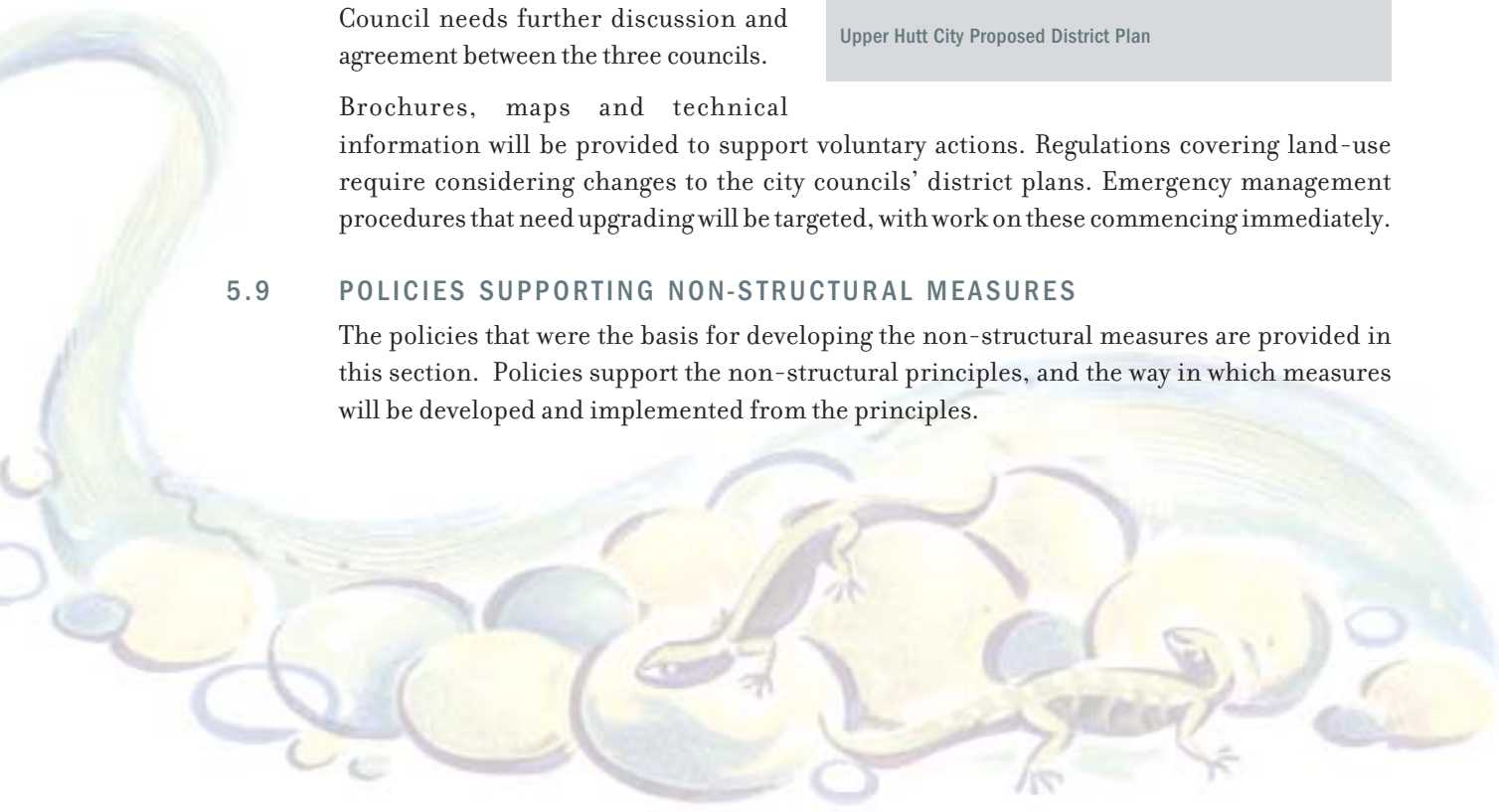
Resource Management Act 1991

Upper Hutt City Proposed District Plan

Brochures, maps and technical information will be provided to support voluntary actions. Regulations covering land-use require considering changes to the city councils' district plans. Emergency management procedures that need upgrading will be targeted, with work on these commencing immediately.

5.9 POLICIES SUPPORTING NON-STRUCTURAL MEASURES

The policies that were the basis for developing the non-structural measures are provided in this section. Policies support the non-structural principles, and the way in which measures will be developed and implemented from the principles.



Non-structural Measures Policies

NON-STRUCTURAL MEASURE POLICIES – QUICK REFERENCE	
Policy 29:	Providing Flexibility for Agreed Non-structural Principles
Policy 30:	Principles Guiding Non-structural Measures
Policy 31:	Developing Balanced Measures Appropriate to Hutt Valley
Policy 32:	Applying Risk-based Approach to Non-structural Measures
Policy 33:	Sharing Responsibilities for Implementing Measures
Policy 34:	Using Flexible Mitigation Methods

Policy 29: Providing Flexibility for Agreed Non-structural Measures Principles

Issue

Non-structural measures principles have been developed, modified and finalised relatively quickly and the final principles and associated outcomes are reasonably complex. Therefore the implications for how the measures should be developed need to be looked at closely at the local level.

Policy

The Hutt and Upper Hutt City Councils require flexibility to develop non-structural measures in a way that enables a number of matters to be considered. These include, but are not limited to, legal validity, annual plan priorities, the difficulties of implementing measures, and fairness and balance.

Explanation

The flexibility described in this policy will provide the three councils with the necessary forum to continue exchanging ideas and developing sound non-structural solutions. This policy should be considered together with Policy 31.

Policy 30: Principles Guiding Non-structural Measures

Issue

The potential look and make-up of the eventual non-structural measures need to be clearly understood by all three councils. Developing guiding principles, or brief and clear statements of intent, supports this need.

Policy

The comprehensive suite of non-structural measures principles will be used to further develop, refine and implement non-structural measures.

Explanation

The principles clearly guide the way residual flood hazard risk in the Hutt Valley needs to be managed. The principles are a reference point to guide further development of land-use and emergency management measures.

Policy 31: Developing Balanced Measures Appropriate to the Hutt Valley

Issue

Non-structural measures can impose significant restrictions on land-uses in flood-prone areas. Measures must balance landowners' rights against a need to reduce flood impacts on people directly at risk. In achieving this balance, measures must not only be reasonable and fair but also responsible, and this requires using a wide range of non-structural tools.

Policy

The non-structural measures principles require that final measures be balanced, fair, and responsible. Recommended measures must also be legally sound.

Achieving measures that satisfy these criteria will require:

- applying a risk-based approach (rather than applying one flood standard), which treats land-use activities at varying locations more fairly
- developing voluntary actions, so that the suitability of proposed policies and rules can be tested
- forming legally defensible and enforceable planning policies and rules, which are not difficult for councils to implement
- ensuring adverse amenity effects are not likely to be significant, including adverse visual, noise, access and general amenity .

Wide-ranging measures will provide appropriate non-structural solutions, including:

- land-use policies and rules in district plans, and information and advice encouraging voluntary action
- emergency management programmes and procedures.

Explanation

This policy requires non-structural measures to be balanced. This means that dangers posed by the potential hazard are balanced against the costs and the practicalities of implementing measures. Balance does not mean that strong non-structural measures should not be considered. Legal advice has generally moderated the principles, making them fairer. Moderating adverse amenity effects, developing voluntary actions, and using a risk-based approach to develop measures are all ways to help ensure that balance is achieved.

The Hutt Valley spreads out in the distance beyond the Hutt River upper catchment.

Policy 32: Applying a Risk-based Approach to Non-structural Measures

Issue

The Regional Council has endorsed a risk-based approach for flood protection in the Hutt Valley for non-structural measures. This approach has been used to determine the balance between

the design standard and individual structural measures for the Hutt River. It makes sense to apply the same approach to non-structural protection in order to account for varying flood hazard risk.

Policy

Non-structural measures need to be developed in a way that accounts for the varying flood hazard risk between the various flood-prone areas.

Explanation

A varying non-structural protection standard not only responds to the varying flood hazard affecting different river corridor and floodplain areas, but also retains consistency with the design standard.

Policy 33: Sharing Responsibilities for Implementing Measures

Issue

While Hutt City and Upper Hutt City Councils are the primary implementers of non-structural measures, responsibilities for further developing and implementing measures that also involve the Regional Council need to be clarified.

Policy

District plan change process: both city councils will drive the plan change or variation processes. However, the Regional Council will have an active role helping to form district plan policies and rules, and supporting the councils during consultation, under the city councils' direction.

Voluntary action: the Regional Council will play a support role to the city councils by providing technical flood hazard information.

Emergency management programmes and procedures: while the city councils are primarily responsible for implementing measures, the Regional Council is available to play a co-ordinating role in providing information and developing enhanced measures. Joint-venture projects between the councils will also be promoted.

Explanation

The Regional Council's supporting role in developing and implementing non-structural measures needs further discussion with the two city councils. The Regional Council's normal emergency management functions mean it is positioned to help co-ordinate efforts to enhance emergency management measures. Joint-venture projects have many advantages, including consistency of approach and cost savings. Current civil defence law reform suggests that the Regional Council may play a more significant emergency management administrative role in future.

Policy 34: Using Flexible Mitigation Methods

Issue

Landowners and developers need flexibility to mitigate flood hazard effects on existing and new land-uses. While there is no one correct way to mitigate hazards in flood-prone areas, some methods may be less desirable because they create additional problems.

Policy

Flexible methods that minimise flood hazard effects will be promoted. However, these methods must not cause additional problems such as:

- reducing the integrity of the flood protection system
- creating an unacceptable additional hazard for adjoining landowners and other floodplain occupants
- unduly compromising emergency services
- requiring stronger river alignment control in undeveloped areas
- creating significant ongoing maintenance and costs to the flood protection system.

Explanation

This policy assigns importance to allowing flexibility while not creating additional and unacceptable problems. There are many reasons why certain land-uses may not be appropriate, although this part of the policy is likely to be more relevant for highly hazardous locations, such as erosion-prone river corridor areas.

THE OUTCOMES: ENHANCING THE RIVER ENVIRONMENT

6

The Hutt River at Kaitoke Regional Park

6.1 INTRODUCTION

The structural measures described in Chapter Four will alter the look of the Hutt River and its surroundings. Stopbanks will be raised, rock linings placed, trees planted along the river edges, and the width of the river channel and where it runs may be changed. How will this look and what can we do to enhance the river and its environment?

The Environmental Strategy (the Strategy) was developed to provide a co-ordinated approach to managing and enhancing the river corridor environment. The Strategy sets out the long-term vision for the Hutt River environment as a *linear park* to provide a tranquil environment for people to escape to and enjoy the natural character of the river. When we undertake structural measures, the Strategy gives us direction to help achieve the community's wishes for the Hutt River environment.

To achieve this vision, guiding principles ensure that the river's ecosystems, cultural, landscape, recreational, iwi and community values are maintained and enhanced. In doing so, the Strategy places the river in the wider environment that includes the ecological values of the Hutt Valley and surrounding hills. The key to enhancing native ecological values along the river is ensuring there are connections (or corridors) between the areas that have native species and those areas we would like to see them along the river. Acknowledging the importance of corridors between the hills, upper catchment areas and the river, is vital to achieving the Strategy's vision.

This chapter outlines the opportunities proposed by the Environmental Strategy for enhancing the river's environment, and presents policies that support the Strategy. Opportunities range from improving areas for passive recreation, to enhancing native habitats. The Strategy's concept plans, provided at the end of the chapter, illustrate this vision.

6.2 WHAT THE ENVIRONMENTAL STRATEGY IS

VISION

The river and its corridor are developed as a linear park that provides a tranquil environment where people can go to escape the hustle and bustle of urban life, and enjoy the natural character of the river environment.

The Strategy's Purpose

The Environmental Strategy guides management of the Hutt River and its corridor in a way that:

- maintains and enhances the river environment
- provides for a range of recreational uses
- contributes positively to the community's spiritual, mental and physical well-being.

The Environmental Strategy is governed by the Floodplain Management Plan's general principles. Accordingly, any proposals or activities covered in the Environmental Strategy will not compromise the integrity of the flood defence system.

Native Mistletoe, R. Lucas 2001©

Area Covered by the Environmental Strategy

The area covered by the Environmental Strategy runs from Kaitoke Regional Park in the north, to Seaview Marina at the river mouth. Te Ati Awa iwi hold manawhenua over the river and the harbour, and are the kaitiaki of the area.

The majority of the land is in public ownership and is administered by either the Upper Hutt City Council, the Hutt City Council or the Wellington Regional Council.

When determining what areas to include in the Strategy, existing open spaces and habitat connected to the Hutt River were given prime consideration. Current land uses are varied, and range from recreation, farming and forestry to industrial.

Developing the Strategy

The Strategy was developed jointly with iwi, the Regional Council and the two city councils between 1999 and 2000. The Department of Conservation, NZ Fish & Game and the community also provided input. The concept for the Strategy borrows from similar strategies developed for the Waikanae and Otaki Rivers. Those strategies arose from the community's desire to see the river environment enhanced in a co-ordinated manner as structural works were completed. By promoting a wider range of enhancement projects, including areas not directly affected by the structural works, this Strategy is an extension of that initial approach.

The Strategy's Guiding Principles

The guiding principles were used to develop the concepts, proposals and recommendations for the river and specific areas. They are the ideas that will drive the vision forward, and their aim is to achieve the purpose of the overall Strategy. These guiding principles are to:

- protect and enhance the ecosystems of the river and its margins
- protect and enhance the cultural and historical values of the river and its margins
- protect and enhance the visual quality of the river and its margins
- improve and extend passive recreational facilities
- allow iwi to participate in decision-making and appropriately apply tikanga
- provide for continuing community input.

6.3 OPPORTUNITIES PROMOTED BY THE STRATEGY

The Strategy contains *concept plans* which suggest significant changes to the river environment. These changes can only be implemented as funds and opportunities become available. Proposals developed under the Strategy are subject to the resource management process, and resource consents may be required. The landowner's permission must also be gained before any projects are undertaken.

We also include some 'kite-flying' ideas in the Strategy. These ideas show what *could* be done, not necessarily what *should* be done. They have been included to illustrate ways to develop concepts for each area and generate discussion. The feasibility and desirability of kite-flying ideas need to be investigated before they can be implemented.

The following list (Table 11) indicates the priorities for implementing a range of initiatives under the Strategy. The individual items are derived from the reach-based proposals for the river environment.

Table 11: Environmental strategy – priorities summary

PRIORITY	PROJECT / ACTIVITY
Urgent	• Prepare an ecological management strategy for the Hutt River catchment • Support Te Ati Awa in reviewing culturally significant sites and areas • Establish a joint management committee, which includes representatives from Hutt and Upper Hutt City Councils, the Regional Council and Te Ati Awa • Establish a mechanism for ongoing tangata whenua and community input • Trial the use of salt-tolerant plant species for use in bank protection works
High	• Employ a river ranger • Control access for cars and motorbikes • Prepare a plan to formalise access to and along the whole length of the river
Medium	• Investigate environmental education opportunities • Remove barriers to fish movement • Develop protocols with other agencies for managing Hutt River ecosystems • Erect information boards • Upgrade existing tracks • Upgrade existing facilities • Investigate land acquisition options
Low	• Establish a heritage trail • Develop a unified signage system • Produce recreational guides • Extend tracks and walkways • Provide additional facilities

Opportunities and Obligations

School children planting native species on the Hutt River berms during Arbor Day.

Although the Strategy promotes a range of projects, it does not prescribe what a person or an organisation *should* do. The proposals were developed using a holistic approach that considered the whole river and its corridor over a 40-year period. On this basis, opportunities for enhancing the river and its margins were identified, regardless of ownership. This approach helps to identify future opportunities that may otherwise be lost.

The recommendations and proposals in the Strategy place no additional obligations on any of the parties involved. They are actions that *can* be adopted if funding becomes available.

6.4 POLICIES SUPPORTING THE ENVIRONMENTAL STRATEGY

The policies, issues and explanations detailed in the following sections reflect the guiding principles above. They have been derived from reach objectives and guidelines contained in the Environmental Strategy.

The policies apply to the river generally rather than to specific locations or sites. They either:

- direct what is appropriate within the linear park (for example, to control conflicting recreational uses); *or*
- identify actions for implementation (for example, upgrade the Hutt River Trail to an all-weather surface).

ENVIRONMENTAL STRATEGY POLICIES – QUICK REFERENCE

Policy 35: Tangata Whenua and the Community

Issue

Tangata whenua and community involvement is critical to the success of the Environmental Strategy.

Policy

Involve iwi and the community in decision-making, and make sure that tikanga is appropriately applied.

Explanation

Kaitiakitanga is an essential part of the relationship tangata whenua have with the environment. Central to kaitiakitanga is the understanding that successive generations have a responsibility to protect and nurture the mauri of their natural environment.

In some areas, local communities have a strong connection with the Hutt River, with good access, views of the river and berms, and a sense of ownership. In these places many of the local residents voluntarily monitor inappropriate behaviour, such as littering and vandalism. In other areas, roads and stopbanks physically and visually limit people's affiliation with the river. Experience has shown that where the local community is actively involved in specific enhancement projects and management, problems with littering and vandalism are reduced.

Ultimately, involving tangata whenua and the community should ensure that people's appreciation and enjoyment of the Hutt River and its environment are increased.

Policy 36: Ecosystems and Ecological Processes

Issue

Development within the floodplain affects ecological values and processes. In the past this has been at the expense of indigenous ecological values.

Policy

The ecological values of the river and its margins should be protected and enhanced.

Explanation

The Hutt River – its bed and banks, and the surrounding floodplain – form a series of interrelated ecosystems, each with distinct natural processes. These processes include physical ones such as rainfall and flooding, and biological ones such as plant and animal reproduction, migration and colonisation.

Human activities within these ecosystems affect each process differently. Human development of the floodplain has changed the ecology fundamentally, particularly during the 20th century. Often development has gone ahead without any thought to the effects on native species and their ecological values and processes.

By learning more about these ecological processes, and our effects on them, the wider community will be better placed to use the Strategy to ensure ecological values are protected and enhanced.

Cabbage Tree, A. Palmer 2001©

Policy 37: Maori – History and Cultural Values

Issue

Te Ati Awa iwi hold manawhenua over the river and harbour. As tangata whenua they maintain their right to take and manage resources from the river, and retain a tradition of fishing from both banks and the river mouth.

Policies

The cultural values of the river and its margins should be protected and enhanced.

Ensure that tangata whenua participate in the management of the Hutt River, and in implementing the Environmental Strategy.

Explanation

The Hutt River is a taonga of the tangata whenua. It is an important symbol associated with tupuna (ancestors), food and sustenance. The banks are places of Maori settlement, gardens and urupa (burial grounds). There are a number of places that have special significance to tangata whenua, including existing marae, urupa and sites of old settlements.

This policy requires ongoing consultation with tangata whenua to ensure the cultural values of the river are protected and enhanced. Involving tangata whenua in this way is consistent with the Treaty of Waitangi and the Regional Council-local iwi *Charter of Understanding*.

Policy 38: Contemporary History

Issue

Historic sites and structures along the Hutt River form an important part of the area's cultural heritage. The changing history of the area over the last 150 years is reflected along the entire length of the Hutt River and the river corridor.

Policy

The historical values of the river and its margins should be protected and enhanced.

Explanation

There are many significant historic sites within the Hutt River environment. The influx of European immigrants brought changing land uses and buildings. Farming gave way to industries such as saw milling, manufacturing, retailing and boat building, and evidence of these historical developments can still be seen today. The history of the Hutt Valley is in danger of being lost if steps are not taken to preserve sites and to educate people about them.

People crossing the Hutt River at Kaitoke Regional Park, during a Regional Council Summer Programme walk.

Policy 39: Landscape and Visual Quality

Issue

The Hutt River and its environment have distinct landscape qualities that are appreciated by the Hutt communities and contribute to the area's unique identity.

Policy

The visual quality of the river and its margins should be protected and enhanced.

Poets Park, located on the river berm at Moonshine, Upper Hutt.

Explanation

The Hutt River and its tributaries were instrumental in creating the floodplain landscape, which was once covered in native vegetation. A few small remnants remain, but almost continuous bands of willows stretch along the banks from Birchville down to the sea. Although these can restrict people's view and appreciation of the river, their value for flood protection is significant.

In implementing this policy, consideration must be given to an area's unique identity. This unique identity arises, in part, from an area's landscape and visual qualities.

Policy 40: Recreation

Issue

The Hutt River and its corridor are extensively used for a variety of activities, and there are opportunities to improve their recreational amenities. However, there are conflicts between some uses, and particular care is needed to resolve these conflicts and ensure a balanced approach to considering all recreational uses.

A. Palmer, 2001©.

Policies

Passive recreational facilities and uses of the river and its margins should be improved and extended.

Compatible recreational uses should be considered on a reach-by-reach basis, or as otherwise appropriate, in consultation with the community.

Explanation

Given the close proximity to major population centres, the Hutt River is a unique resource greatly valued by the local community. The river and its corridor are well used for recreational activities including angling, swimming, canoeing, rafting and walking, as well as for other more contentious activities such as driving cars and motorbikes, and exercising dogs and horses. There are opportunities to improve areas that are unattractive or where access is difficult, promote the river, and resolve conflicts between users.

Recreational uses are best considered on a reach-by-reach basis as enhancement projects are developed.

The Pakuratahi River, part of the Hutt River's upper catchment. R. Blake, 2001©.

Considering activities (such as vehicle access) requires a balanced approach, that does not compromise the Strategy's passive recreation focus. Public discussion and monitoring information should support this process. Monitoring information could include measuring effects on the environment, or the impacts on other recreational users. Activities that may have a major adverse effect on the river environment or impact significantly on other users should be discouraged.

Policy 41: Enabling Land Exchange or Purchase

Issue

Opportunities to exchange or purchase land may be critical to successfully implementing the Environmental Strategy. Flexibility to consider these opportunities is needed.

Policy

Land exchange or purchase should be considered where they are needed to advance the Environmental Strategy's vision.

Explanation

Policy enabling land acquisition to be considered provides necessary flexibility to implement the Environmental Strategy. It is practical to consider land acquisition, particularly where enhancement projects may lead to significant community benefit.

DO YOU WANT TO KNOW MORE ?

Ref 31: Hutt River Environmental Strategy

Ref 38: Hutt River Modern History

Ref 52: Nga Uruora

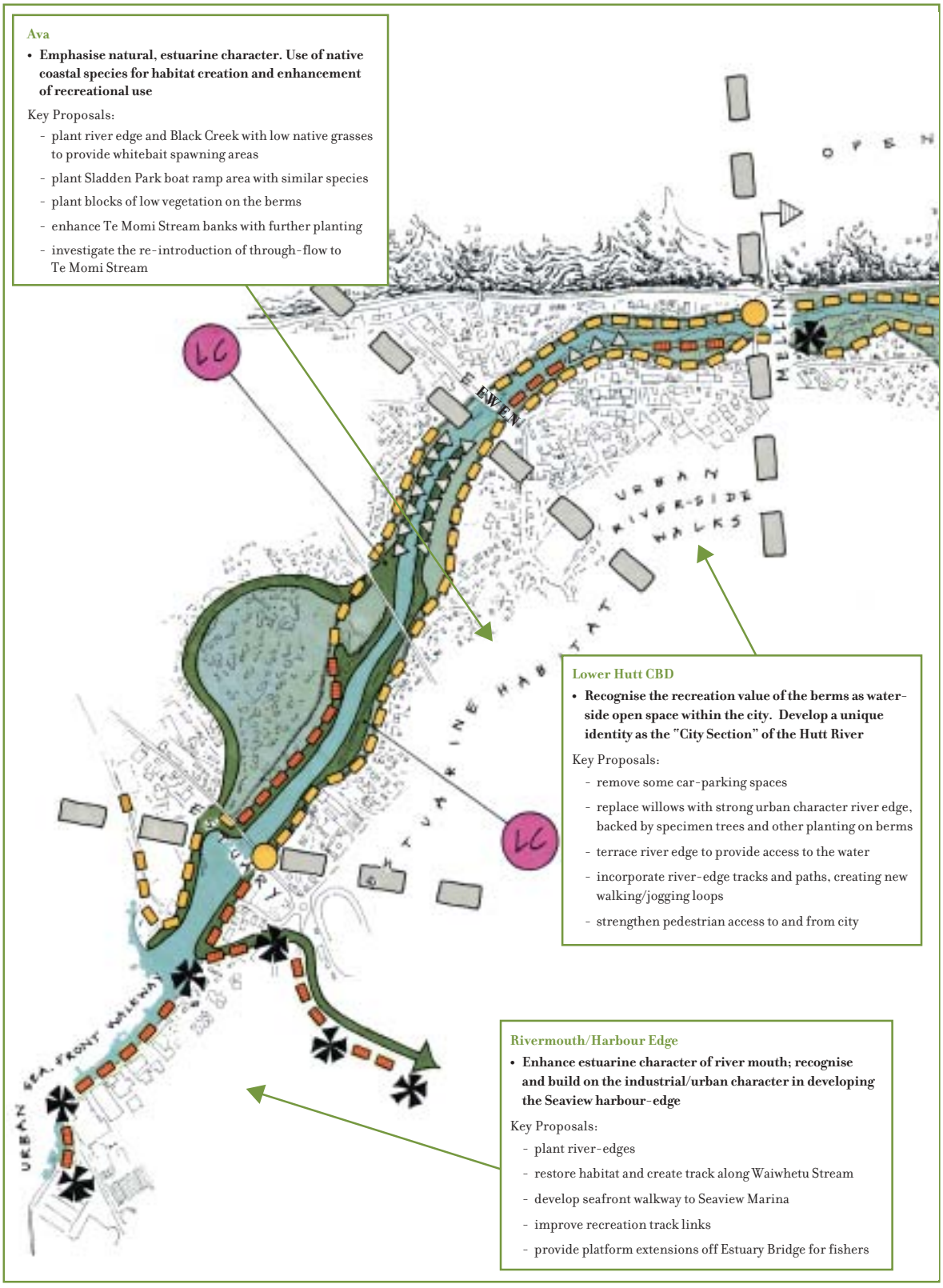
Also:
Newsletter No. 4: The Environmental Strategy

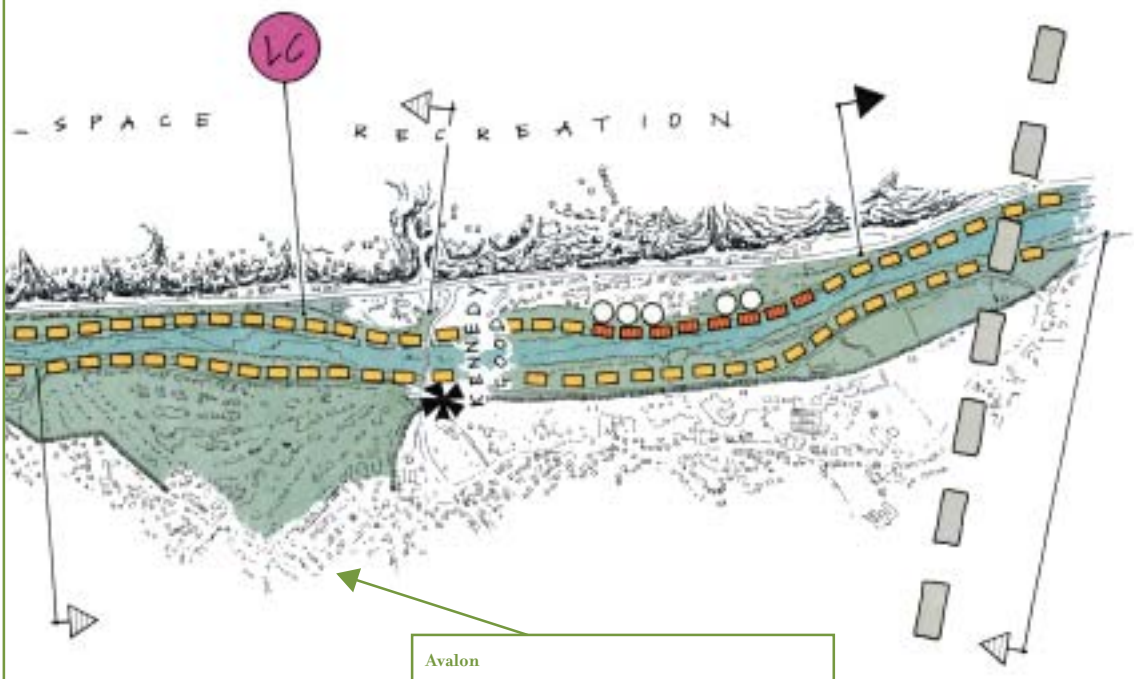
6.5 THE CONCEPT PLANS FOR THE HUTT RIVER

Figures 28 to 31 are concept plans showing the Hutt River from Wellington Harbour to Kaitoke Regional Park. The concept plans define each character area or *reach* of the river, detailing the broad environmental objectives and the key proposals for each area. The plans also show existing and proposed access tracks, historic features, open space and recreational facilities, and vehicle access.

Native fish are typically shy species and can be difficult to see in the Hutt River.

FIGURE 28: CONCEPT PLAN 1 – ESTUARY TO AVALON





Avalon

- **Planting to enhance recreation experience**

Key Proposals

- planting on both berms
- on east berm: create picnic spaces, improve visual connections with the river, rationalise vehicle access to the area
- on west berm: improve visual and physical access to the river

Legend

- *"Character Area" division*
- *Stopbank*
- *Existing track*
- *Proposed track*
- *Improved link needed on existing recreation track*
- *Feature for historical interpretation*
- *Proposed area for ecological planting*
- *"Local Community": Open space adjacent to residential communities where enhancement is needed*
- *(Other) Public open space within the river corridor*
- *Need for acquisition of land or easement strips to give public access*
- *Planned river-edge work presenting a significant opportunity*
- *Motorised vehicles to be prohibited between these points*
- *Access for motorised vehicles to be controlled between these points with improved parking nodes*
- *Proposed extensive enhancement for recreation*

Hutt River Environmental Strategy

Concept Plans: Overview Plan 1

Scale: Approx 1:10,000 @ A1
Approx 1:20,000 @ A3

Plans prepared for the Wellington Regional Council by Rose Armstrong and Clive Anstey, Consultant Landscape Architects. February 2000

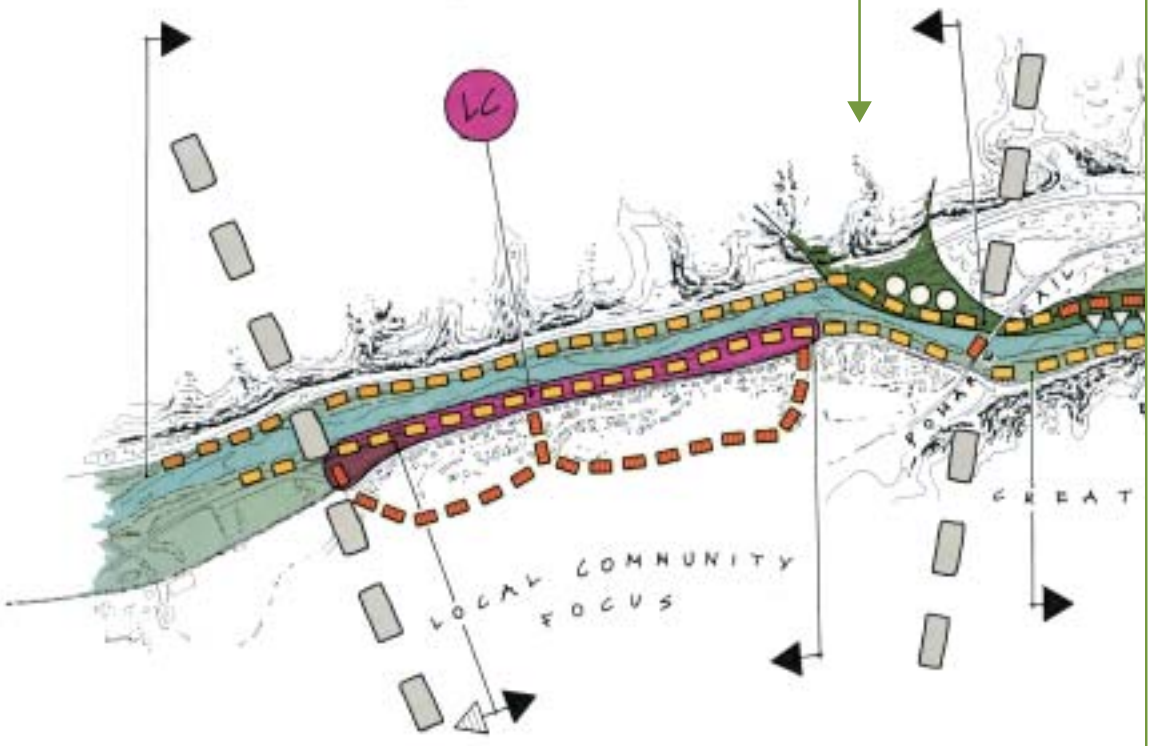
FIGURE 29: CONCEPT PLAN 2 – AVALON TO SILVERSTREAM

Taita

- **Enhance eastern berm as an important local community recreation space**

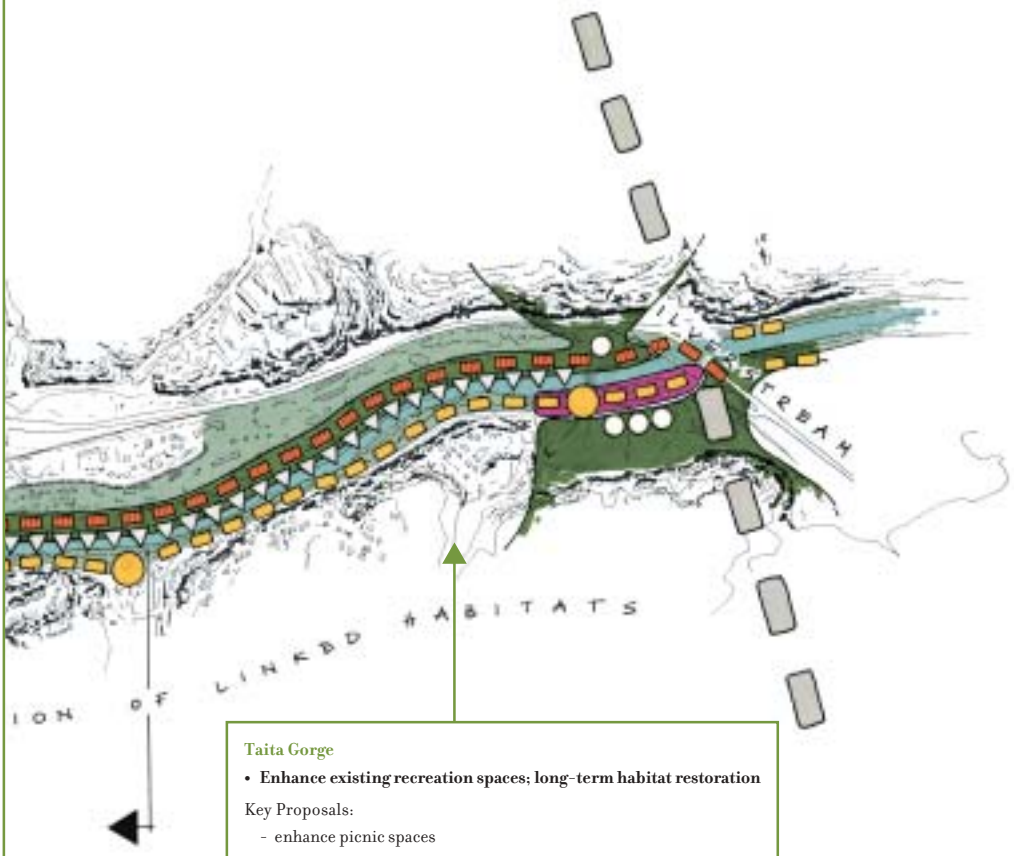
Key Proposals:

- plant eastern berm for more variety and better picnic spaces
- improve visual and community connections to river
- create walking loops that include the river and existing open space
- control vehicle access to the eastern berm
- plant western bank as backdrop for eastern bank (maintaining motorway river views)



Legend

- *"Character Area" division*
- *Stopbank*
- *Existing track*
- *Proposed track*
- *Improved link needed on existing recreation track*
- *Proposed area for ecological planting*
- *"Local Community": Open space adjacent to residential communities where enhancement is needed*
- *(Other) Public open space within the river corridor*



Taita Gorge

- **Enhance existing recreation spaces; long-term habitat restoration**

Key Proposals:

- enhance picnic spaces
- improve recreation links to the south – proposed footbridge across Hulls Creek
- screen recreation trail from the road with plants
- recognise long-term large scale habitat restoration and enhanced recreation potential; create ecological corridors to adjacent hills and north; recognise possible long-term need to acquire land

Legend

Need for acquisition of land or easement strips to give public access

Planned river-edge work presenting a significant opportunity

Motorised vehicles to be prohibited between these points

Access for motorised vehicles to be controlled between these points with improved parking nodes

Proposed extensive enhancement for recreation

N

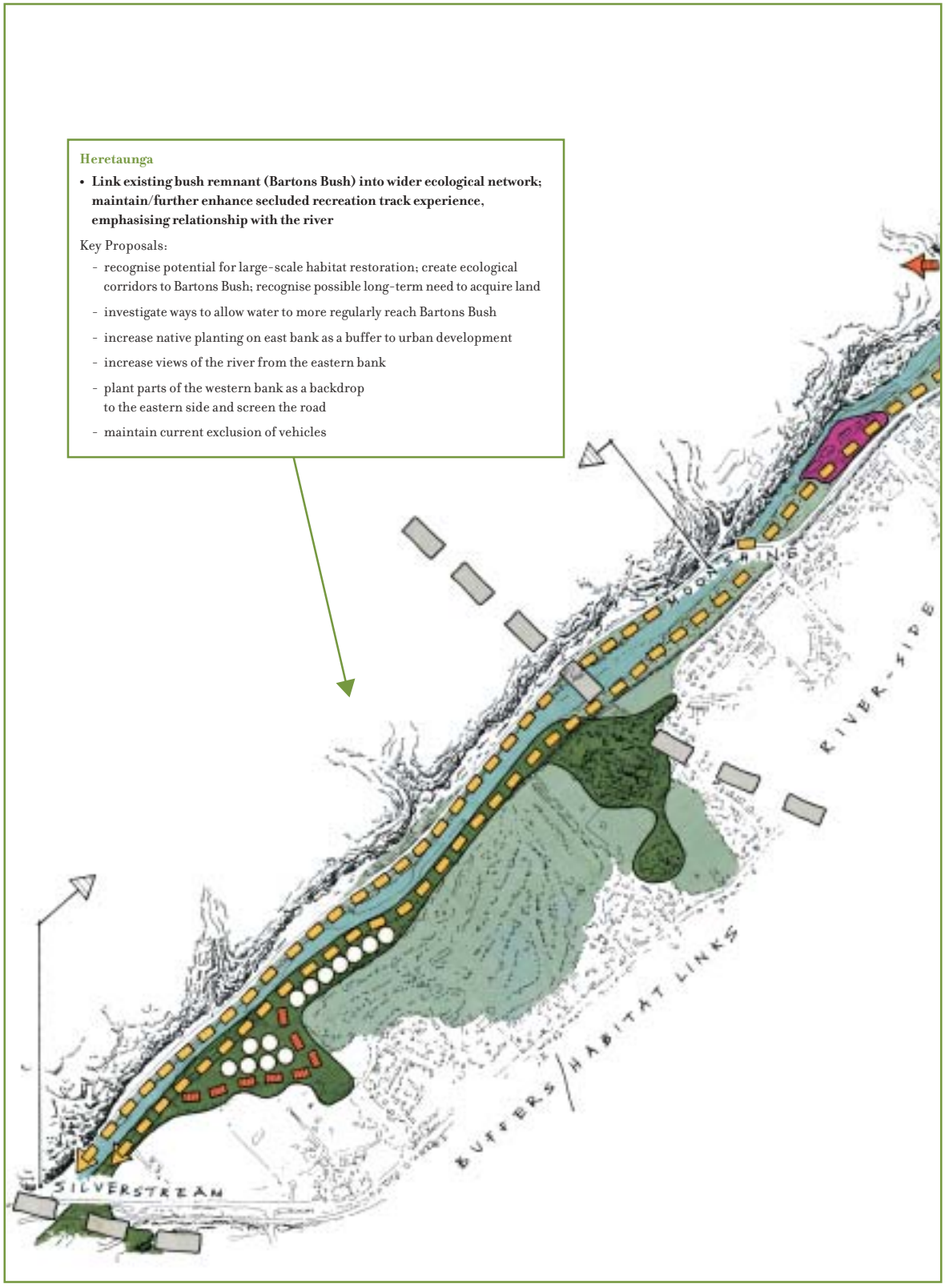
Hutt River Environmental Strategy

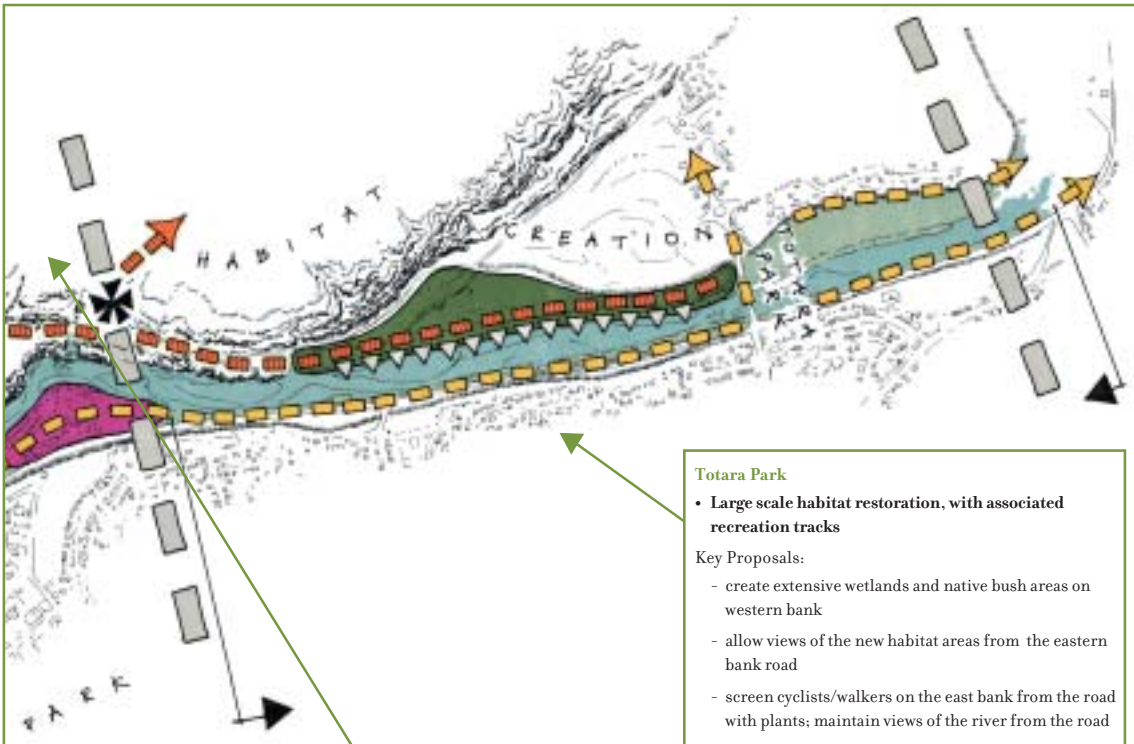
Concept Plans: Overview Plan 2

Scale: Approx 1:10,000 @ A1
Approx 1:20,000 @ A3

Plans prepared for the Wellington Regional Council by Rose Armstrong and Clive Anstey, Consultant Landscape Architects. February 2000

FIGURE 30: CONCEPT PLAN 3 – SILVERSTREAM TO TOTARA PARK





Totara Park

- **Large scale habitat restoration, with associated recreation tracks**

Key Proposals:

- create extensive wetlands and native bush areas on western bank
- allow views of the new habitat areas from the eastern bank road
- screen cyclists/walkers on the east bank from the road with plants; maintain views of the river from the road
- enhance existing sports fields with groups of Totara and Beech

Moonshine

- **Enhance character as a river-side park**

Key Proposals:

- plant to create interest and new picnic spaces; and to screen State Highway 2
- redevelop and further plant recreation area at Whakatikei River confluence and swimming holes
- improve visual connections with the river from the recreation track

Legend

- *"Character Area" division*
- *Stopbank*
- *Existing track*
- *Proposed track*
- *Feature for historical interpretation*
- *Proposed area for ecological planting*
- *Proposed extensive enhancement for recreation*
- *(Other) Public open space within the river corridor*
- *Need for acquisition of land or easement strips to give public access*
- *Planned river-edge work presenting a significant opportunity*
- *Motorised vehicles to be prohibited between these points*
- *Access for motorised vehicles to be controlled between these points with improved parking nodes*

N

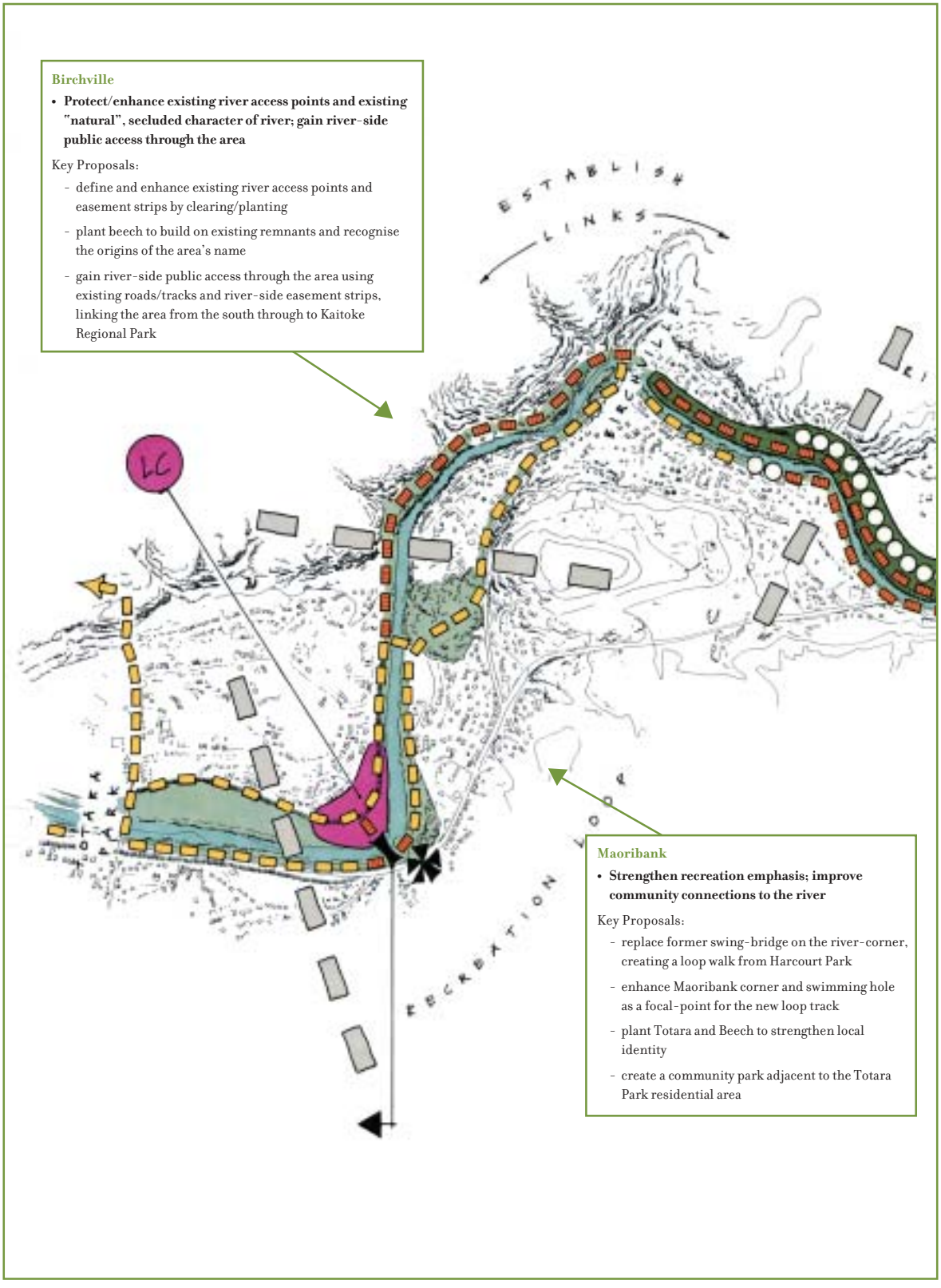
Hutt River Environmental Strategy

Concept Plans: Overview Plan 3

Scale: Approx 1:10,000 @ A1
Approx 1:20,000 @ A3

Plans prepared for the Wellington Regional Council by Rose Armstrong and Clive Anstey, Consultant Landscape Architects. February 2000

FIGURE 31: CONCEPT PLAN 4 – TOTARA PARK TO KAITOKE REGIONAL PARK

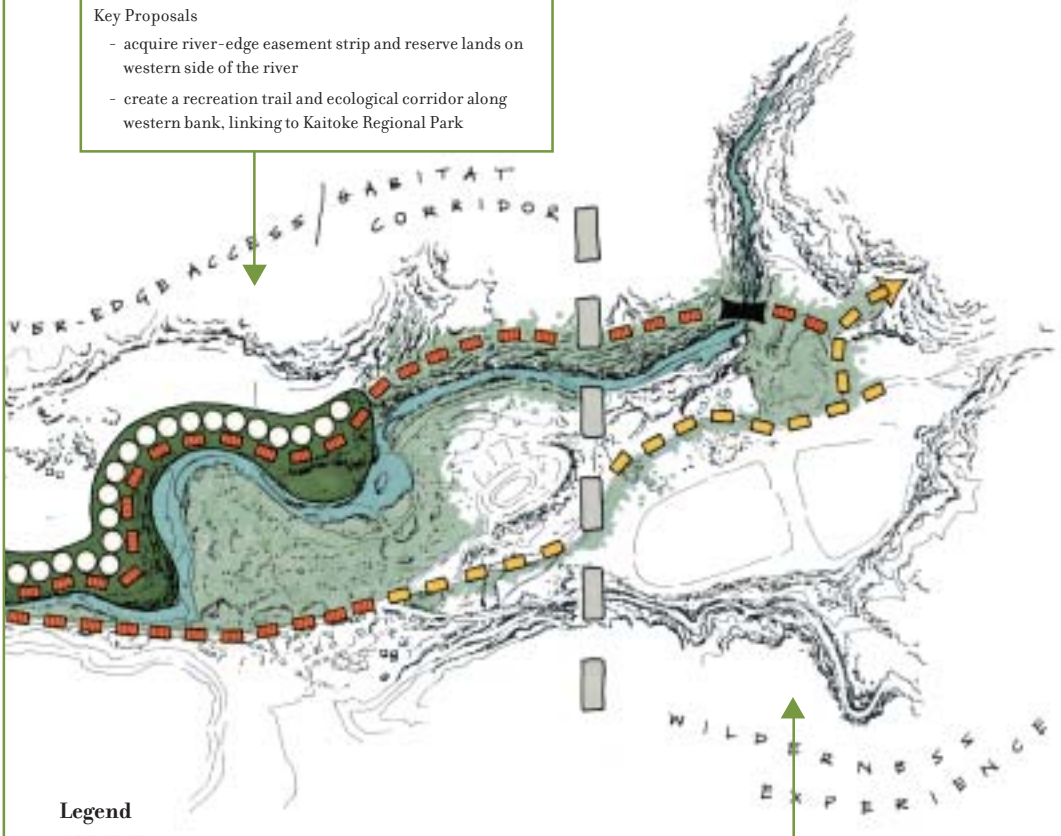


Te Marua

- **Gain river-side public access through the area and preserve a "natural" backdrop to the river in the event of subdivision of surrounding private land**

Key Proposals

- acquire river-edge easement strip and reserve lands on western side of the river
- create a recreation trail and ecological corridor along western bank, linking to Kaitoke Regional Park



Kaitoke Regional Park

- **Reinforce the natural, indigenous character and establish recreation links south**

Key Proposals:

- plant native species only
- establish recreation trail links south: create a new cycle way along State Highway 2; create a new track on the west bank using the historic logging route. Link the historic logging route across the river into Kaitoke Regional Park with a swing bridge

N

Legend

- *"Character Area" division*
- *Stopbank*
- *Existing track*
- *Proposed track*
- *Feature for historical interpretation*
- *Proposed area for ecological planting*
- *"Local Community": Open space adjacent to residential communities where enhancement is needed*
- *(Other) Public open space within the river corridor*
- *Need for acquisition of land or easement strips to give public access*
- *Motorised vehicles to be prohibited between these points*
- *Proposed extensive enhancement for recreation*
- *Proposed new bridge over river*

Hutt River Environmental Strategy

Concept Plans: Overview Plan 4

Scale: Approx 1:10,000 @ A1
Approx 1:20,000 @ A3

Plans prepared for the Wellington Regional Council by Rose Armstrong and Clive Anstey, Consultant Landscape Architects. February 2000

IMPLEMENTING AND FUNDING THE PLAN

7

The Ava to Ewen reach dissecting the suburbs of Woburn and Alicetown.
The Eastbourne hills and Wellington Harbour lie beyond.

7.1 INTRODUCTION

Now that we have covered what to do about flood protection, we need to look at how much it will all cost and who will be responsible for carrying out the various measures. This chapter details responsibilities for implementing and funding flood mitigation measures and environmental enhancement proposals contained in the Plan.

Basically, responsibility for implementing this Plan is shared in the following way.

- *Structural measures*: the Regional Council has responsibility for physical flood protection and works, with utility agencies and the city councils taking primary responsibility for their own flood-prone assets (including stormwater outlets, and sewerage and communications infrastructure).
- *Non-structural measures*: Hutt and Upper Hutt City Councils are primarily responsible for implementing land-use policies and rules and emergency management measures, with the Regional Council providing substantial support.
- *Environmental Strategy*: the three councils will share responsibilities, with iwi and the community being actively involved. The Regional Council facilitates implementing the Strategy.

Implementation costs will generally lie where they fall. Most costs for implementing the Plan will be incurred by the Regional Council, funded by rates from Hutt Valley residents and the rest of the Wellington region.

7.2 HOW THE SELECTED MEASURES ARE FUNDED AND IMPLEMENTED

Current Regional Council Funding Policy

The Regional Council, through rates, provides funding for implementing certain parts of the Plan. The Regional Council funding policy determines the proportion of rating available for flood protection. The current policy for implementing flood protection[1] is:

- 0 to 50 percent general rate from the regional community
- 50 to 100 percent from a special rate,[2] a scheme rate, or funds directly contributed.

Willow plantings reinforced with rail-iron debris fences, being used to reinstate eroded river bank and berm areas at Manor Park, Lower Hutt.

All issues and decisions in relation to the Regional Council's funding policy are considered and made as part of the Regional Council's Long-term Financial Strategy (LTFS) and annual plan processes. Current application of the funding policy provides 50 percent of the costs of providing flood protection to the Hutt Valley through a general rate, and 50 percent through a works and services rate levied on Upper Hutt and Hutt City Councils areas. This means that funding for structural measures will be shared 50:50 between Upper or Lower Hutt cities' residents and the regional community.

1 *This policy is subject to review at least every three years under the Council's business plan.*

2 *A works and services rate on the local authority area.*

The Regional Council's LTFS, *Towards a Greater Wellington Region*, provides for funds for structural, non-structural and environmental enhancement projects. The LTFS also details what flood mitigation capital works will be undertaken and when they are programmed between 2000 and 2010, placing high importance on:

- keeping people and communities safe from *flood hazards*
- reducing economic losses from flood damages
- ensuring that communities are ready to cope in flood emergencies
- implementing non-structural measures, which complement the structural flood protection works
- maintaining existing assets before committing to capital improvements
- enhancing 'special places' such as the river environment
- using sustainable floodplain mitigation measures.

We will now look at funding and implementation for each of the three parts of the Plan in turn.

Structural Measures

Funding

The Regional Council has endorsed a $78 million capital works (structural measures)[3] programme and a priority schedule for upgrading the Hutt River flood protection system to the *risk-based 2300 cumec design standard*. This works out at about $2 million a year, but does not cover additional spending on day-to-day operations, maintaining works or repairing flood damages over the 40 years. The capital works programme is subject to ongoing review through the LTFS process. These reviews will continue to look at the affordability and appropriateness of measures, and other issues such as the influence of earthquakes and climate change on works, and the scheme as a whole.

Implementation

All structural measures have been prioritised according to the social, economic and environmental benefits they provide, and the vulnerability of existing stopbanks to flood damages. Both the agreed works programme and structural measures priority schedule are presented in Section 4.2. Implementation commenced in July 2001.

Non-structural Measures

Funding and Resources

Funding for implementing non-structural measures will come from programmed budgets.

Policies and rules for land use will be implemented through proposed changes to the Hutt and Upper Hutt City Councils' district plans. The Regional Council's Landcare Division will provide staff resources and technical information to assist the city councils through any district plan change process.

The Regional Council will also provide technical information and help in organising *voluntary actions* and enhanced *emergency management programmes and procedures* for the three councils. The details of Regional Council involvement are still to be determined. Although the councils will be collectively responsible for developing these measures, the city councils are the primary implementers.

3 *The 2000-2010 LTFS provides $22 million for structural measures until 2010.*

Details of how emergency management measures will be implemented depend on:

- the amount of Regional Council assistance requested by the city councils
- the assistance the Regional Council can realistically provide
- timeframes required for implementing enhanced measures
- how much resourcing and funding is required annually to enhance measures
- whether operational budgets already exist for developmental work to enhance measures
- current national civil defence emergency management law reforms.

These factors will influence the city councils' future business planning in the civil defence emergency management area.

Implementation

Developing and implementing non-structural measures will commence after the Plan's release. The Upper Hutt and Hutt City Councils are the primary implementers, with the Regional Council providing a supporting role. Non-structural principles guiding the way *residual flood hazard risk* in the Hutt Valley should be managed are presented in Section 5.4.

Land-use Measures

Regulation

The cities' district plans are the key tools for implementing the land-use measures described above. Land-use measures will be implemented through changes to Hutt and Upper Hutt cities' district plans, and led by the respective city councils.

Under their direction the Regional Council will have an active role:

- helping to develop changes to policies and rules in the district plans
- providing technical assistance
- supporting the councils in consulting the community.

The district plan change process is an independent statutory process under the Resource Management Act 1991, and will determine the ultimate make-up of any district plan policy and rules.

Voluntary Actions

The Regional Council will support the city councils by providing flood hazard information, and will also produce brochures describing localised floodplain management measures, which support the Plan.

Emergency Management Programmes and Procedures

The city councils are primarily responsible for implementing measures to enhance community preparedness and have a substantial role to play in emergency response and recovery. As well as providing technical assistance, the Regional Council can play a co-ordinating role between the two city councils. The role should encourage a consistent approach to programmes and procedures, while each city council determines the specific content of its own measures.

Ensuring Emergency Management and Voluntary Actions Are Implemented

Unlike land-use measures, voluntary actions and emergency management measures do not have any statutory mechanism to cover their implementation: they do not legally oblige anyone to take a certain action. The three councils will need to ensure that related actions and programmes are steadily implemented by setting completion targets, and programming these into their business plans.

Environmental Strategy

Funding and Resources

The flood protection capital works budgets include a five percent allocation – or approximately $3 million over the next 40 years – for Environmental Strategy projects related to these works. However, the costs of implementing the basic components of the Strategy are about $12 million. Maintenance costs are also likely to increase as more and improved facilities are developed.

The Environmental Strategy's recommendations and proposals place no extra funding obligations on the three councils. Instead, additional enhancement projects will be implemented as and when funding becomes available in response to community needs. Likely funding sources are the three councils, the New Zealand Lotteries Commission, foundations and trusts, and community groups.

Funding provisions in the Regional Council's 2000–2010 LTFS for environmental enhancement works on the Hutt River are as follows.

ENVIRONMENTAL STRATEGY EXPENDITURE UNTIL 2010	
Hutt River ranger (eight years from 2002/03)	$ 922,000
Habitat enhancement (four years from 2003/04)	$ 34,000
Environmental Strategy implementation (2007/08)	$ 50,000
Environmental enhancement associated with capital works (indirect) (5% of $15 million)	$ 750,000
TOTAL	**$1,756,000**

The Environmental Strategy also contains opportunities that would have little additional financial impact on the three councils, including policy changes and ongoing operational maintenance of the river environment.

A stand of native beech near the Hutt River.

Implementation

Environmental Strategy opportunities will be considered as flood protection works are designed and implemented. As yet, no implementation programme for the Strategy has been formed, although priorities for proposals have been developed, and are presented in Chapter Six.

Some proposals outlined in the Environmental Strategy have already been included in the Regional Council's annual planning process and the 2000–2010 LTFS. These include funding research and trialling salt-tolerant species suitable for whitebait habitats, and establishing a mechanism for ongoing tangata whenua and community input into managing the linear park.

Plan Implementation and Governance

Advisory Committee

Throughout the preparation of this Plan, the Hutt River Floodplain Management Advisory Committee has acted as an advisor and made recommendations to the Regional Council's Landcare Committee.

While the issues that will arise through implementing the Plan are likely to be different (more operational than policy related), the three councils and iwi have agreed that the Advisory Committee will be retained to operate in a similar capacity. The Advisory Committee will exchange information with the community, and advise on future decisions required throughout the Plan's implementation. The Committee will also act as an initial forum for reporting on the Plan's progress and providing advice to the Regional Council. The frequency of meetings may be reduced to annually or biannually, or to holding special meetings as the need arises.

Tangata Whenua

In addition to Advisory Committee involvement, tangata whenua will be included in formal ongoing consultation as the Environmental Strategy is implemented, and throughout the recurring resource consent processes for flood protection works.

Consultation on Measures and the Environmental Strategy

Consultation has played – and continues to play – a critical part in developing the Plan and its outcomes.

The size of the affected community means that forming a single community resource group which represents the interests of all floodplain residents would be difficult to achieve. Instead, the Regional Council will establish and maintain contact with various resident and interest groups to aid Plan monitoring.[4] Both the Advisory Committee and local user and residents groups will be used to share information between the councils and the community.

Structural Measures

Agencies, iwi, community groups and local residents will be consulted during the design and resource consent application stage for each project. Good consultation will also form an important part of any planned land purchase.

Non-structural Measures

Non-structural measures will be developed in greater detail during Plan implementation, and public input may further modify them. Community involvement will be required particularly to develop emergency management programmes and procedures. Consultation is also part of the statutory process for making changes to the cities' district plans.

Environmental Strategy

Environmental Strategy proposals, and all projects linked to specific flood protection works, will require consultation with landowners, iwi, community groups and clubs, and agencies. Resource consent requirements may demand additional consultation.

Consultation is a vital step if projects are to develop in line with the Environmental Strategy's key concepts.

4 *These groups may also help to co-ordinate local input to the Environmental Strategy.*

Funding for Flood Damages

The dynamics of floods and the variable nature of flood damage, even that occurring in smaller events, means that flood protection maintenance expenditure cannot be accurately budgeted on an annual basis. To manage its risk and the uncertainties of flooding, the Regional Council funds flood damage repairs at three levels.

1. The first sources of funding are the budgeted annual plan provisions for maintaining existing assets and constructing new assets – operating and capital expenditure respectively.
2. The next sources are the Western Region Flood Contingency Reserve and the corresponding local area river reserves. These reserves were set up to deal with small to medium floods (typically up to a 25-year event). A total of $200,000 is budgeted each year. Funds are provided in equal portions from the Regional Council general rate and the respective local authority area rates.[5] Money drawn for flood damage repairs comes equally from the relevant local area reserve and the Flood Contingency Reserve.
3. The last established mechanism for funding flood damage is the Major Flood Protection Recovery Fund, to cater for floods greater than a 25-year event. This is an investment fund and the current Western Region contribution is $100,000 each year. Under the current funding policy, the various local authority area rates funds are provided in equal portions from the Regional Council general rate and the various local authority rates.

The aftermath. Cleaning up at Firths yard, Lower Hutt, following the October 1998 floods.

The balances in each fund reserve will vary according to the incidence and location of flood repairs. A further emergency funding mechanism has been put in place for an extreme flood. The Regional Council will arrange funding for the difference between the assessed cost of recovery and the reserve funds held at the time of the event.

Asset Management

The Hutt River flood protection system relies heavily on expensive assets such as stopbanks and rock linings to provide flood protection to the Hutt Valley community. At 30 June 2001 the total value of protection works assets (excluding land) was estimated at $40 million.

As the plan is implemented the value of these assets will grow. It is important that these existing and upgraded assets are well managed and maintained to ensure that future generations continue to benefit from the protection they are designed to provide. The Regional Council is committed to managing these valuable assets in accordance with modern principles of asset management. Key principles of good asset management the Regional Council has adopted include:

- defining levels of service (how much flood protection is being offered now, and what is intended into the future – the Floodplain Management Plan)
- ensuring assets are maintained in perpetuity or replaced at the end of their useful life
- ensuring assets are managed and maintained in the most cost-effective way, including provision for repairing flood damage
- upgrading existing assets to deliver the agreed flood and erosion protection standards set out in the Floodplain Management Plan.

5 *The Regional Council's funding policy influences the way funding for flood damage repairs is split between regional ratepayers and ratepayers from the local authority where the damage occurs.*

The maintenance budget for the Hutt River is approximately $1,045,000 (direct expenditure) per annum. Funds are also set aside in reserves to pay for flood damage when it occurs, discussed above under 'Funding for Flood Damages'.

The Hutt River's asset management plan, adopted in July 2000, sets out more fully how the Hutt River flood protection assets will be managed and maintained. This plan will be updated every three years. Current and proposed service levels for managing the Hutt Valley's flood protection assets are provided in Table 12.

TABLE 12: CURRENT AND PROPOSED SERVICE LEVELS

SERVICE	CURRENT	PROPOSED
Flood Protection	Variable: from less than 1900 cumec protection (100-year flood) at Belmont, Hathaway Avenue etc. to about 2800 cumec (about a 3000-year flood) with moderate security in Upper Hutt CBD	Risk-based 2300 cumec standard (440-year flood) as set out in this Plan. Main features include: • 2800 cumec capacity for principal stopbanks, protected to 2300 cumec standard edge protection • 2300 cumecs for local stopbanks, including Totara Park, Manor Park and Whirinaki Crescent Additional local area standards also include: • Belmont 1900 cumec edge protection and house raising • Bridge Road 1900 cumec edge protection and house raising • Gemstone Drive 1900 cumec edge protection • Note: no stopbanks constructed downstream from Estuary Bridge
Erosion	Land and assets protected by stopbanks – average to very high service level Land and assets in floodway – low to moderate service level	Land and assets protected by stopbanks – very high service level Land and assets in floodway – low to high service level
Flood Warning and Response	High: comprehensive flood warning system and procedures in place	Very high: with enhanced procedures and emergency management measures
Environmental Enhancement	Basic: clear rubbish, maintain access tracks, mow river berms, and limited environmental plantings	High: linear park vision, river ranger, capital improvements through capital works and environmental enhancement proposals

DO YOU WANT TO KNOW MORE ?

Ref 10: Flood Protection Business Plan

Ref 22: Hutt River Asset Management Plan

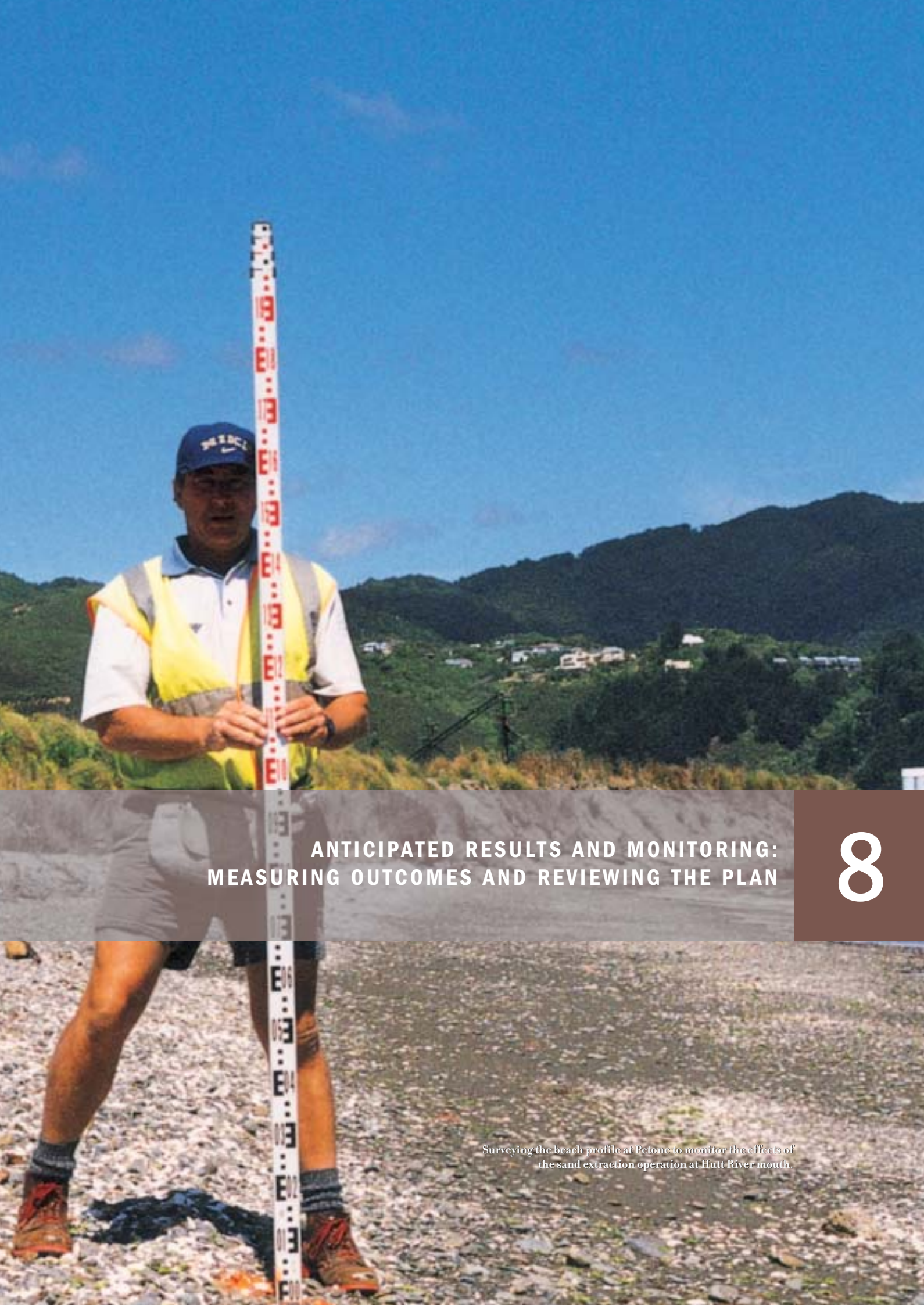
Ref 56: Regional Council 10 Year Plan

Ref 57: Regional Council Annual Plan

Also:
Newsletter No.3: The Design Standard

ANTICIPATED RESULTS AND MONITORING: MEASURING OUTCOMES AND REVIEWING THE PLAN

8



Surveying the beach profile at Petone to monitor the effects of the sand extraction operation at Hutt River mouth.

8.1 INTRODUCTION

How will we know if the Plan is working, and whether it can be improved on? To answer this question we first need to have a very clear idea about what results we hope to achieve. Then we need to be able to monitor whether we have achieved these results, and to have in place arrangements for reviewing the Plan.

The Plan's intended outcomes, or *anticipated results*, are what will be measured to determine the Plan's performance. Monitoring is concerned with how we measure the anticipated results.

This chapter presents the Plan's intended outcomes, discusses how these outcomes will be measured, and looks at arrangements for reviewing the overall Plan.

8.2 ANTICIPATED RESULTS

What They Cover

In summary, the anticipated results for the Plan are to:

- adopt and implement flood mitigation measures and the Environmental Strategy
- reduce adverse flood hazard effects
- manage the residual flood hazard risk
- involve the community in implementing the Plan
- involve tangata whenua in implementing the Plan
- enhance environmental values
- manage adverse environmental effects of works.

The anticipated results have been developed from the Plan objectives (provided in Chapter One), the performance of the measures, additional *floodplain* management planning issues concerning *flood hazard* effects, and issues relating to adverse environmental effects from physical works. These additional issues have been drawn mainly from the Otaki and Waikanae Plans to ensure regional consistency in measuring floodplain management plan performance.

The anticipated results will be measured for the 40-year life of this Floodplain Management Plan, but will commence from 1991, the year the floodplain management planning process began. The progress on anticipated results will be measured every 10 years. Any dollar values cited will be stated in year-2000 dollars.

Measuring the anticipated results requires identifying simple and effective indicators. A monitoring strategy to clarify the anticipated results, and determine how and when monitoring should take place, will be developed. These matters are covered in 'Reviewing the Floodplain Management Plan' later in this chapter.

Recording flood levels at Boulcott following the October 1998 floods.

WHAT IS AN ANTICIPATED RESULT ?

Anticipated results are the specific outcomes that the Plan intends to achieve. They are important because they focus on the things that must be monitored during the life of the Plan in order to measure its performance. One way to represent anticipated results is to produce clear *statements of intent*. These can cover a range of issues including:

- implementing policies and objectives
- environmental performance
- decision-making
- ongoing consultation.

The approach adopted here has been adapted from the Ministry for the Environment / Opus International Consultants 'District Plan Monitoring Project'.

Adopting and Implementing the Plan: Anticipated Results

Following are the specific anticipated results for the Flood Management Plan.

Balanced and Affordable Flood Management Solutions

- The structural and non-structural solutions adopted show an overall social, economic and environmental benefit to the community.
- The community accepts the costs of selected structural and non-structural measures.

Progress in Implementing Measures

- *Structural measures* are constructed in accordance with annual and business plan targets.
- *Non-structural land-use measures* are established in district plans and through other means that support *voluntary actions*.
- Enhanced non-structural *emergency management measures* are established through the councils' annual and business plans, and implemented at regular intervals.
- The *Environmental Strategy* is implemented in a manner acceptable to the community and tangata whenua.

Performance of Measures

- *Flood defences* withstand moderate or large floods to their respective *risk-based design standards.*
- All flood defence assets are maintained to agreed standards described in the Hutt River Asset Management Plan.
- Non-structural emergency management measures enable the community to improve their individual and collective response to a significant flood event.
- The financial costs of flood damages are significantly reduced.

A Partnership Approach with City Councils

- Developing and implementing the Plan involves Hutt City and Upper Hutt City Councils in decision-making.

Reducing Adverse Flooding Effects: Anticipated Results

Reducing General Effects and Damages

- Risk of injury or death resulting from flooding is reduced.
- Levels of potential social disruption from flooding are reduced.
- Levels of potential damages resulting from flooding are reduced.
- People in the Upper Hutt and Hutt city communities cope better with a flood.

Recognising Flood Risks Posed by Tributary Watercourses

- The Regional Council, through investigation and supplying data, supports and assists the territorial local authorities to manage small floodplain tributaries.

Maintaining Optimum Flood Capacity

- The *floodway* is maintained to optimise the river's flood capacity while limiting the extent and degree of lateral erosion, and additional adverse effects.
- Gravel extraction is undertaken in a way that optimises the Hutt River's flood capacity, without causing significant bank erosion and adverse environmental effects.

Managing Residual Flood Hazard Effects: Anticipated Results

Accepting Residual Flood Risk

- The community understands and accepts the *residual risk* associated with the selected suite of structural and non-structural measures.

Ensuring Residual Flood Hazard Effects Are Mitigated

- Non-structural measures reduce residual flood impacts on the Hutt and Upper Hutt city communities.
- New development or areas of redevelopment avoid or mitigate the adverse effects of significant floods.
- A mix of voluntary decisions and regulation in district plans substantially reduces:
  - exposure of new and redeveloped assets (public or private) to the flood hazard in moderate- and higher-risk areas
  - people's vulnerability to the flood hazard.
- Emergency management programmes and procedures enable the Hutt and Upper Hutt city communities to respond quickly and effectively to a range of flooding events.

River flow gauging.

Managing Effects on Neighbouring Property and Land

- New development or redevelopment does not increase the flood hazard on the flood protection system, or neighbouring land and structures.

Involving The Community: Anticipated Results

Agreeing on a Long-term Programme

- The community, iwi, key agencies and community groups accept the programme timeframes for implementing flood mitigation measures and the Environmental Strategy.

Providing Clear, Accurate and Full Information

- The community receives clear, accurate and full information regarding:
  - agency responsibilities
  - the flood hazard associated with the existing and upgraded flood protection system
  - measures adopted to manage the flood hazard
  - design and programming of structural works
  - adverse effects of structural works on the river and its environment.

Involving Tangata Whenua: Anticipated Results

Exercising Kaitiakitanga

- Tangata whenua are active in decision-making regarding managing the Hutt River and its environment.
- The relationship of tangata whenua, and their culture and traditions with the environment is recognised and provided for.

Enhancing Environmental Values: Anticipated Results

Ensuring Quality Access to the River

- The existing quality of public access to and along the river is maintained or improved.

Implementing the Environmental Strategy

- The Environmental Strategy's guidelines to maintain and enhance the quality of the river and its environment are implemented.
- Projects implemented through the Environmental Strategy enhance the quality of the river and its environment.

Managing Adverse Environmental Effects: Anticipated Results

Minimising Adverse Effects of Works

- Adverse effects associated with flood mitigation works are mitigated or avoided to an acceptable community standard, determined by the resource consent process and compliance monitoring requirements.
- Flood mitigation works do not create significant long-term adverse effects on the environment.

8.3 MONITORING ANTICIPATED RESULTS AND REVIEWING THE PLAN

Why Monitor and Review?

Ongoing monitoring of the Plan will enable the outcomes to be regularly reviewed. Reviews mean that the floodplain management planning process, and flood hazard mitigation measures, can be updated and changed where the need arises.

Monitoring and review of the Plan will:

- measure progress made achieving the above-listed anticipated results
- evaluate the overall performance of the Plan.

Developing a Monitoring Strategy

Over 30 anticipated results have been developed from the Plan objectives and related issues. The sheer number of anticipated results means that developing monitoring priorities, associated indicators, and realistic reporting requirements requires considerable effort. A monitoring strategy will be formulated by June 2002 to tackle the need to:

- clarify what each anticipated result specifically measures
- identify higher-priority anticipated results so that we can start measuring them immediately
- develop staggered starting dates for monitoring the remaining anticipated results
- identify appropriate indicators to measure anticipated results
- determine monitoring programmes and baseline survey requirements
- develop annual and longer-term reporting requirements to meet the Regional Council's Long-term Financial Strategy, Annual Plan and Floodplain Management Plan review timeframes
- identify the community's role in monitoring.

The strategy will allow anticipated results to be modified – or even dropped where they are superseded or become outdated. Any changes to the anticipated results will need to be regularly reported.

Devising Indicators to Measure Results

An important part of forming a monitoring strategy will be developing the specific indicators. Indicators are measures that enable us to gauge the progress the Plan is making. Indicators need to be simple, easily measured and cost-effective, and they should provide reliable data. Indicators can measure trends, patterns and overall performance in many ways, including:

- progress towards a set goal or target (for example, completing structural works or implementing land-use controls)
- changes in behaviour (for example, the community response to flooding events)
- changes in attitude and understanding (for example, knowledge of the flood hazard)
- changes in environmental conditions (for example, population, volume of gravel or river flows, climate)
- linking human activity to environmental problems (for example, hazard exposure through new development)
- reaching a threshold (for example, predicted costs of mitigation measures)
- following a process (for example, involving the community, iwi and councils in future decision-making).

8.4 REVIEWING THE FLOODPLAIN MANAGEMENT PLAN

The Plan will be reviewed every 10 years, or earlier if the flood hazard is significantly altered by flooding, earthquakes or new information. Minor reviews will also be done yearly through the Regional Council's annual plan process. Table 13 summarises what will be reviewed and when.

A new floodplain management plan will be produced after 40 years, or earlier should any review outcomes require it.

Table 13: What will be reviewed

TIMEFRAME	REVIEWING WHAT ?
Every year (in line with the Flood Protection Group's annual plan)	• Programme to implement measures and the Environmental Strategy • Operational programme summary
Every three years (in line with the Regional Council's Long-term Financial Strategy	• Priority and cost of works • Preliminary report on anticipated results
Every 10 years	• Processes for implementing the Plan • Progress on implementing all measures • Hutt River and catchment hydrology • Flood extent and river hydraulics • Capital and operational expenditure budgets • Full report on key anticipated results
Important triggering events • When the flood hazard is significantly changed by completing structural works • Following a major flood • Prior to approval of district and regional plans, including plan changes • When high priority anticipated results are not being met	• Proposed land-use measures compared with agreed non-structural principles • Flood hazard and extent maps (floodplain and river corridor) • Performance of the flood protection works • Progress in implementing measures • Flood damages and disruption

Future Role of the Hutt Community in Monitoring the Plan

There will be a future role for the Hutt community in monitoring the progress of the Plan. The Hutt community, the city councils, iwi and other agencies and interest groups will provide feedback on the Plan's implementation, including monitoring and review.

DO YOU WANT TO KNOW MORE ?

Ref 5: District Plan Monitoring Guide

APPENDICES

Constructing a rock-lining at Bridge Road, Upper Hutt

1 APPENDIX 1: FLOOD EMERGENCY PROCEDURES, RESPONSE AND RECOVERY

LOCAL CIVIL DEFENCE AND EMERGENCY MANAGEMENT

Response Procedures

The Hutt City and Upper Hutt City Councils are responsible for managing emergency events in their areas, where civil defence measures are required.

A flood can become a civil defence emergency if evacuations are required, roads need to be closed, the emergency services (Police, Fire Service) do not have enough resources to do the tasks that are required, or emergency housing and welfare are needed. To respond effectively to an emergency, the councils work with the emergency services, essential services providers (for example, water suppliers, electricity suppliers), volunteer organisations and people with specialist information (such as the MetService, or the Regional Council Flood Protection Group).

Figure A1 gives examples of organisations involved in responding to flooding emergencies, while Figure A2 shows what tasks are done as the flood event escalates into an emergency.

Emergency Operations Centre

The city councils manage emergency events from specialised emergency operations centres. The role of these centres is to gather information, organise the appropriate response, and disseminate information about the emergency back to the affected communities.

Representatives from the essential response organisations such as the Police, Fire Service, utility companies and medical services may be present at the emergency operations centres to offer expert advice and updates on the situation. If it is a declared civil defence emergency, the response representatives will direct their organisations according to priorities set by the local civil defence organisation.

The Hutt City Council emergency operations centre is located at The Pavilion, Laings Road, Lower Hutt. The Upper Hutt City Council emergency operations centre is located on the ground floor, Council Buildings, Fergusson Drive, Upper Hutt.

Recovery

If necessary, the councils will appoint local disaster recovery managers. These managers will work alongside any central government recovery personnel.

Actions to enhance recovery start in the early part of the emergency response and continue until essential services are restored to a minimum operating standard. Civil defence powers (such as the councils' abilities to evacuate and requisition equipment) are not maintained during the recovery period.

The contributing councils and other central government, local and voluntary agencies may provide additional financial assistance and resources to the community during the recovery phase. The response support agencies identified in figure A1 are likely to be involved in the community's recovery. Central government agencies such as Housing New Zealand, Department of Work and Income, Ministry of Economic Development, Transit New Zealand, and Inland Revenue may also play an important role in assisting recovery.

REGIONAL EMERGENCY MANAGEMENT

General Responsibilities

Regional emergency management is the responsibility of the Regional Council, under the Civil Defence Act 1983. However, if the proposed civil defence and emergency management law reforms are enacted, emergency management at a regional level will become the responsibility of a Civil Defence Emergency Management Group (CDEMG). The CDEMG would be made up from all territorial local authorities in the Wellington region, the Regional Council, and Marlborough District Council. The CDEMG would also receive input from the Police, Fire Service, lifelines organisations and other emergency responders.

Because of the possibility of this change, the following sections have been divided into 'Current Arrangements' and 'Possible Future Arrangements'.

Response Procedures

Current Arrangements

The Regional Council gets involved when a local council or emergency services are overwhelmed by the emergency, and are unable to manage the event effectively. In this situation the Regional Council's role is to:

- co-ordinate group resources
- prioritise emergency responses
- provide public information
- facilitate communication between emergency responders
- direct the response.

Possible Future Arrangements

These roles would be taken up by the CDEMG under the proposed new legislation.

Emergency Operations Centre

Current Arrangements

The Regional Council may operate either from the National Emergency Operations Centre located at the Beehive, from the Regional Council centre, or from a mobile facility.

Possible Future Arrangements

It is expected that the CDEMG would operate out of many emergency operations centres. The selection of a particular centre depends on the type of emergency event and the areas affected. Possible centre locations are Wellington Emergency Management Office, Hutt City Council, Masterton District Council, and the CDEMG Emergency Management Office.

During an emergency, members of the CDEMG and representatives from the emergency services, health providers and lifelines would be present at the emergency operations centre as needed. They would provide advice about the best strategies for response, and their current ability to respond.

Recovery

Current Arrangements

Priorities for regional recovery are the safety of people, social restoration, economic restoration and physical restoration. The Regional Council may appoint a recovery manager to guide the recovery process if necessary.

Possible Future Arrangements

Regional recovery would become the responsibility of the CDEMG.

NATIONAL EMERGENCY MANAGEMENT

Response Procedures

The Ministry for Emergency Management and Civil Defence may become involved in emergency response when more than one region is involved, international co-ordination is required or national or central government resources (such as the NZ Defence Force) are required.

If the National Emergency Operations Centre is activated, it is located in the sub-basement of the Beehive, Bowen Street, Wellington.

The Department of Internal Affairs administers funding for emergency expenditure related to accommodating, transporting, feeding and clothing emergency evacuees. Other emergency expenditure may be eligible for subsidy if expenditure is greater than the threshold of 0.01 percent of net equalised rateable value.

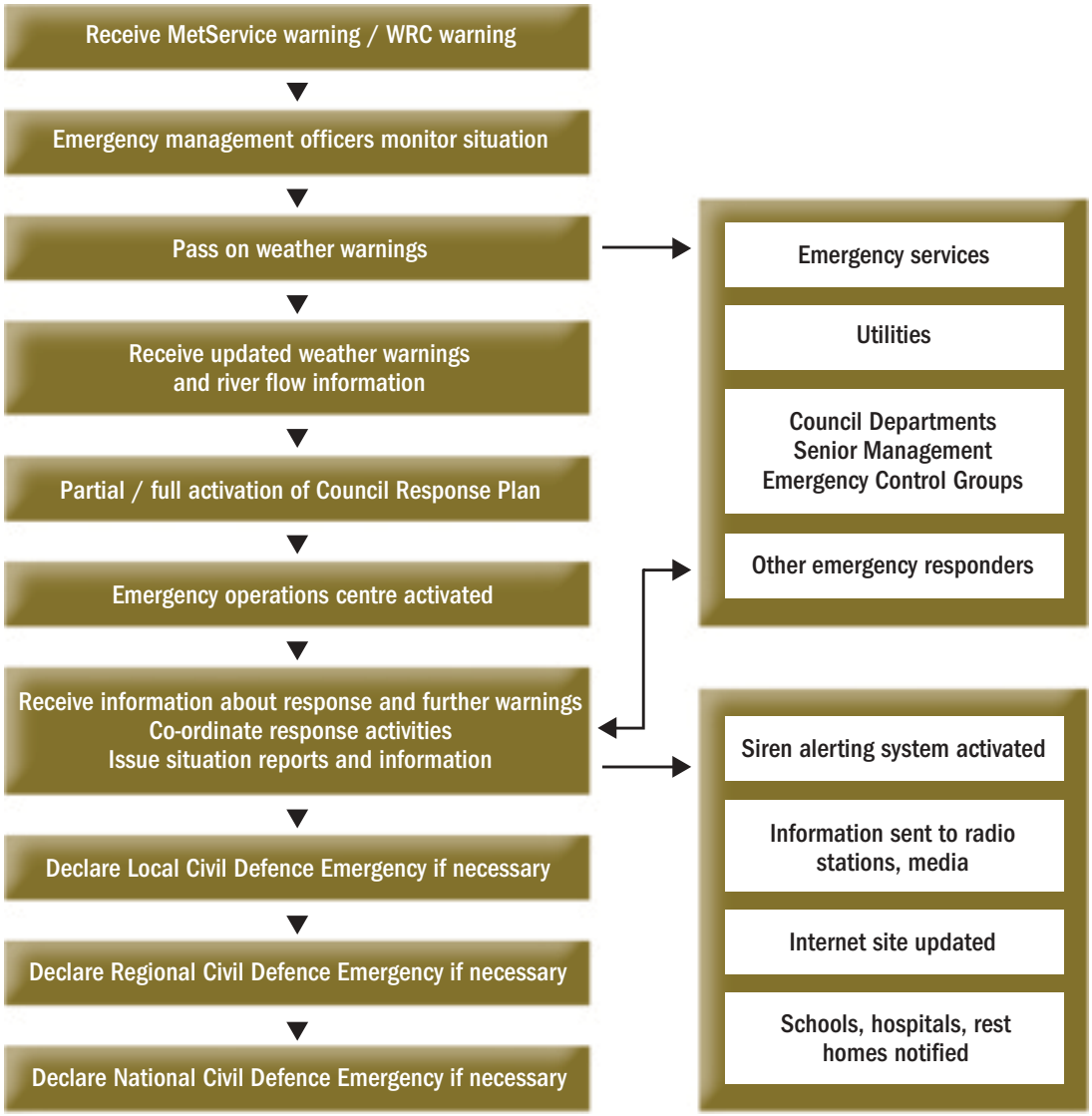
Recovery

The Ministry for Emergency Management and Civil Defence may appoint a disaster recovery co-ordinator to work with affected communities and institute necessary programmes of disaster recovery. The Ministry also assesses proposals for recovery funding, making recommendations to central government.

FIGURE A1: EXAMPLES OF SUPPORT ORGANISATIONS

NZ Police:	law and order, evacuations, normal Police role
NZ Fire Service:	fire fighting, rescue
Hutt Valley Health:	medical treatment
Public Health:	provide advice on health issues
NZ Red Cross:	emergency clothing
Salvation Army:	emergency feeding
WRC Flood Protection:	flood warnings and advice
MetService:	weather advice
Civil Defence centres:	collection point for information and people needing assistance.
Wellington Free Ambulance:	transportation of injured people
Transit New Zealand:	restoration of highways
Excel:	HCC road maintenance
WRC Investigations:	pollution response
United Networks:	electricity restoration
Nova Gas, AGL:	gas restoration

FIGURE A2: EMERGENCY PROCEDURES



FLOOD WARNING SYSTEM

Existing System

The flood warning system for the Hutt River consists of rainfall recording stations and river level recorders. These recorders send data through to the Regional Council flood base, located at the Regional Council Centre. Flood forecasts and flood warnings are generated and passed on to those people who are potentially affected. Figure A3 provides an overview of this process.

Flood Detection

There are nine rainfall recording stations relevant to the Hutt River. Seven of these stations are telemetered. These recording stations trigger alarms at certain intensities of rainfall. Table A1 gives an idea of trigger levels for various areas.

Table A1: Alarm trigger levels for selected Hutt areas

AREA	AMOUNT OF RAINFALL IN A 2-HOUR PERIOD (MM)
Cemetery (Akatarawa Valley)	20
Phillips Station (Kaitoke headwaters)	20
Warwicks Station (Akatarawa Hill Road summit)	15
Centre Ridge Station (Rimutaka Incline)	20
Te Marua Station (treatment plant)	20
TVL Station (Mangaroa Valley)	20
Mabey Road (Avalon)	20

These alarms are automatically transmitted back to the Regional Council flood base. The information is then fed into a flood-forecasting model, which forecasts the river heights for a period of up to 12 hours.

Nine river-level recorders measure the height of the river, and seven of these are telemetered. The telemetered river-level recorders are located on the Hutt River at Kaitoke, Te Marua, Birchville and Taita Gorge, as well as on the Akatawara and Mangaroa Rivers, and Waiwhetu Stream. Non-telemetered recorders are located on the Whakatikei and Pakuratahi Rivers. The Birchville river-level recorder is backed up by an alternative interophone system.

Flood Warning Time

The flood warning time is how long a person subject to a flood has to react. The warning time is determined by the time taken to detect flooding, recognise its characteristics, and issue warnings. The approximate warning times for the Hutt River once a rainfall alarm has been activated are given in Table A2.

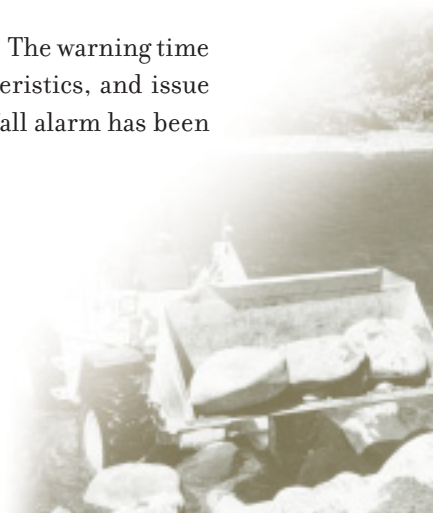


Table A2: Flood warning times for selected Hutt Valley areas

Kaitoke	1:30 hours
Birchville	3:00 hours
Taita Gorge	3:45 hours
HCC Car Park	4:30 hours
Harbour	5:00 hours

Passing on Flood Information

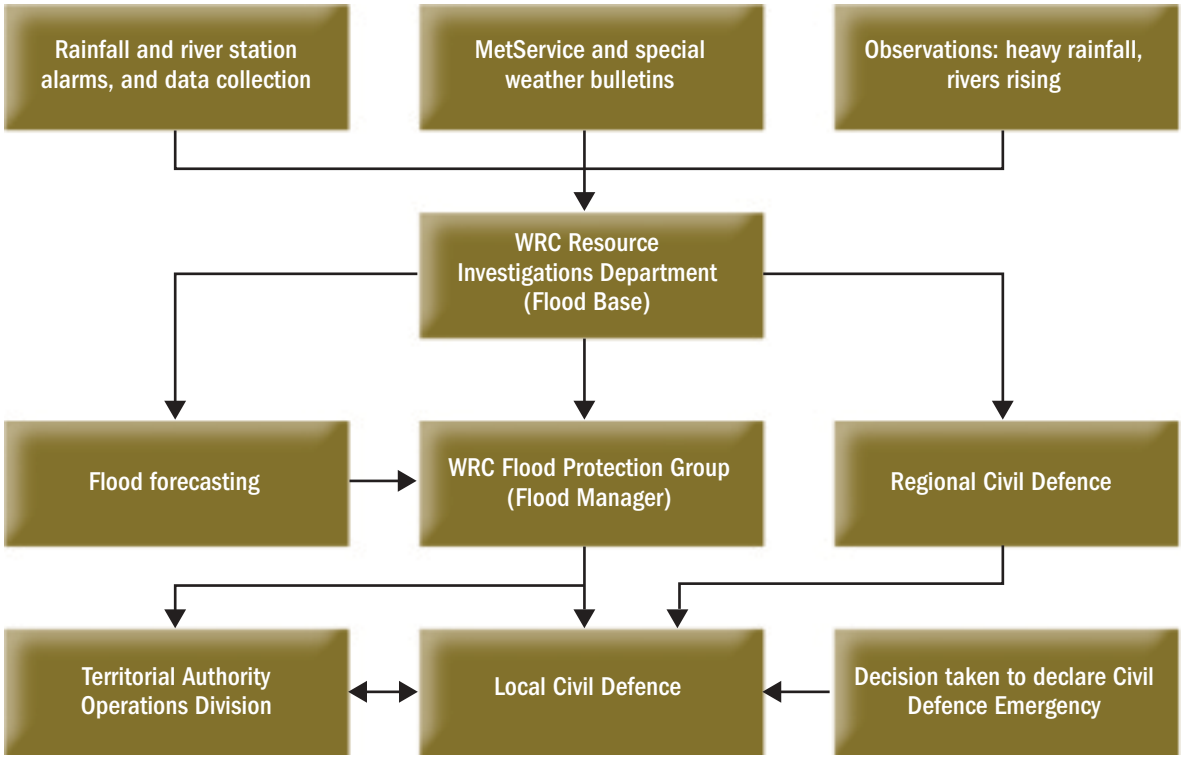
Public warnings are issued by:

- MetService (heavy rain forecast)
- Hutt City Council or Upper Hutt City Council (surface flooding, stormwater problems, slips, etc.)
- Police (road closure, delays, etc.)
- Regional Council Flood Protection (flood warning).

Flood warning information may be circulated by radio, television or telephone. The Regional Council Flood Manager passes information directly to local and regional civil defence and emergency management organisations. These organisations, in turn, pass on the warnings to those who may be affected.

The public can also directly access river level and rainfall data from the telemetered sites via the Hydroline service. This data is automatically updated every three to six hours, and more frequently during floods. The information is also available via the Regional Council website: www.wrc.govt.nz.

FIGURE A3: OVERVIEW OF FLOOD WARNING SYSTEM



2 APPENDIX 2: LEGISLATIVE FRAMEWORK FOR FLOODPLAIN MANAGEMENT PLANNING

RELEVANT LEGISLATION

This appendix covers key parts of relevant legislation that guide:

- managing natural hazards (principally flooding)
- the jurisdiction for undertaking flood protection works
- managing the effects of flood protection works and the use and development of land.

The responsibilities of all three councils are discussed, as well as the Regional Council's long-term and annual planning requirements.

Resource Management Act 1991

The primary statute under which the natural and physical resources of the region are managed is the Resource Management Act 1991 (RMA). The RMA enables the preparation of regional and district plans. They assist the Regional Council and the Hutt and Upper Hutt City Councils to carry out their functions to achieve the purpose of the Act. The functions we are mainly interested in here involve managing the:

- relationships between land use and development in the Hutt Valley, and the flood hazard
- adverse effects of Regional Council flood protection works.

DEFINING NATURAL HAZARDS

Natural hazards are those naturally occurring events that threaten human life, property or other aspects of the environment. Section 2 of the Act defines a natural hazard as:

any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

Managing Natural Hazards

Sections 30 and 31 cover the three councils' general responsibilities for managing the effects of natural hazards.

Section 30: The Regional Council has numerous responsibilities including:

(a) The establishment, implementation and review of objectives, policies and methods to achieve integrated management of the natural and physical resources of the region.

(b) The preparation of objectives and policies in relation to any actual or potential effects of the use, development, or protection of land which are of regional significance.

(c) The control of the use of land for the purpose of –

… (iv) The avoidance or mitigation of natural hazards.

Section 31: Hutt City and Upper Hutt City Councils have responsibility for:

(a) The establishment, implementation and review of objectives, policies and methods to achieve integrated management of the effects of the use, development, or protection of land and associated natural and physical resources of the district.

(b) The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards…

The Wellington Regional Policy Statement further clarifies the three councils' shared and separate responsibilities for managing natural hazards. These are discussed later in this appendix.

Other Key Sections for Managing Natural Hazards

Under **Section 9**(1) the city councils may control the effects of the use and development of land through rules in their district plans. Section 9(3) provides the Regional Council with the same function for activities under its control; for instance, excavations on steep hill country.

Section 11 provides the Upper Hutt and Hutt City Councils with the ability to control the subdivision of land, so that they can consider the land's intended use.

Sections 221 and 224 cover placing critical information on new property titles. Section 221 allows information to be inserted if it is part of a subdivision consent condition that must be complied with on an ongoing basis. This includes a condition for the protection of land from flooding and erosion under section 220.

Managing the Effects of Flood Protection Activities

The following parts and sections relate to managing the use and development of land, including effects of flood protection activities on the environment. They cover general matters such as:

- using and developing natural and physical resources
- natural character
- public access
- maori traditions and culture
- managing amenity values and ecosystems
- recognising heritage values.

These sections also cover more specific matters, including:

- controlling the use of land, riverbeds and water
- restricting discharges of contaminants to the environment
- considering alternative approaches
- hazard information on property titles.

Part II of the Act contains a number of specific provisions that must be taken into account when considering the use, development or protection of the region's water bodies and associated floodplains and catchment lands.

Section 5 states the purpose of the Act is *to promote sustainable management of natural and physical resources.*

Section 6 identifies a number of matters of national importance the Council must recognise and provide for in managing the use, development and protection of the natural and physical resources, including:

(a) The preservation of the natural character of … wetlands, lakes and rivers and their margins, and the protection of them from inappropriate use and development.

(d) The maintenance and enhancement of public access to and along … lakes and rivers.

(e) The relationship of Maori and their culture and traditions with their ancestral lands, waters, sites, waahi tapu and other taonga.

Section 7 of the Act identifies a number of additional matters the Council must have particular regard to in managing the use, development and protection of natural and physical resources, including:

(a) Kaitiakitanga.

(b) The efficient use and development of natural and physical resources.

(c) The maintenance and enhancement of amenity values.

(d) Intrinsic values of the ecosystems.

(e) Recognition and protection of the heritage values of sites, buildings and places, or areas.

(f) Maintenance and enhancement of the quality of the environment.

Sections 9, 13, 14 and 15 allow the Regional Council to include rules in regional plans that restrict the use of land, river beds and water, and discharges in order to manage the adverse effects of various activities on the environment. That includes rules for controlling the effects of the Regional Council's flood protection works.

Part VI of the RMA covers the resource consent application process, and important considerations and guidance for making decisions on them. Key sections include sections:

- 88: Making an application
- 93: Notification of applications
- 94: Applications not requiring (public) notification
- 104: Matters to be considered (when considering a consent application)
- 105: Decisions on applications
- 108: Conditions of resource consents

Other Sections

Section 32 requires councils to consider alternative solutions when preparing regional and district plans. In particular, they must be satisfied that the plan provisions (such as policies and rules) are necessary to achieve the purpose of the Act, and that they are more appropriate than alternative approaches. In preparing the Hutt River Floodplain Management Plan, the broad costs and benefits of various options have been discussed with members of the community.

Building Act 1991

The Building Act 1991 and Building Regulations 1992 provide a performance-based building control system that applies to the construction, alteration, demolition and maintenance of most buildings and significant structures. The controls within the Building Act assist in ensuring that new development is compatible with the prevailing flood hazard, and that the overall level of flood damage will not be increased significantly. Examples of types of controls available through the Building Act are:

- restrictions on new buildings in flood- and erosion-prone areas under Section 36
- minimum standards for setting floor levels under clause E1 (Surface Water) of the Act's Building Code.

Recent case law from the Environment Court has ruled that in certain instances the RMA can provide more stringent restrictions over and above the Building Act. For instance, the RMA can set higher standards and requirements to avoid or mitigate the effects of natural hazards on new land-use activities.

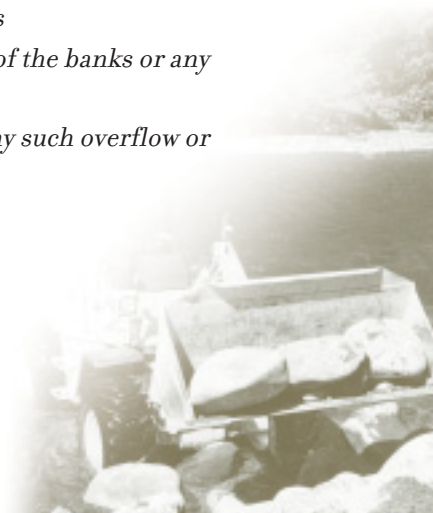
Soil Conservation and Rivers Control Act 1941

The Soil Conservation and Rivers Control Act 1941 includes provisions for "the prevention of damage by erosion" and "the protection of property from damage by floods". Within the general powers (Section 126) of this Act, the principal function of every catchment board is "to minimise and prevent damage within its district by floods and by erosion". These catchment boards, whose powers have now been assumed by regional councils, were given wide powers in relation to watercourses.

Preventing Flooding and Erosion

Section 126: General Powers of Catchment Boards:

2. *Each Board shall have all such powers, rights and privileges as may reasonably be necessary or expedient to enable it to carry out its functions, and in particular each Board shall have power to construct, reconstruct, alter, repair, and maintain all such works and do and execute all such other acts and deeds, including the breaching of any stopbank, as may in the opinion of the Board be necessary and expedient for:*
   - *a) (Repealed)*
   - *b) Controlling or regulating the flow of water in and from watercourses*
   - *c) Preventing or lessening any likelihood of the overflow or breaking of the banks or any watercourse*
   - *d) Preventing or lessening any damage which may be occasioned by any such overflow or breaking of the banks*
   - *e) Preventing or lessening erosion or the likelihood of erosion*
   - *f) Promoting soil conservation.*



RELATIONSHIP OF FLOODPLAIN MANAGEMENT PLANNING WITH THE REGIONAL POLICY STATEMENT, STATUTORY PLANS AND BUSINESS PLANNING

The following describes the relationship between floodplain management planning, the Regional Policy Statement, and the various statutory and business plans. Figure 8 in Chapter One provides a basic summary of the roles of the various planning instruments in implementing the Floodplain Management Plan outcomes.

Floodplain Management Plans

The Regional Council made the decision that the region's floodplain management plans would not be statutory documents in themselves. Instead, these plans would be non-statutory documents prepared in consultation with the community. They would be working guides to carry out floodplain management, providing structural measures and direction for non-structural approaches.

The approach has been taken that the Regional Council's long-term business and annual plans would be primarily used to implement the structural methods. The district plans would be primarily used to ensure that the non-structural land-use measures are achieved. Emergency management measures would be achieved through business planning of all three agencies, with the city councils taking the lead role.

Therefore, in comparison to regional plans (which cover a diverse range of issues), the Hutt River Floodplain Management Plan specifically deals with management of the river and its environment, and providing flood protection measures. At the same time the Plan provides the framework for guiding land use and development on the floodplain. The relationships between floodplain management plans and these other documents are presented below.

Regional Policy Statement

The Regional Policy Statement provides an overview of the resource management issues and sets the policies and methods by which the Wellington Regional Council seeks to achieve integrated management of the natural and physical resources of the region. The Regional Policy Statement contains objectives, policies and methods covering a wide range of resource management issues, including the mitigation of natural hazards (Chapter 11) and the management of fresh water (Chapter 5), ecosystems (Chapter 6), and landscape and heritage (10).

In particular, key methods and statements in Chapter 11 highlight the split in responsibilities for managing natural hazards (including flooding) between the city and regional councils. Method 14 requires the Council to implement natural hazards policies through regional plans. Section 11.7 identifies that district and city councils are primarily responsible for producing rules in district plans to manage the effects of natural hazards on land use and development. Methods in this chapter also cover identifying the risk of natural hazards to existing development, implementing measures to manage the risk, analysing potential effects of natural hazards, and providing hazard information. The Hutt River Floodplain Management Plan includes structural measures and non-structural principles reflecting the intent of these methods.

Regional Plans

The Regional Freshwater Plan contains objectives, policies and methods to manage the effects of activities on water, the beds of lakes and rivers and associated ecosystems, and the diversion of water. It also contains policies to support floodplain management planning.

Section 12.1.4 of the Freshwater Plan supports the Council's approach to floodplain management planning. Section 7.2 includes policies for constructing flood protection structures, considering new development on floodplains, using flood hazard information, and avoiding impacts on the flood defence system. Section 8.3 contains a number of methods related to these policies, including preparing floodplain management plans and promoting emergency management.

This Plan also contains policies and rules relevant for flood protection works and other activities. Areas covered include:

- water quality (Chapter 5) – policies relating to receiving water quality and non-point source discharges, and rules 1 and 5
- diverting water (Chapter 6) – policies relating to damming and diverting water, and rules 8 and 16, which are particularly relevant for protecting flood protection structures
- using river and lake beds (Chapter 7) – policies relating to appropriate uses of river beds, flood and erosion mitigation, structures, and disturbance and plantings in river beds. Rules 22 to 24, 33 to 44, and 48 and 49 are all relevant to flood protection.

The Regional Soil Plan contains objectives, policies and methods to manage the effects of activities on the soil resource; in particular, policies covering sustainable land management, and vegetation and soil disturbance. Rules 1 to 4 concern managing soil excavations and vegetation removal on erosion-prone hill country. These rules are particularly relevant to managing land uses such as production forestry and track construction in the upper catchment areas of the Hutt River.

District Plans

Both Hutt City's and Upper Hutt City's Proposed District Plans contain broad policies and rules restricting particular land uses in open-space areas immediately adjacent to the Hutt River. Upper Hutt's Proposed Plan also requires new residential dwelling floor levels to be above a 100-year flood.

Towards a Greater Wellington Region

Towards a Greater Wellington Region is the Regional Council's 2000-2010 Long-term Financial Strategy. It outlines:

- what the Council plans to do between 2000 and 2010
- why the Council is going to do it
- what it will cost – particularly the impact on rates
- how the community will benefit
- what challenges the Council will face.

Regarding flood protection, the 10-year action programme includes the preparation of floodplain management plans, flood hazard assessments and scheme reviews; and the management and improvement of river corridors, stopbanks and associated flood protection assets. The Strategy is reviewed every three years.

Flood Protection Group Operating Plan

The Operating Plan's long-term performance targets are:

- complete floodplain management plans for all regionally significant rivers by 2007
- complete flood hazard assessment for western region rivers and streams affected by flooding and erosion by 2007
- implement the adopted floodplain management plans for the Hutt, Otaki and Waikanae by 2040
- maintain service levels of flood protection assets in accordance with asset management plans
- complete and implement environmental strategies for regionally significant rivers at a rate acceptable to the community
- provide advice to the territorial authorities to help develop flood procedures, and provide warning and response advice during flood events.

Annual Plan

The annual plan is prepared as required under the Local Government Amendment Act 1996. All local authorities must prepare an annual plan. The annual plan must outline the nature and scope of activities undertaken by the organisation over the financial year, along with the funds required to undertake these activities.

PHASES OF FLOODPLAIN MANAGEMENT PLANNING

Phase One: Defining the Flood Problem

The nature, extent and severity of flood hazards were determined, and the values of the community, development and the area's environmental issues were recognised. Outcomes are reported in the Phase One summary document, *Living with the River*. This document draws together the findings of the detailed reports prepared as part of the documentation of Phase One investigations.

Phase Two: Evaluating the Effectiveness of All Flood Mitigation Options

Evaluation included initial selection of some (or a combination of) options and used technical, social and environmental databases established in the preceding phase. Factors considered included physical flood conditions, land requirements, costs, benefits and economic efficiency, visual impact, development pressure, and social / community values regarding perceived risk and level of protection. Mitigation methods are those that modify:

- the flood event – stopbanks, detention dams, channel improvements
- damage susceptibility – zoning and building permit restrictions, flood proofing, flood warning and community preparedness
- the flood-loss burden – insurance, disaster relief, etc.

Phase Three: Refining the Chosen Options

Refining options takes into consideration:

- impacts of works on the environment
- engineering considerations
- social, economic and environmental benefits.

The **Reference List** contains a number of reports and publications from Phases Two and Three of the Plan.

Phase Four: Plan Drafting

The public consultation and submissions phase forms a critical part of the process of drafting the Hutt River Floodplain Management Plan.

Phase Five: Plan Implementation

Theoretically, implementation will occur when the Plan is completed. In reality, the rate of implementation will depend on many factors, including the Regional Council's Long-term Financial Strategy and the Flood Protection Group's business plan. Implementing structural measures can commence during Phase Three, prior to non-structural measures being selected.

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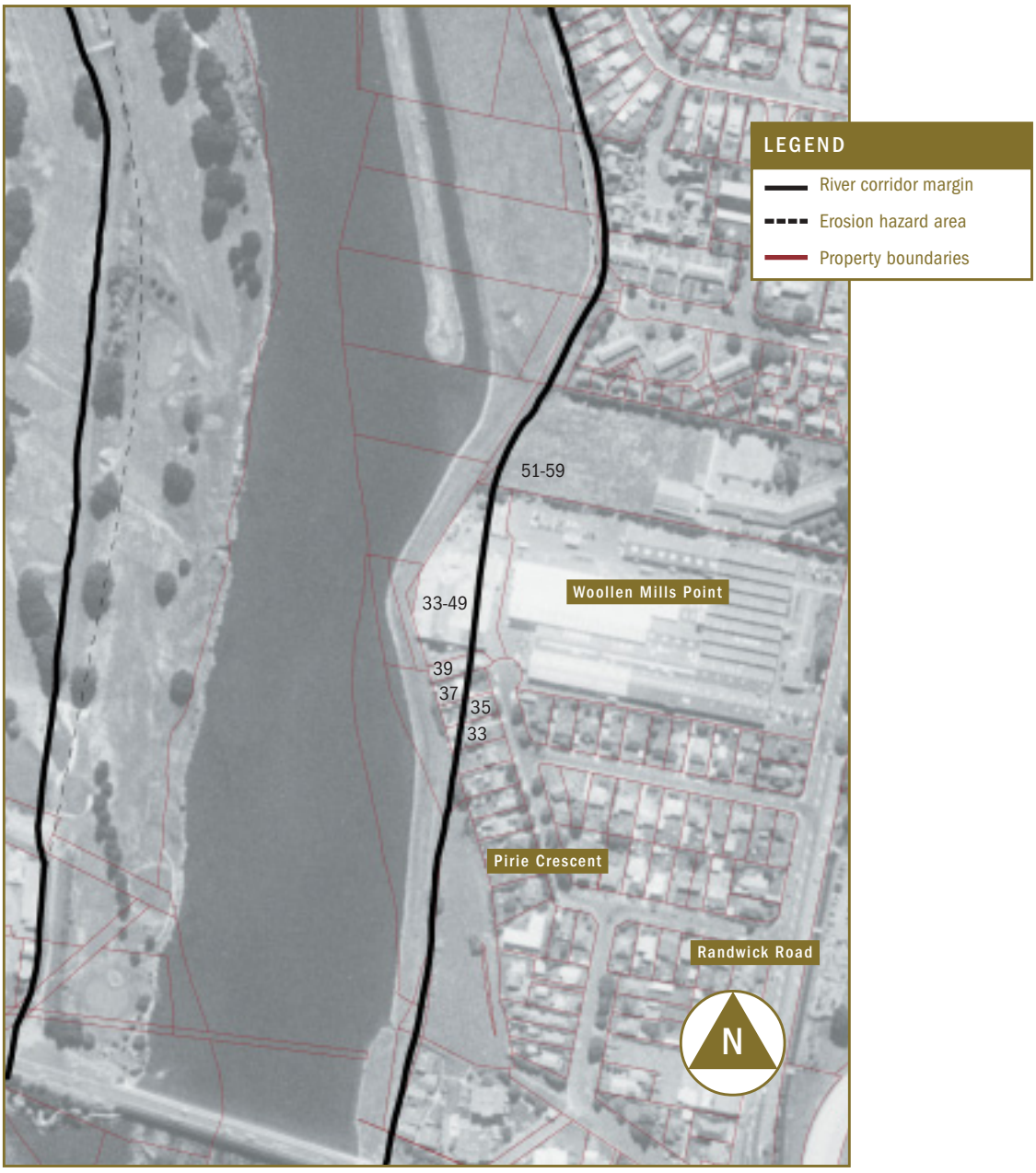
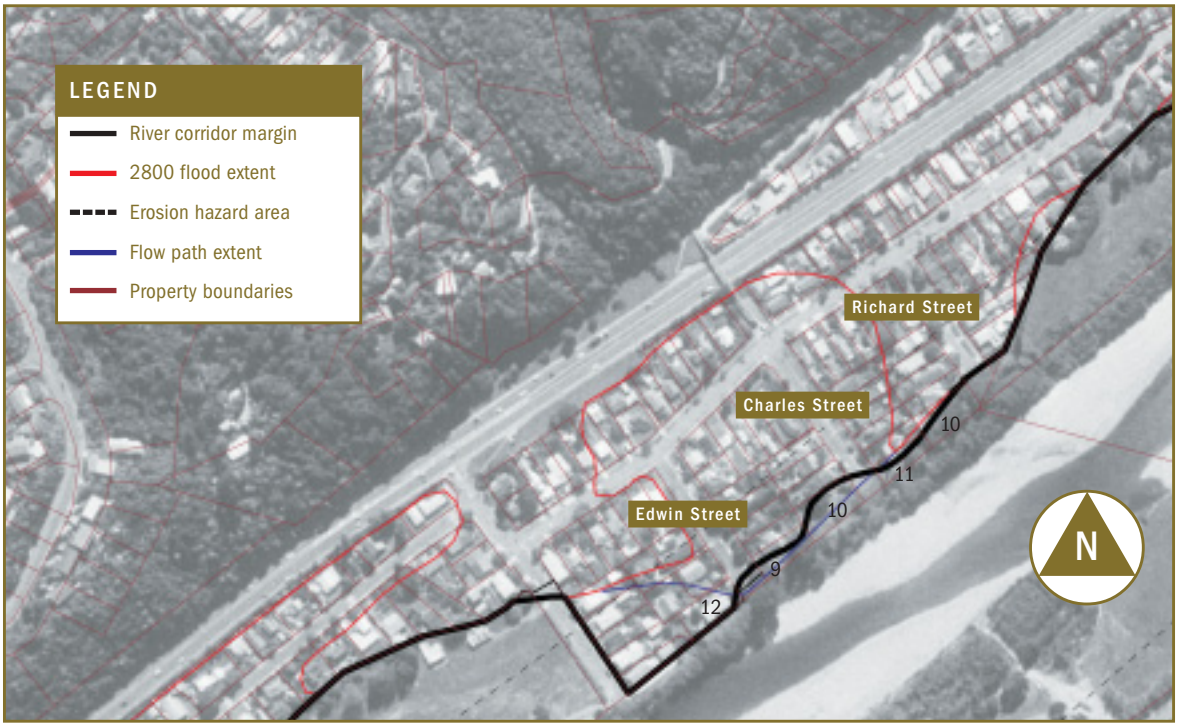
APPENDIX 3: PROPERTY AFFECTED BY THE RIVER CORRIDOR BOUNDARY AND STRUCTURAL WORKS

FIGURE A4



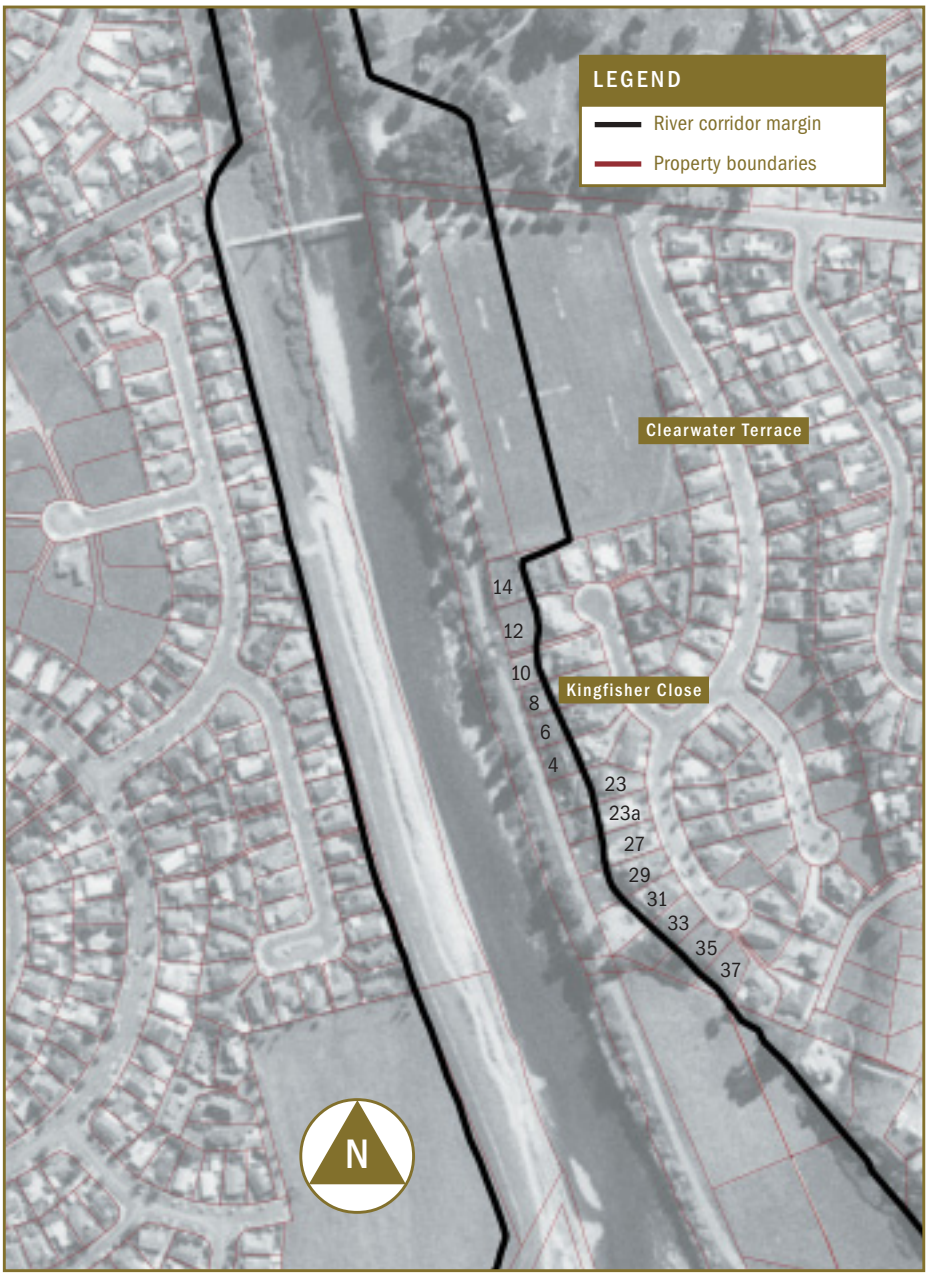
Private land within river corridor margins (Woollen Mills Point). These properties may be affected by structural works.

FIGURE A5



Private land within River Corridor margins (Belmont)

FIGURE A6

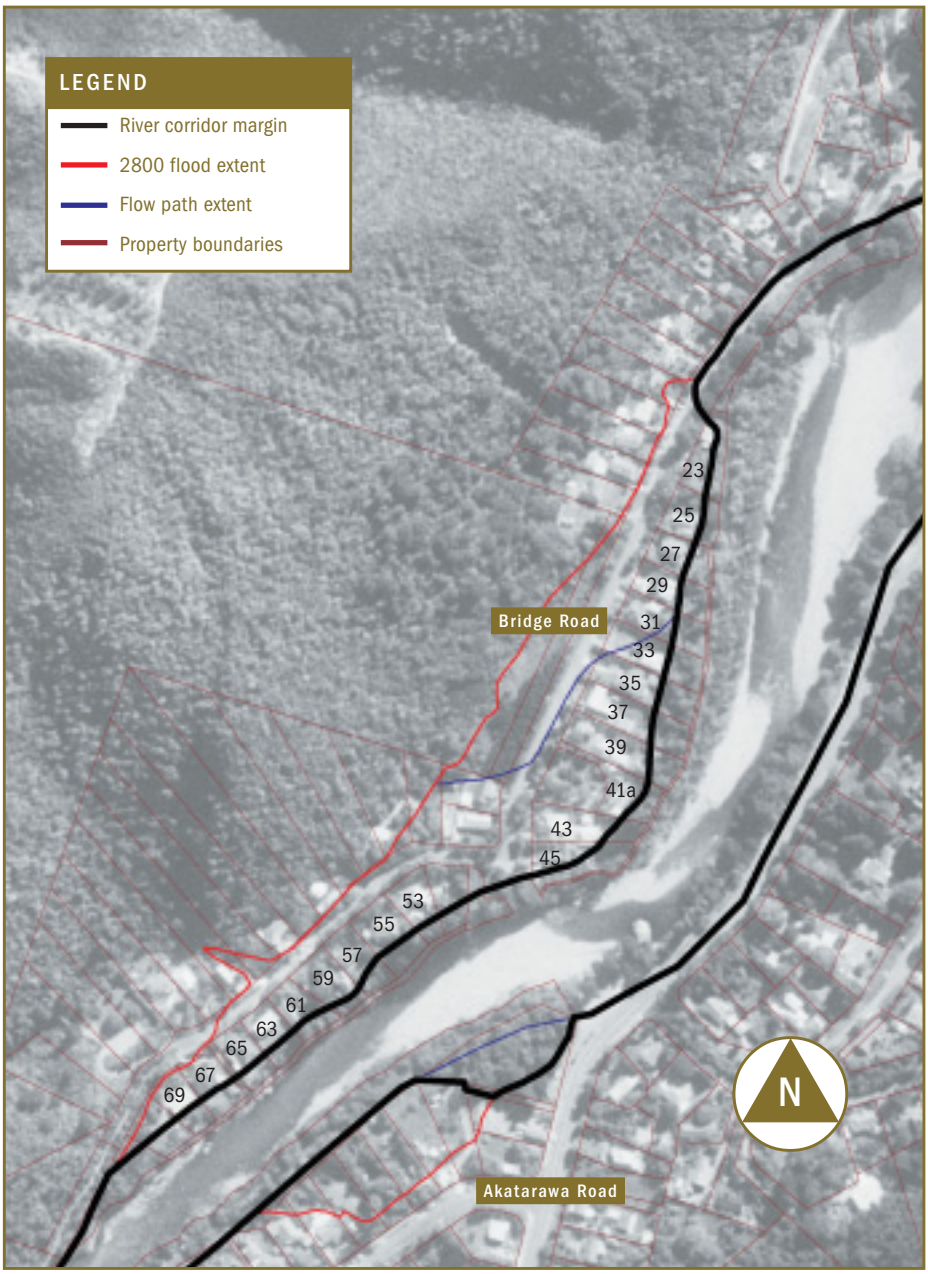


Private land within river corridor margins (Clearwater Terrace)

FIGURE A7

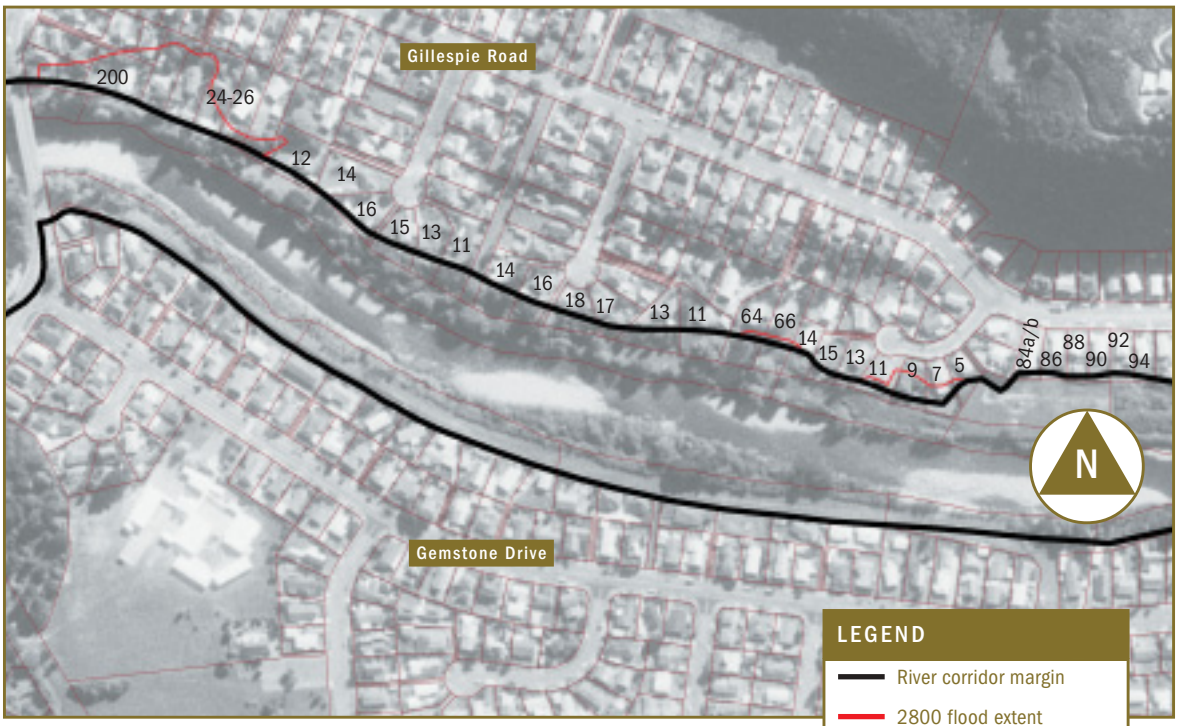
Private land within river corridor margins (Black Beech Street)

FIGURE A8



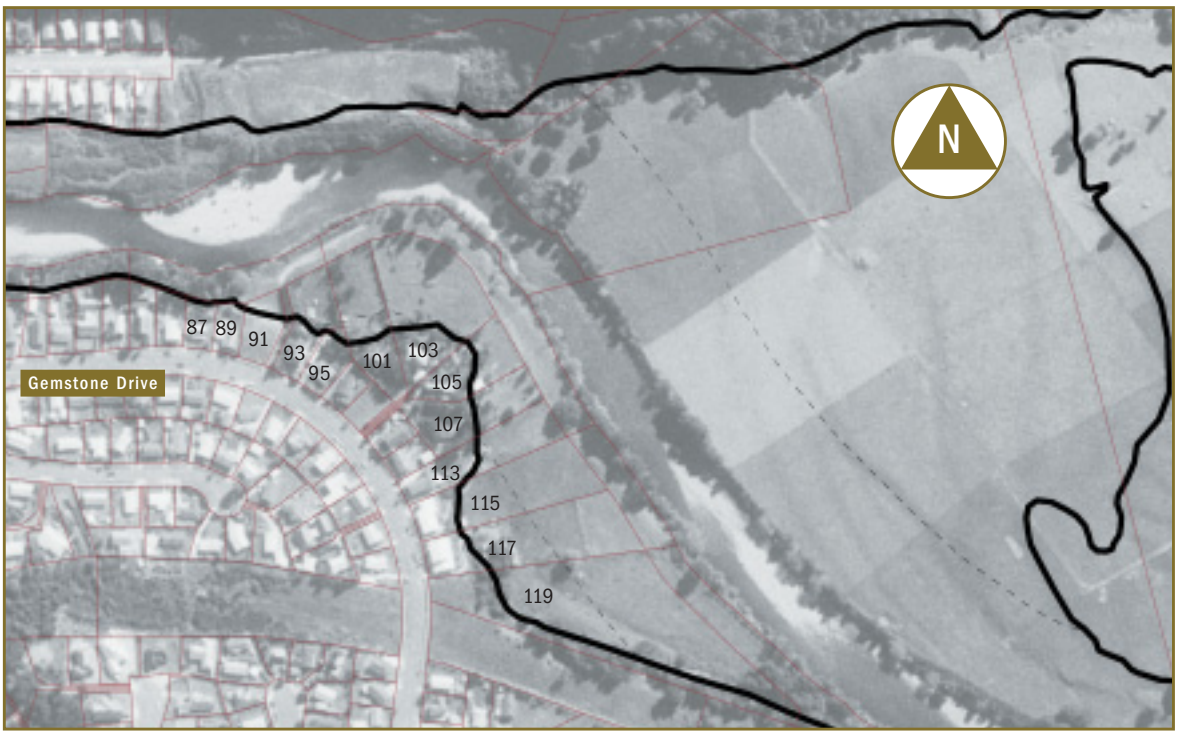
Private land within river corridor margins (Bridge Road)

FIGURE A9



Private land within river corridor margins (Gillespie Road)

FIGURE A10



Private land within river corridor margins (Gemstone Drive)

LEGEND

- River corridor margin
- Erosion hazard area
- Property boundaries

Table A3: Private land in the river corridor

STREET ADDRESS	TOTAL LAND AREA (M^2)	LAND AREA AFFECTED (M^2)
FIGURE A4: WOOLLEN MILLS POINT, MOERA		
33 PIRIE CRESCENT, LOWER HUTT	560	20
35 PIRIE CRESCENT, LOWER HUTT	590	140
37 PIRIE CRESCENT, LOWER HUTT	560	240
39 PIRIE CRESCENT, LOWER HUTT	610	370
33-49 RANDWICK ROAD, LOWER HUTT	6070	3950
51-59 RANDWICK ROAD, LOWER HUTT	15940	640
FIGURE A5: BELMONT		
12 EDWIN ST, LOWER HUTT	840	40
9 EDWIN STREET, LOWER HUTT	1200	720
10 CHARLES ST, BELMONT, LOWER HUTT	1080	940
11 CHARLES ST, BELMONT, LOWER HUTT	1080	780
10 RICHARD STREET, LOWER HUTT	1480	1180
FIGURE A6: CLEARWATER TERRACE, MAORIBANK		
14 KINGFISHER CLOSE, UPPER HUTT	1440	790
12 KINGFISHER CLOSE, UPPER HUTT	1450	650
10 KINGFISHER CLOSE, UPPER HUTT	1160	320
8 KINGFISHER CLOSE, UPPER HUTT	1180	350
6 KINGFISHER CLOSE, UPPER HUTT	1170	410
4 KINGFISHER CLOSE, UPPER HUTT	1130	510
23 CLEARWATER TERRACE, UPPER HUTT	1230	530
23A CLEARWATER TERRACE, UPPER HUTT	1120	450
27 CLEARWATER TERRACE, UPPER HUTT	1150	460
29 CLEARWATER TERRACE, UPPER HUTT	1180	440
31 CLEARWATER TERRACE, UPPER HUTT	1330	640
33 CLEARWATER TERRACE, UPPER HUTT	1110	490

Continued on the next page.

35 CLEARWATER TERRACE, UPPER HUTT	1110	410
37 CLEARWATER TERRACE, UPPER HUTT	780	140
19 VERNON GROVE, UPPER HUTT	11880	9500
FIGURE A7: BLACK BEECH STREET, BIRCHVILLE		
20 BLACK BEECH STREET, UPPER HUTT	1090	50
22 BLACK BEECH STREET, UPPER HUTT	1410	160
24 BLACK BEECH STREET, UPPER HUTT	1660	130
26 BLACK BEECH STREET, UPPER HUTT	1240	60
30 BLACK BEECH STREET, UPPER HUTT	1230	60
32 BLACK BEECH STREET, UPPER HUTT	774	50
38-42 BLACK BEECH STREET, UPPER HUTT	2090	150
44 BLACK BEECH STREET, UPPER HUTT	820	70
46 BLACK BEECH STREET, UPPER HUTT	850	60
48 BLACK BEECH STREET, UPPER HUTT	830	40
50 BLACK BEECH STREET, UPPER HUTT	810	50
52 BLACK BEECH STREET, UPPER HUTT	810	50
54 BLACK BEECH STREET, UPPER HUTT	810	50
56 BLACK BEECH STREET, UPPER HUTT	810	40
58 BLACK BEECH STREET, UPPER HUTT	810	40
60 BLACK BEECH STREET, UPPER HUTT	810	40
70 BLACK BEECH STREET, UPPER HUTT	970	60
72 BLACK BEECH STREET, UPPER HUTT	760	40
FIGURE A8: BRIDGE ROAD, AKATARAWA		
69 BRIDGE RD, UPPER HUTT	1620	730
67 BRIDGE RD, UPPER HUTT	880	350
65 BRIDGE RD, UPPER HUTT	810	270
63 BRIDGE RD, UPPER HUTT	810	280
61 BRIDGE RD, UPPER HUTT	830	270

59 BRIDGE RD, UPPER HUTT	1010	230
57 BRIDGE RD, UPPER HUTT	930	280
55 BRIDGE RD, UPPER HUTT	1220	450
53 BRIDGE RD, UPPER HUTT	1670	500
45 BRIDGE RD, UPPER HUTT	1250	730
43 BRIDGE RD, UPPER HUTT	1230	310
41A BRIDGE RD, UPPER HUTT	1050	340
39 BRIDGE RD, UPPER HUTT	1500	420
37 BRIDGE RD, UPPER HUTT	1440	490
35 BRIDGE ST, UPPER HUTT	1340	500
33 BRIDGE RD, UPPER HUTT	1270	510
31 BRIDGE RD, UPPER HUTT	1120	450
29 BRIDGE RD, UPPER HUTT	950	380
27 BRIDGE RD, UPPER HUTT	840	320
25 BRIDGE ROAD, UPPER HUTT	950	330
23 BRIDGE ROAD, UPPER HUTT	980	490
FIGURE A9: GILLESPIES ROAD, AKATARAWA		
200 AKATARAWA ROAD, UPPER HUTT	1380	170
24 GILLESPIES ROAD, UPPER HUTT	1450	90
26 GILLESPIES ROAD, UPPER HUTT	1450	130
12 WAIMARAMA GROVE, UPPER HUTT	1490	250
14 WAIMARAMA GROVE, UPPER HUTT	1150	30
16 WAIMARAMA GROVE, UPPER HUTT	920	180
15 WAIMARAMA GROVE, UPPER HUTT	910	340
13 WAIMARAMA GROVE, UPPER HUTT	1050	320
11 WAIMARAMA GROVE, UPPER HUTT	1390	510
14 WHANGAKOKO GROVE, UPPER HUTT	1290	550
16 WHANGAKOKO GROVE, UPPER HUTT	950	360

Continued on the next page.

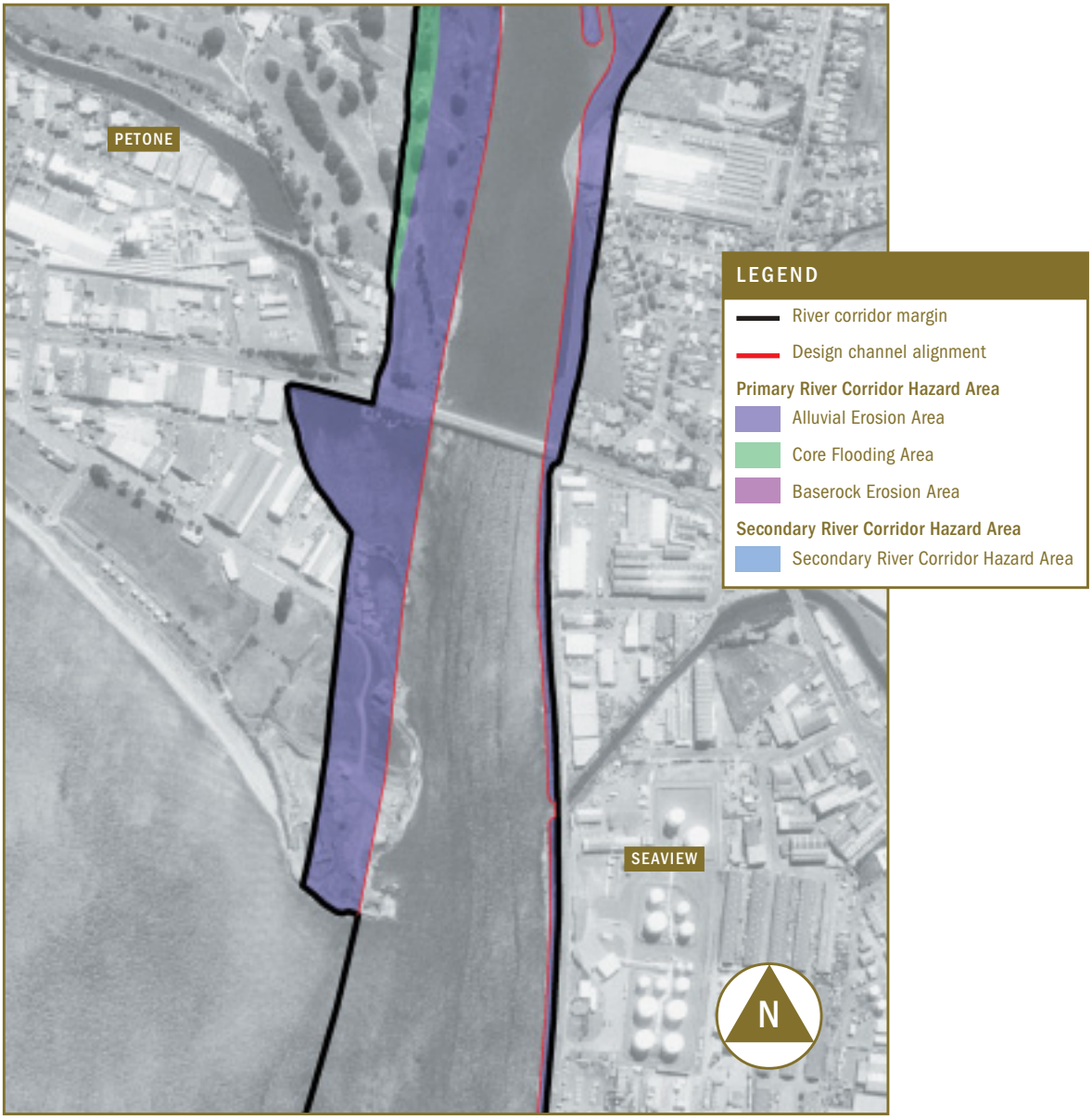
18 WHANGAKOKO GROVE, UPPER HUTT	880	440
17 WHANGAKOKO GROVE, UPPER HUTT	890	120
13 WHANGAKOKO GROVE, UPPER HUTT	1320	620
11 WHANGAKOKO GROVE, UPPER HUTT	1480	670
64 GILLESPIES ROAD, UPPER HUTT	1430	640
66 GILLESPIES ROAD, UPPER HUTT	1490	450
14 EDMUND LOMAS DRIVE, UPPER HUTT	750	340
15 EDMUND LOMAS DRIVE, UPPER HUTT	670	170
13 EDMUND LOMAS DRIVE, UPPER HUTT	630	110
11 EDMUND LOMAS DRIVE, UPPER HUTT	630	140
9 EDMUND LOMAS DRIVE, UPPER HUTT	770	180
7 EDMUND LOMAS DRIVE, UPPER HUTT	730	240
5 EDMUND LOMAS DRIVE, UPPER HUTT	540	140
84A & B GILLESPIES ROAD, UPPER HUTT	630	80
86 GILLESPIES ROAD, UPPER HUTT	590	80
88 GILLESPIES ROAD, UPPER HUTT	550	60
90 GILLESPIES ROAD, UPPER HUTT	540	60
92 GILLESPIES ROAD, UPPER HUTT	540	50
94 GILLESPIES ROAD, UPPER HUTT	540	40
FIGURE A10: GEMSTONE DRIVE, AKATARAWA		
87 GEMSTONE DRIVE, UPPER HUTT	700	40
89 GEMSTONE DRIVE, UPPER HUTT	680	30
91 GEMSTONE DRIVE, UPPER HUTT	1170	350
93 GEMSTONE DRIVE, UPPER HUTT	2010	1110
95 GEMSTONE DRIVE, UPPER HUTT	990	80
101 GEMSTONE DRIVE, UPPER HUTT	3120	1870
103 GEMSTONE DRIVE, UPPER HUTT	5600	4200
105 GEMSTONE DRIVE, UPPER HUTT	2340	1170

107 GEMSTONE DRIVE, UPPER HUTT	2810	1260
113 GEMSTONE DRIVE, UPPER HUTT	2870	1580
115 GEMSTONE DRIVE, UPPER HUTT	4470	3350
117 GEMSTONE DRIVE, UPPER HUTT	5120	3990
119 GEMSTONE DRIVE, UPPER HUTT	12400	8060

4

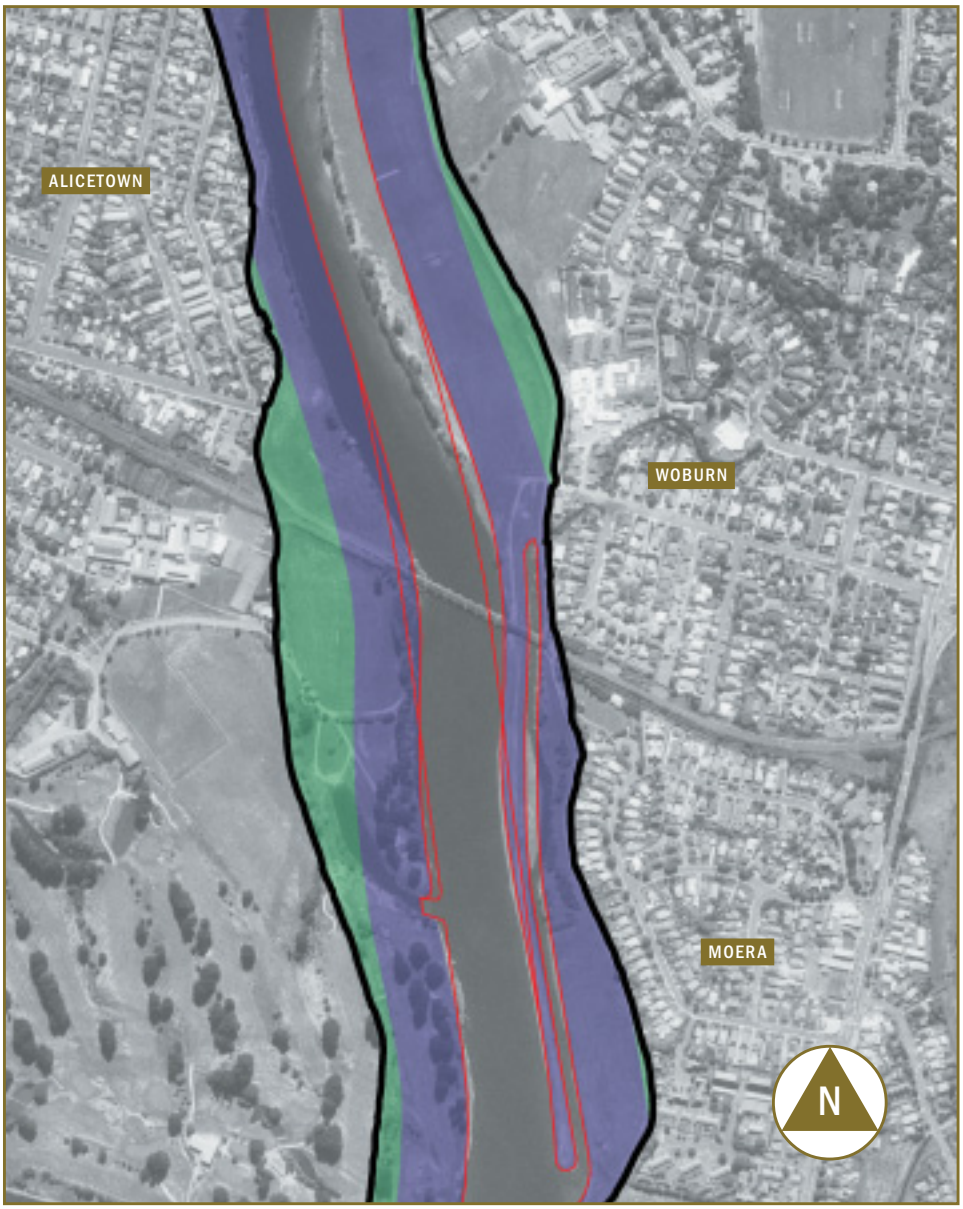
APPENDIX 4: RIVER CORRIDOR HAZARD AREAS – REACH BY REACH

FIGURE A11



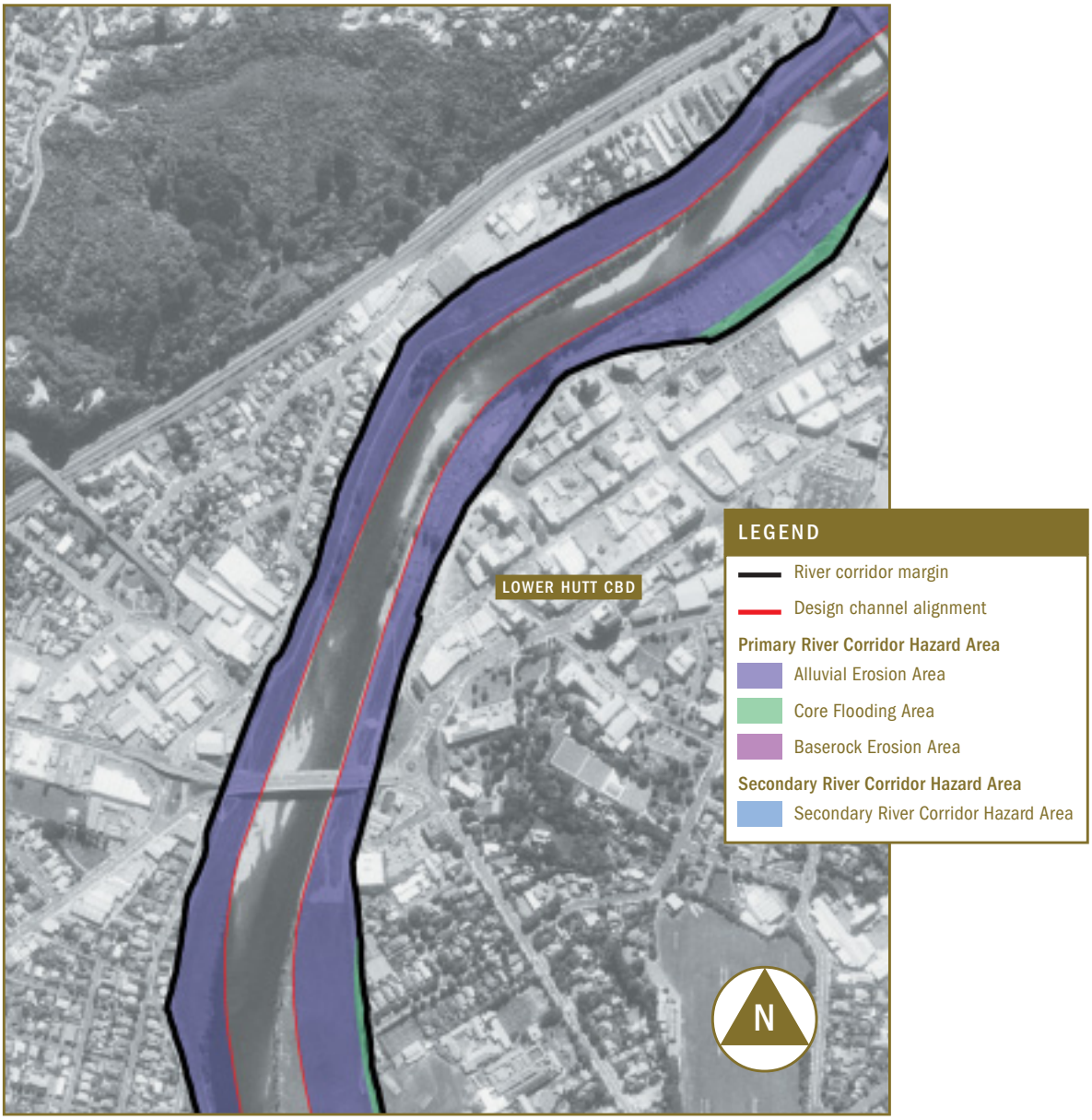
Hutt River Corridor Hazard Areas – 1. Estuary

FIGURE A12



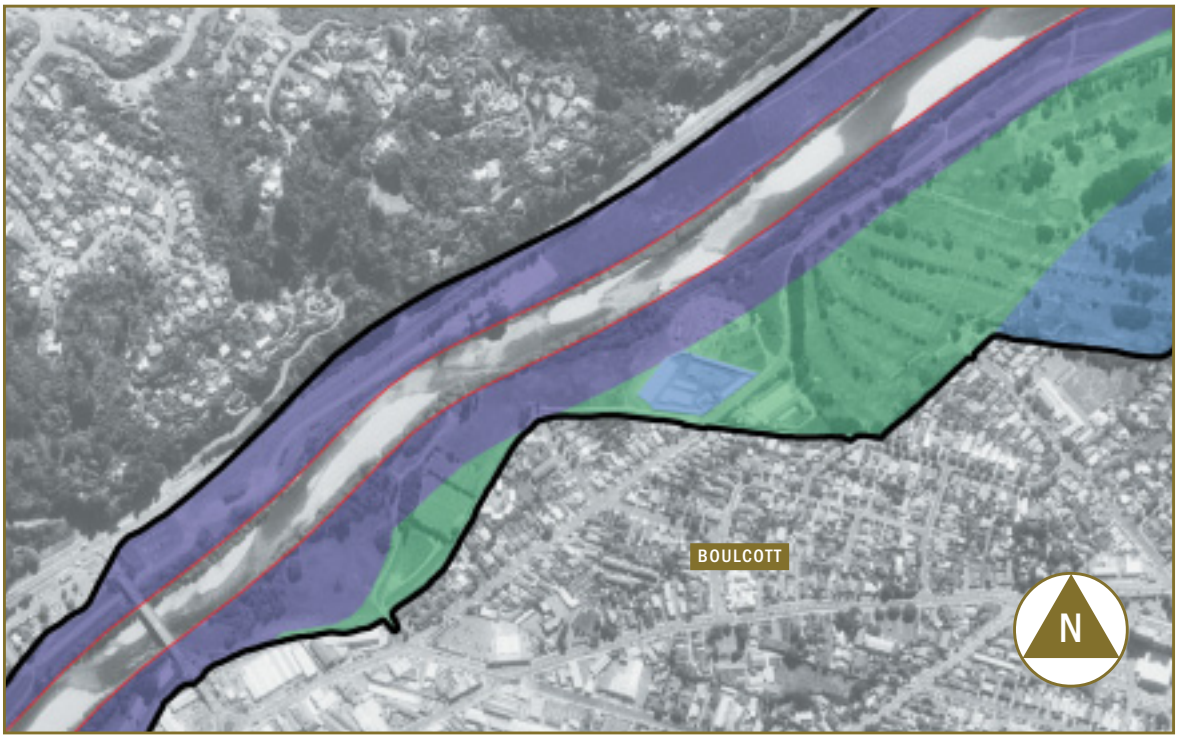
Hutt River Corridor Hazard Areas – 2. Shandon to Ava

FIGURE A13



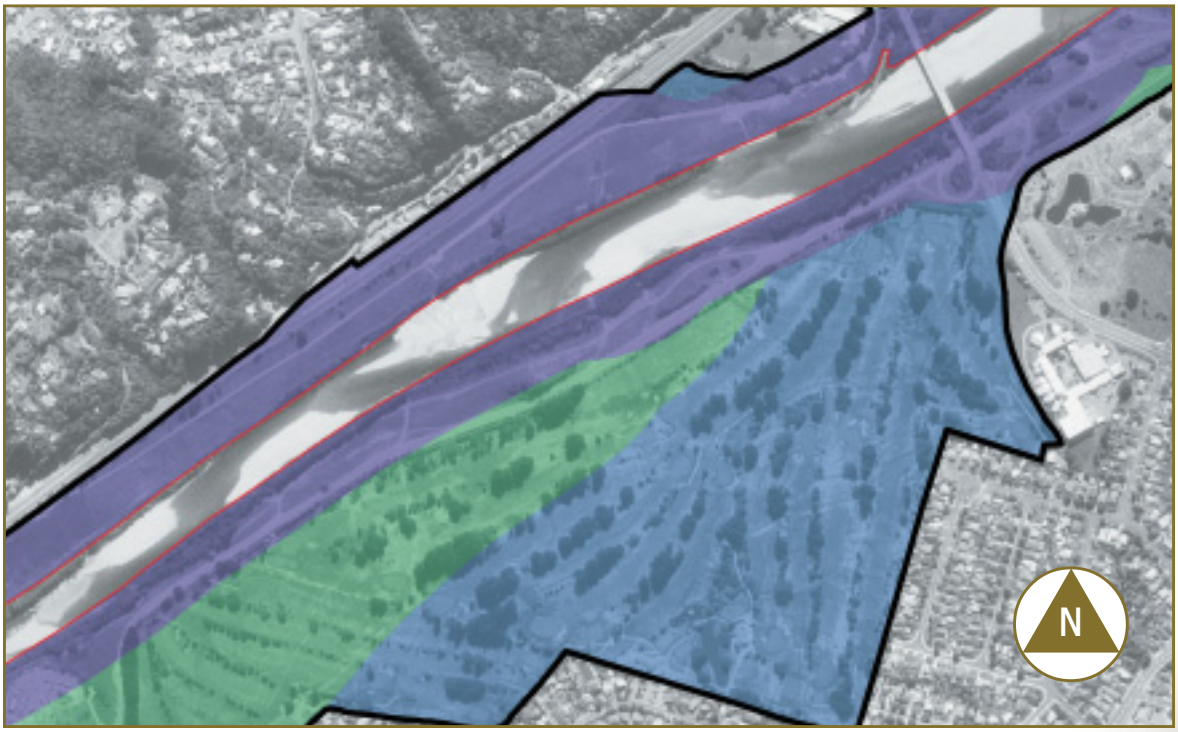
Hutt River Corridor Hazard Areas – 3. Ewen to Marsden

FIGURE A14



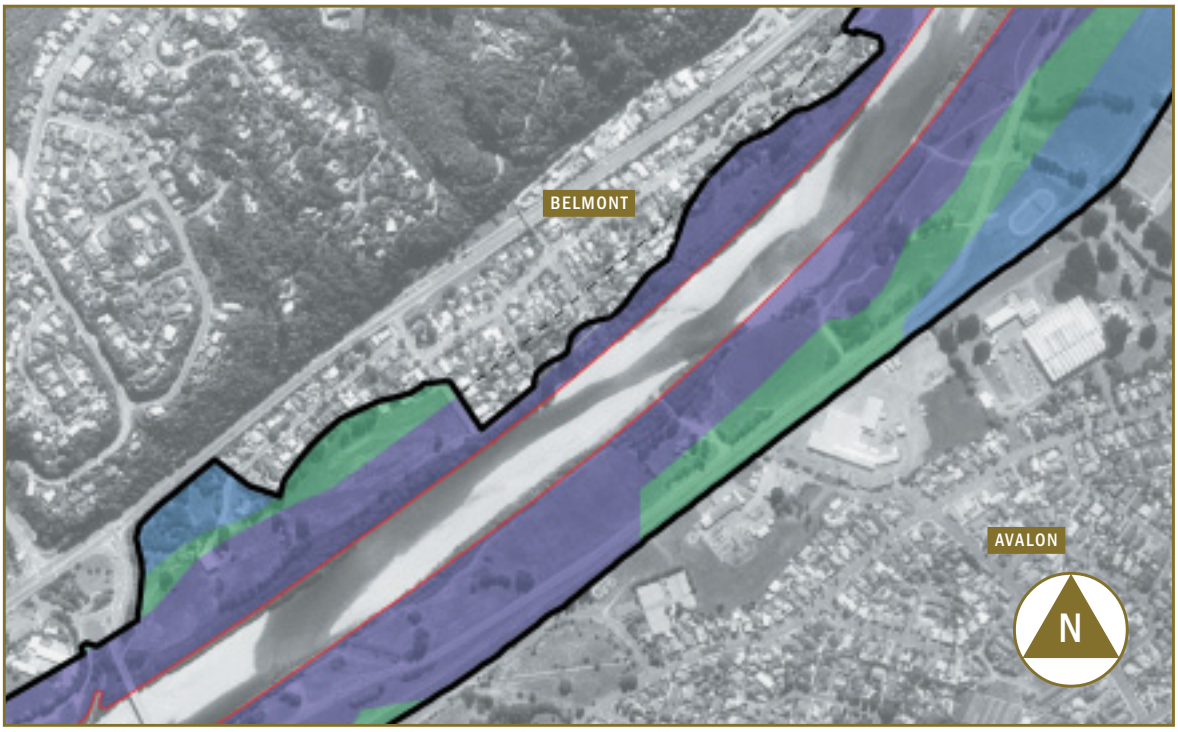
Hutt River Corridor Hazard Areas – 4. Melling

FIGURE A15



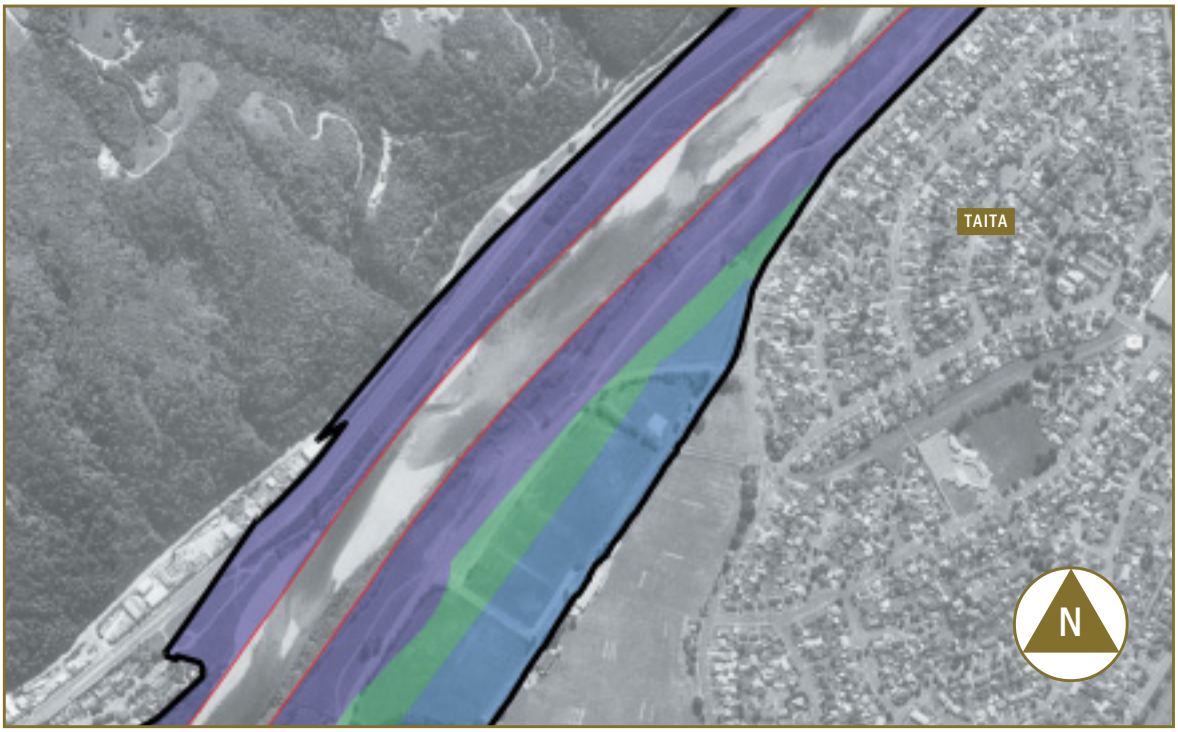
Hutt River Corridor Hazard Areas – 5. Boulcott

FIGURE A16



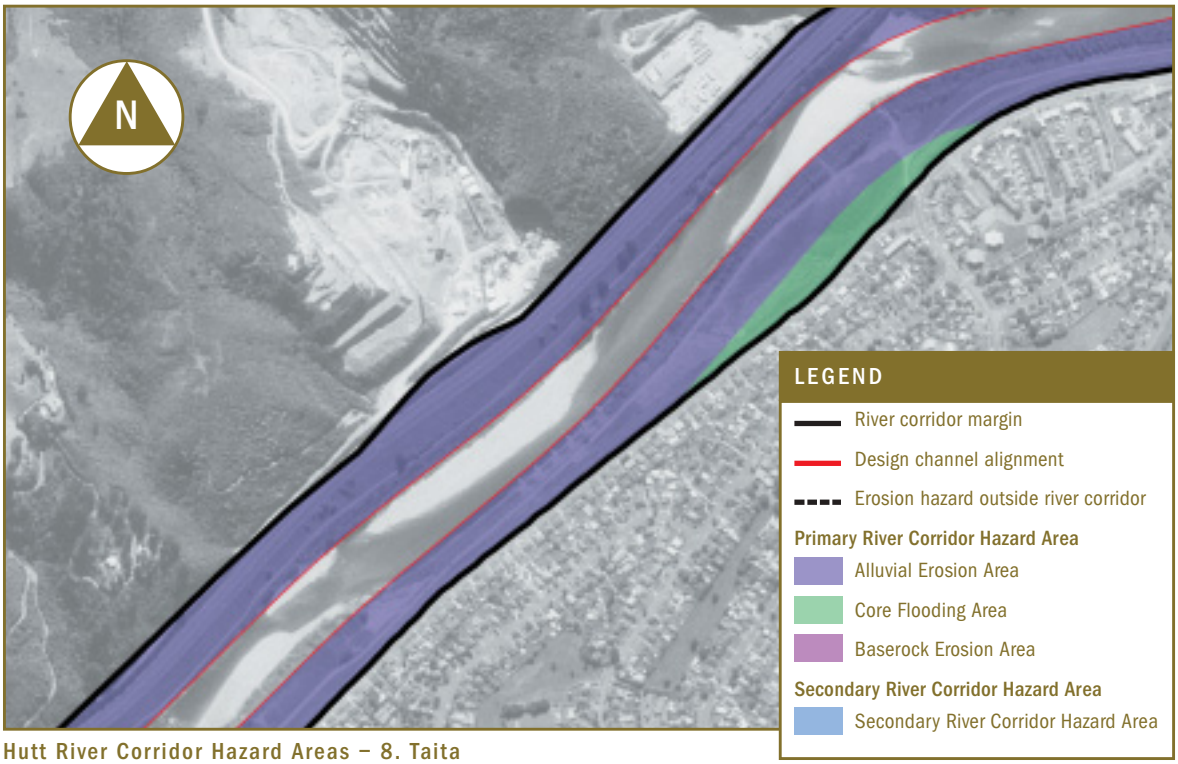
Hutt River Corridor Hazard Areas – 6. Belmont

FIGURE A17



Hutt River Corridor Hazard Areas – 7. Fraser Park

FIGURE A18

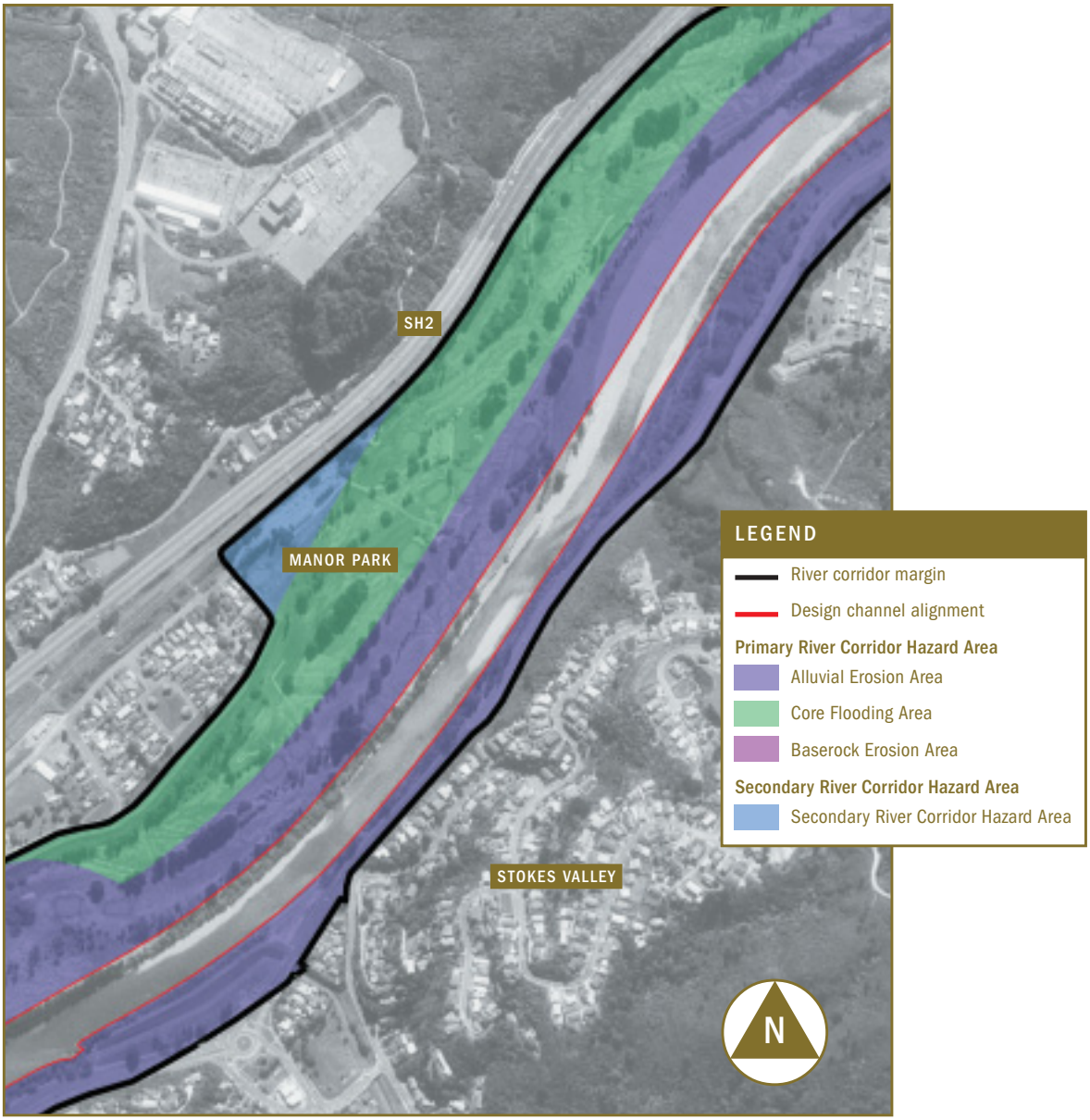


Hutt River Corridor Hazard Areas – 8. Taita

FIGURE A19

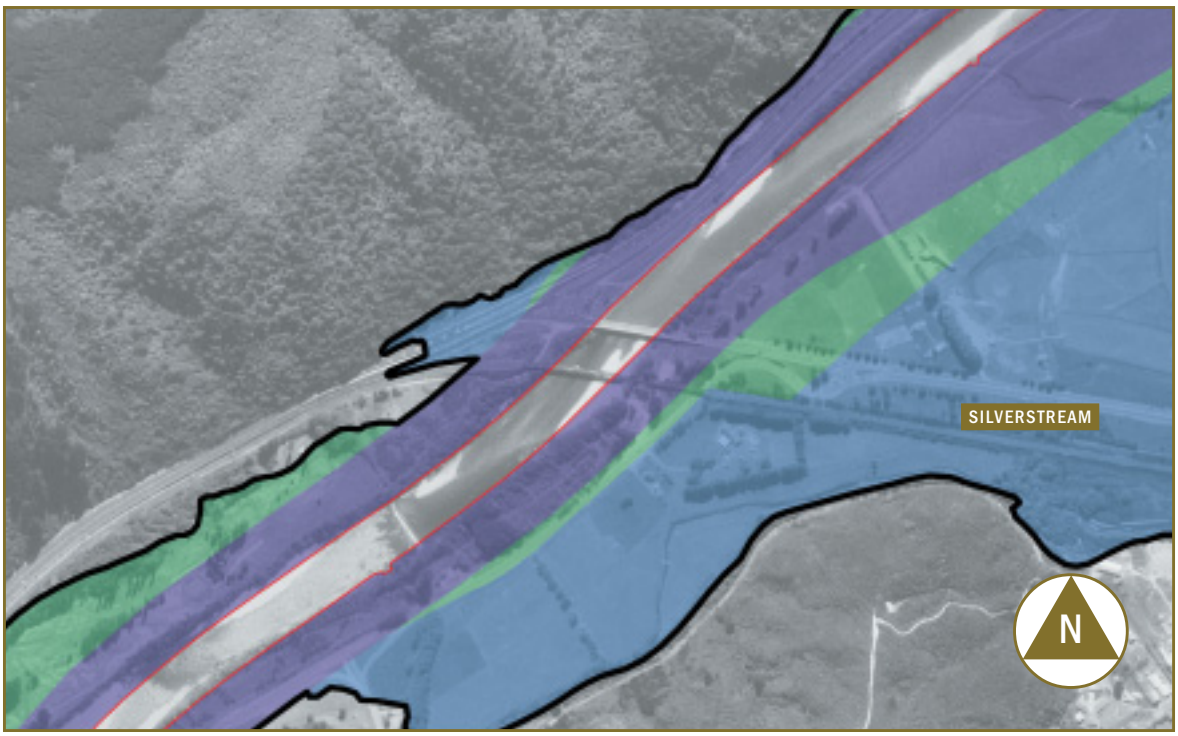
Hutt River Corridor Hazard Areas – 9. Pomare

FIGURE A20



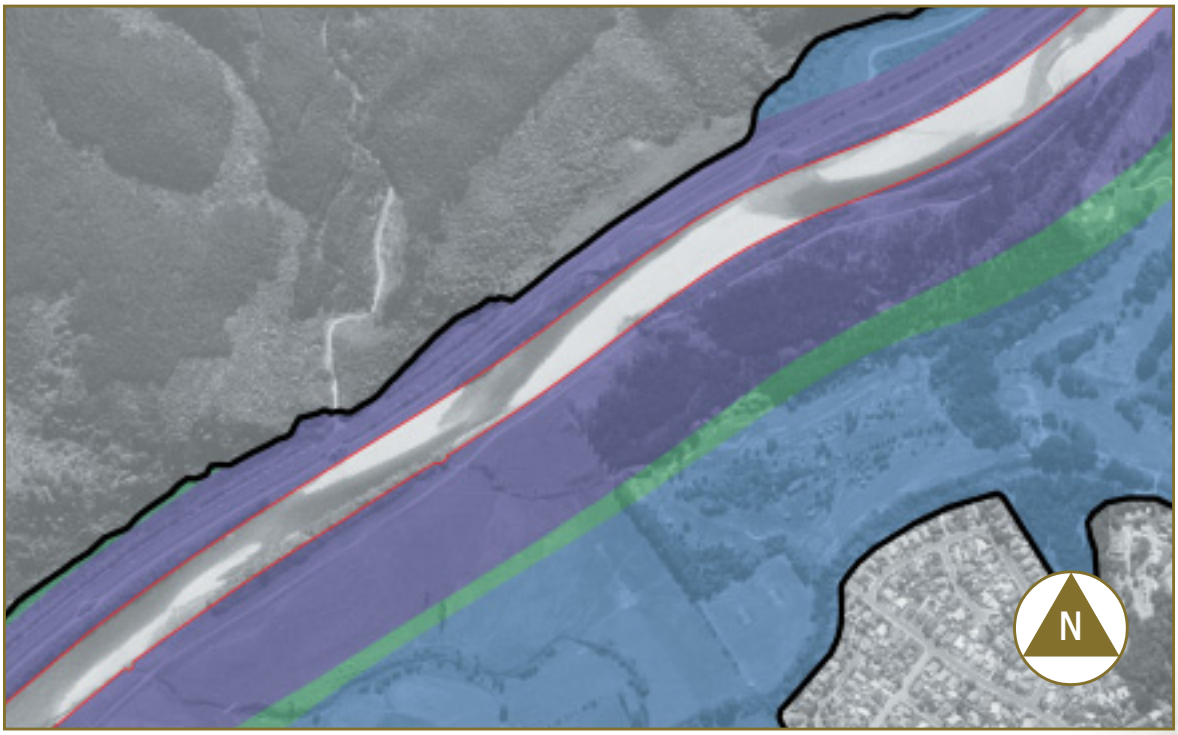
Hutt River Corridor Hazard Areas – 10. Manor Park

FIGURE A21



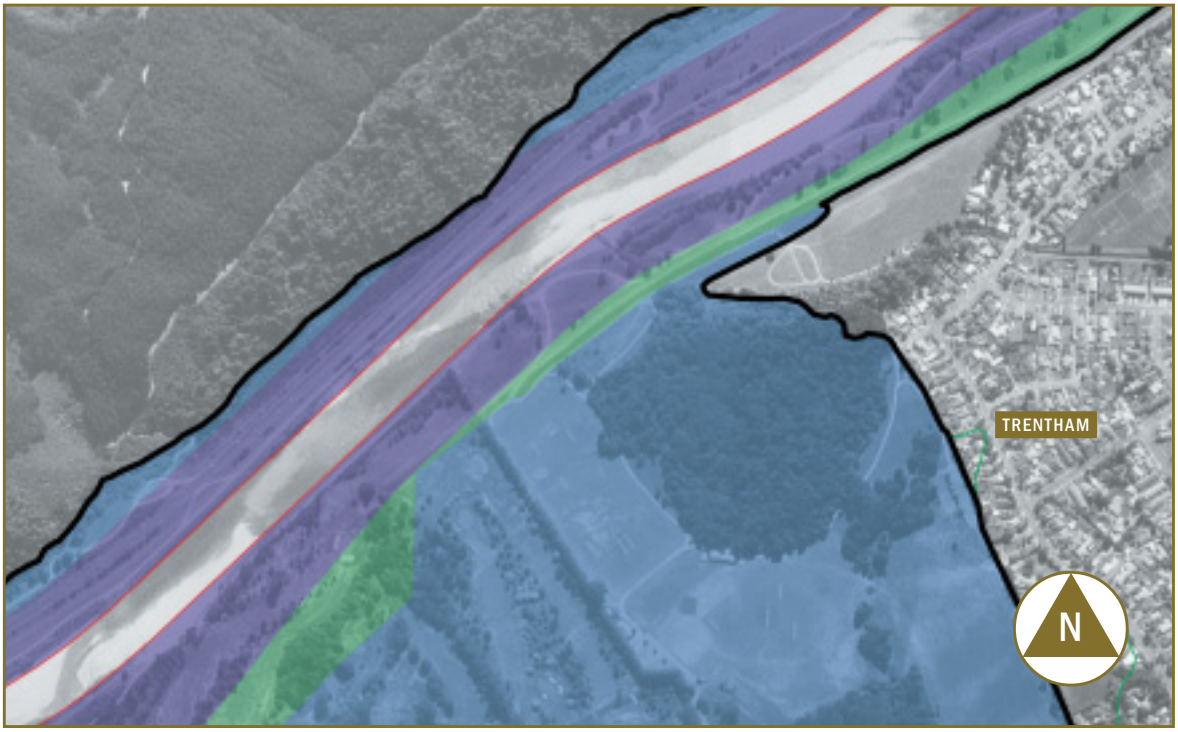
Hutt River Corridor Hazard Areas – 11. Silverstream

FIGURE A22



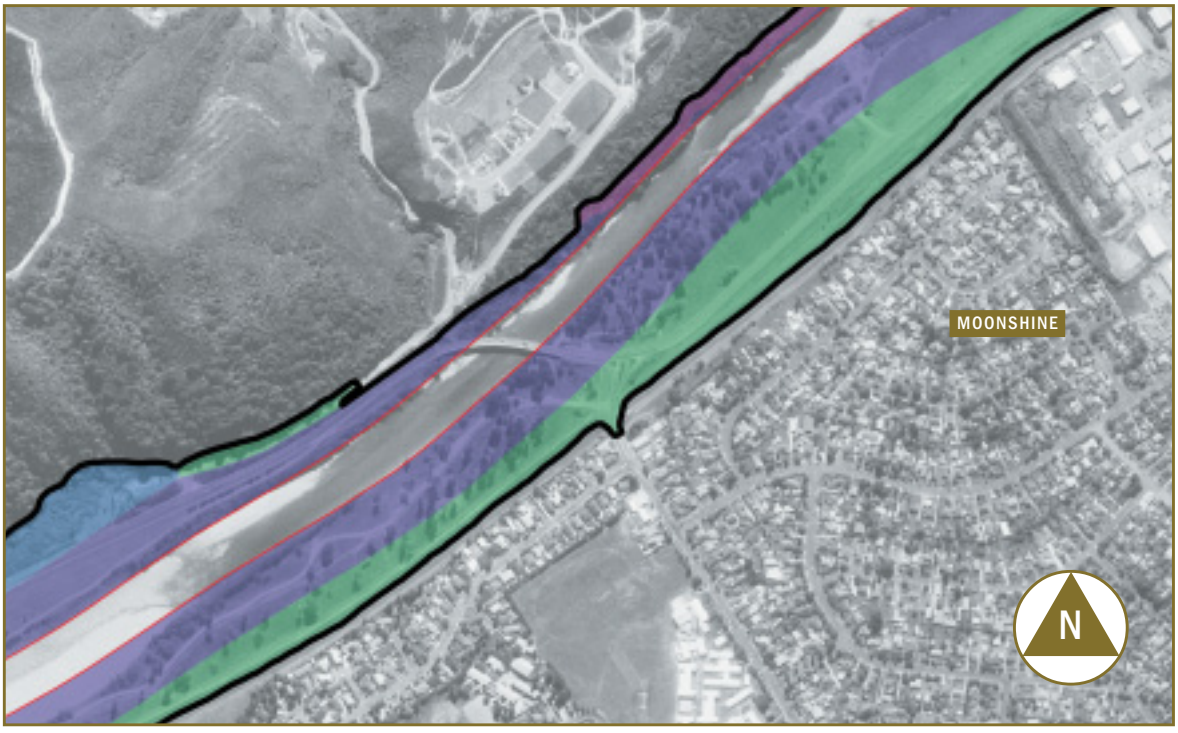
Hutt River Corridor Hazard Areas – 12. St Patricks to Heretaunga

FIGURE A23



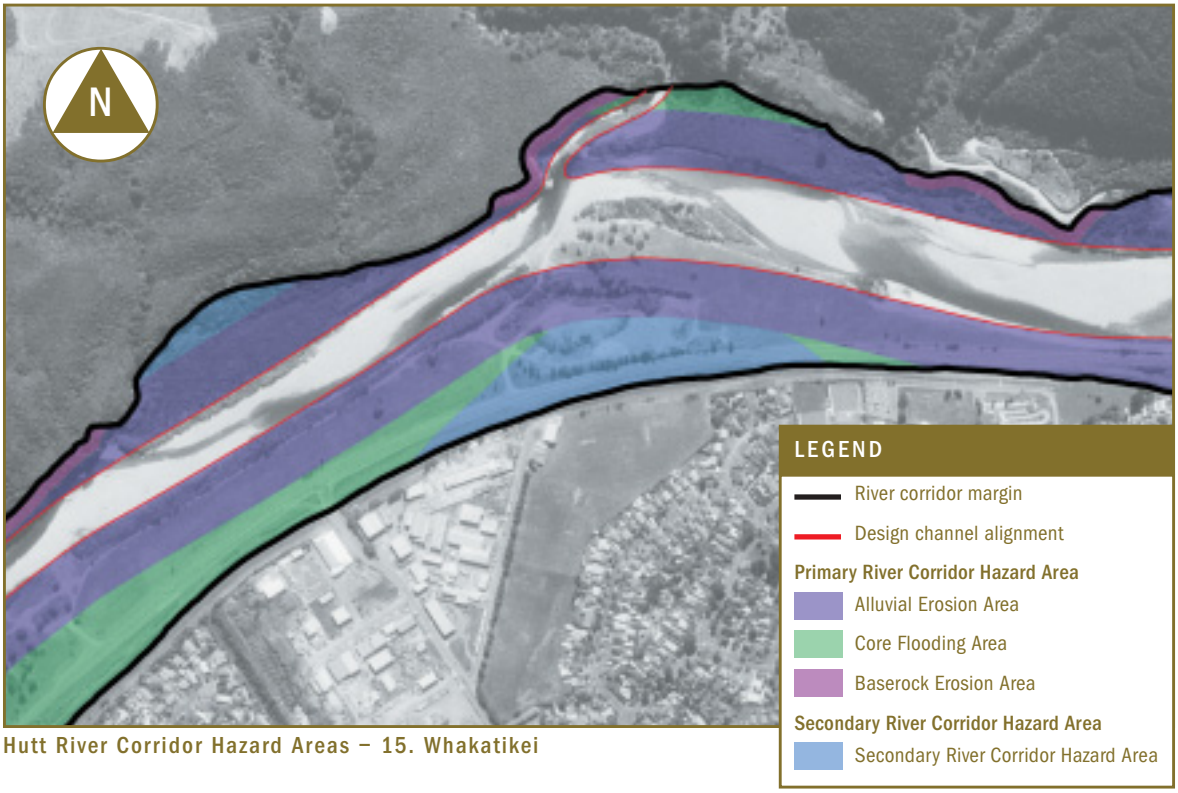
Hutt River Corridor Hazard Areas – 13. Trentham

FIGURE A24



Hutt River Corridor Hazard Areas – 14. Moonshine

FIGURE A25

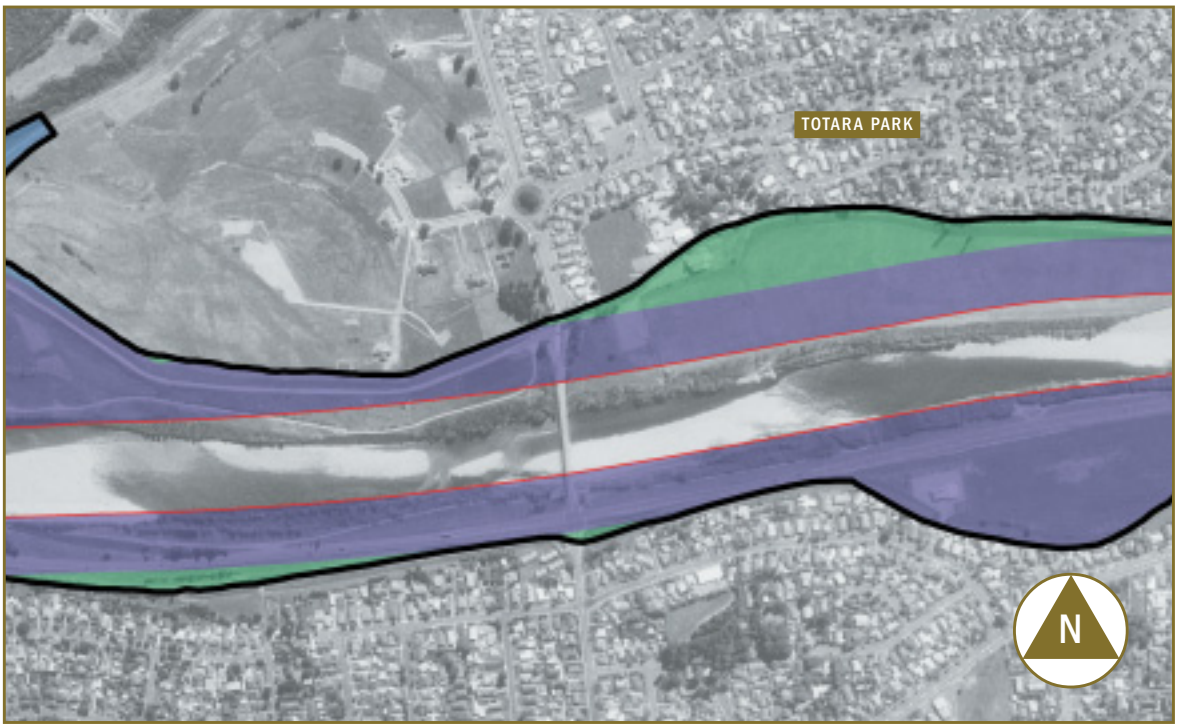


Hutt River Corridor Hazard Areas – 15. Whakatikei

FIGURE A26

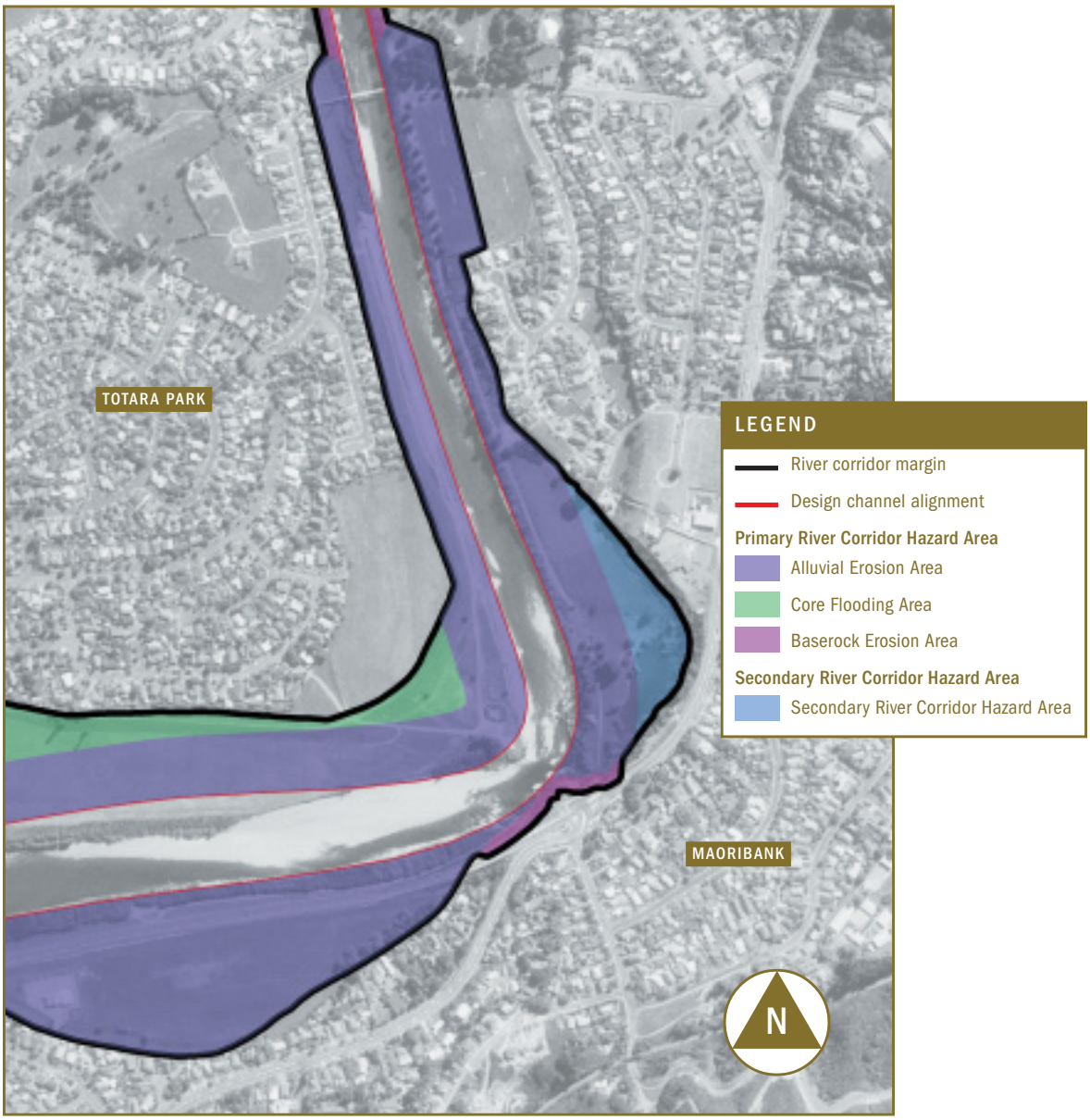
Hutt River Corridor Hazard Areas – 16. Central Upper Hutt

FIGURE A27



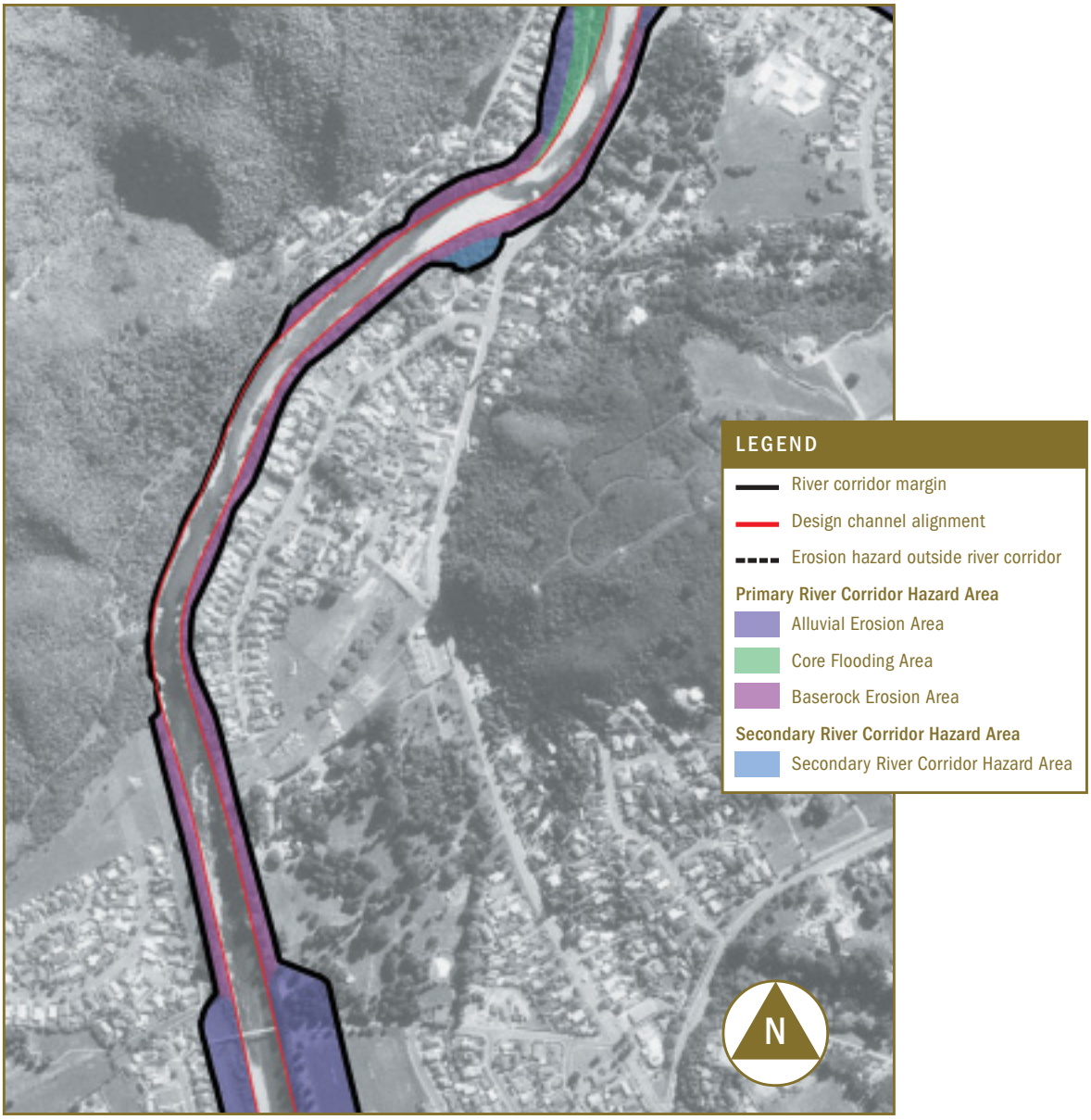
Hutt River Corridor Hazard Areas – 17. Totara Park

FIGURE A28



Hutt River Corridor Hazard Areas – 18. Maoribank

FIGURE A29

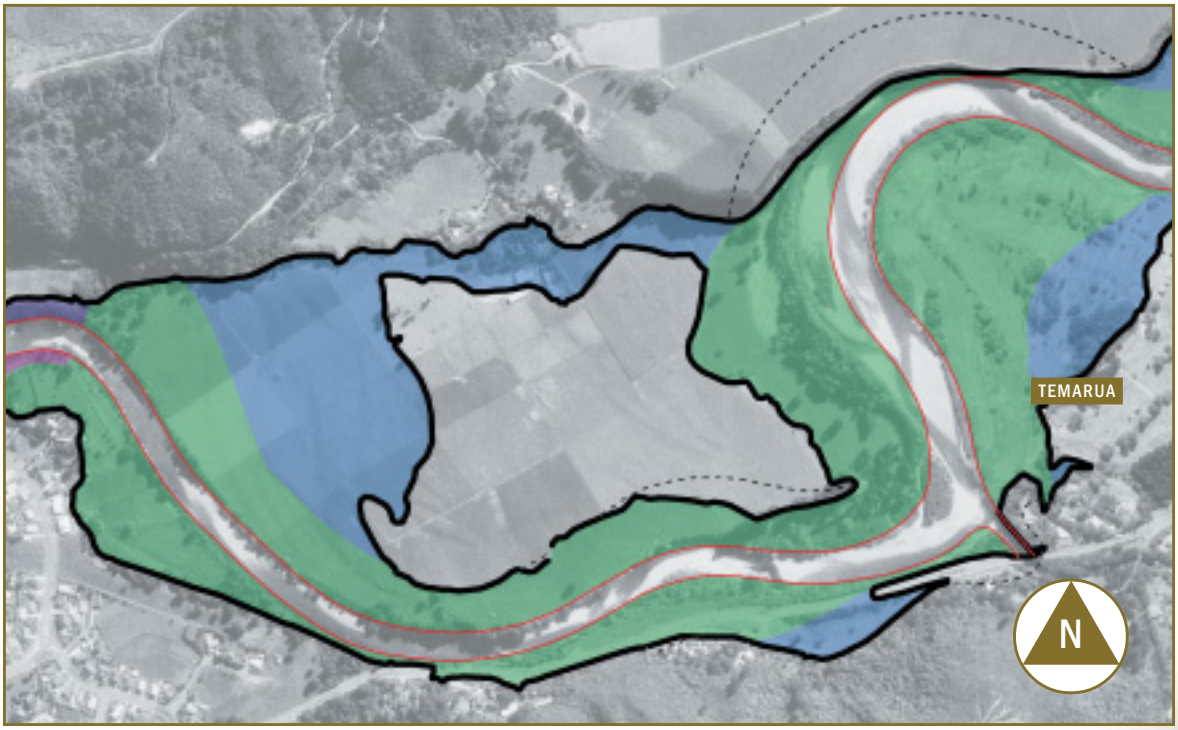


Hutt River Corridor Hazard Areas – 19. Birchville

FIGURE A30

Hutt River Corridor Hazard Areas – 20. Akatarawa

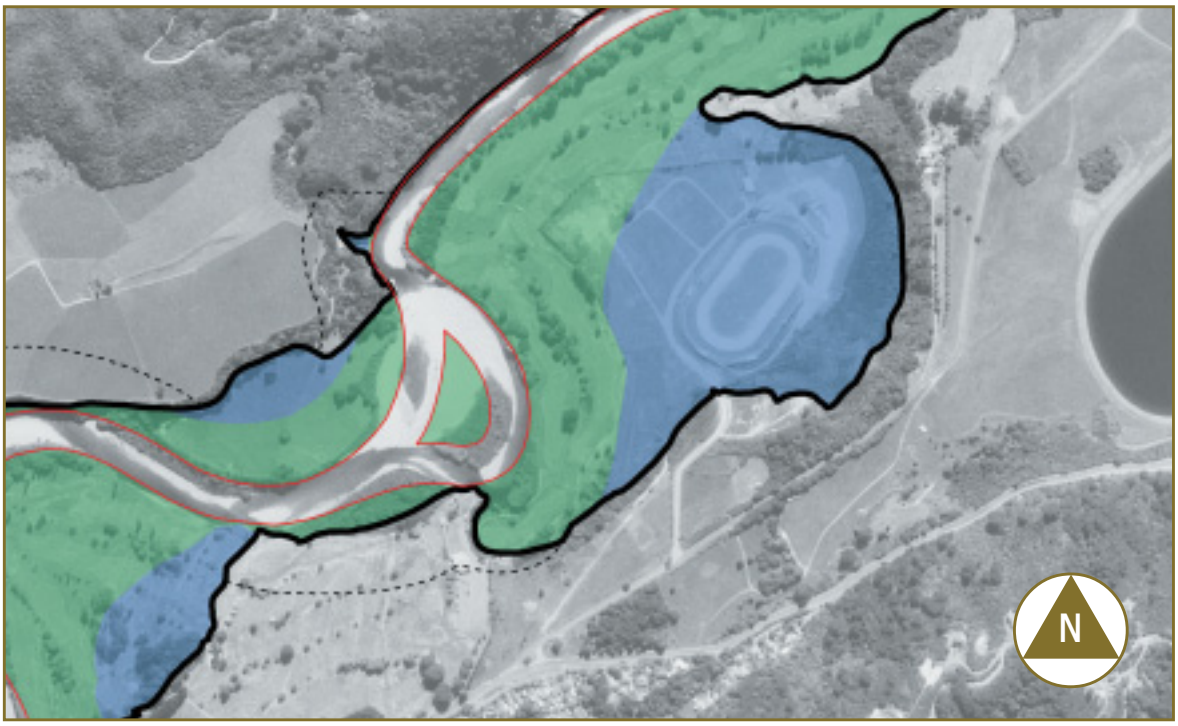
FIGURE A31



Hutt River Corridor Hazard Areas – 21. Wooster-Teasdale

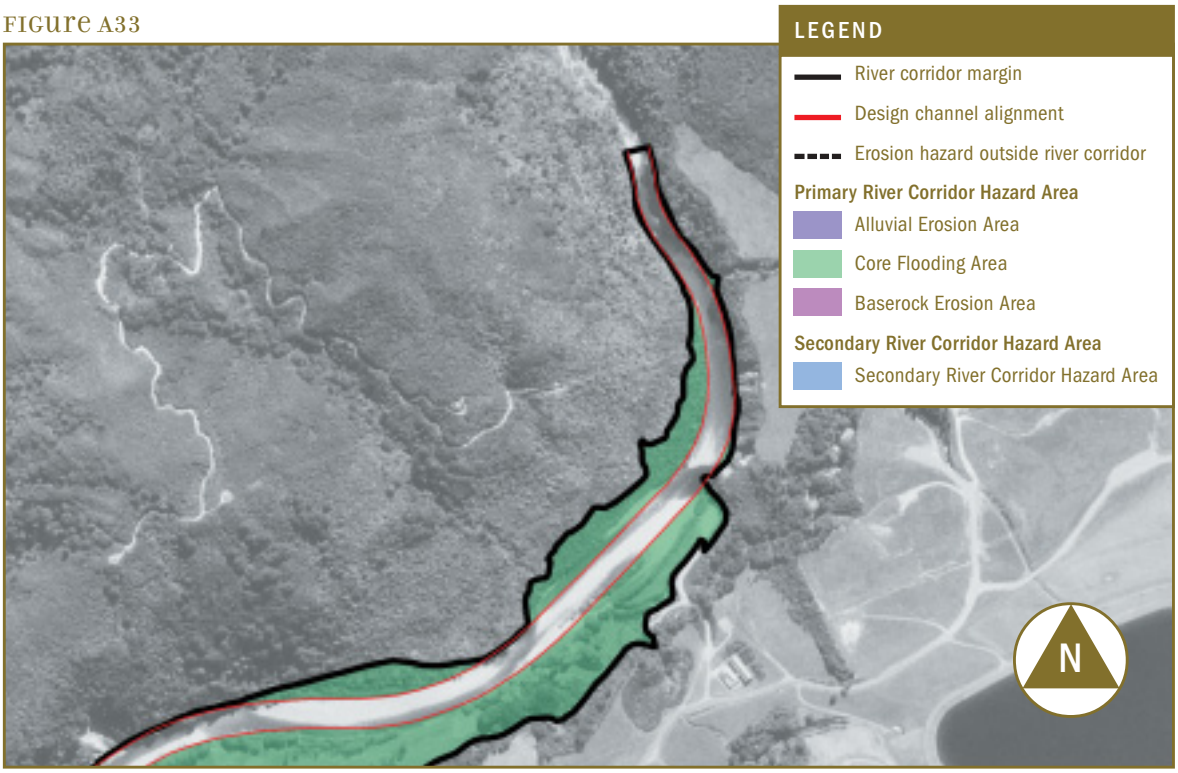
Note: The *Moving Erosion Area* is not marked on Plan 21. This hazard area sits within the river corridor, moving with the position of the river. See Chapter Five for more details.

FIGURE A32



Hutt River Corridor Hazard Areas – 22. Te Marua

FIGURE A33



Hutt River Corridor Hazard Areas – 23. Hutt Gorge

Note: The *Moving Erosion Area* is not marked on Plans 22 and 23. This hazard area sits within the river corridor, moving with the position of the river. See Chapter Five for more details.

5 APPENDIX 5: PRIORITY SCHEDULE FOR STRUCTURAL WORKS - APPROACH USED

DEVELOPING A PRIORITY SCHEDULE FOR STRUCTURAL WORKS

Appendix 5 shows how we arrived at a priority schedule for proposed structural works under the Hutt River Floodplain Management Plan.

Weighting Components

Under the priority schedule each component has been weighted as follows:

1.	economic benefits:	60%
2.	social benefits:	10%
3.	environmental benefits:	10%
4.	present protection level:	10%
5.	number of people directly affected:	5%
6.	area directly affected:	5%

The range of components and their associated weighting are based on the priority schedules established for the Otaki and Waikanae Floodplain Management Plans. The weighting applied to each component was heavily influenced by public feedback during the consultation phases of those plans.

Proposed Works Grouped for Extensive Reaches

The existing priority list considers individual works. The revised schedule groups individual works into 13 more extensive suites of works. Reaches were selected to ensure independence between each of the individual floodplain areas. These reaches cover all urban areas protected by proposed works.

Considering Environmental and Social Costs

Environmental costs are not included. The costs and effects of actual works have been considered in broad terms during the design standard and structural works selection process (prior to October 1999). These effects will be assessed in more detail during the resource consent and application processes for each set of works. The merit of each set of works will be determined in the light of these effects.

Basis for Evaluating Components

The basis for evaluating environmental, social and economic components is the comparison of:

- a snapshot of the existing situation concerning flood-prone land
- changes to the existing situation provided by proposed improvements to the flood protection system.

Using Simple Indicators

The indicators chosen to reflect social, environmental and economic benefits are all relatively easy to understand and measure, because where possible they are stand-alone, certain, and limited in subjective value judgements. A desire to keep this wider evaluation of benefits as straightforward as possible influenced the selection of indicators.

COMPONENTS MEASURED

1. Economic Benefits

The costs are based on concept designs and have an accuracy of ±30 percent. *Average annual saved damages* are calculated on a reach-by-reach basis by estimating the damages that can be saved by upgrading each reach to the risk-based 2300 cumec standard.[1]

Benefit–cost ratios have been calculated based on saved damages and implementation costs. The damage costs originally assessed in 1990[2] were indexed to reflect 1999 costs. The damages include direct and indirect tangible costs to:

- residential, commercial and industrial/business properties.
- public services and utilities.

It was assumed that the implementation of structural measures would be at an average expenditure rate of $2 million per year.

A total weighting of 60 percent was distributed equally among the annual flood damages saved and the benefit–cost ratio.

2. Social Benefits

The components to determine environmental benefits are:

a) disruption

b) stress and trauma.

The potential benefit of community preparedness and non-structural land-use measures has not been measured.

Social benefits receive a 10 percent weighting, with each of the two components comprising 5 percent. The variables representing each component combine equally to make up this 5 percent. Area and population multipliers (percentage of greatest affected population) have been applied to measures of disruption and stress and trauma, respectively.

1 *See Hutt River Risk Assessment and Hydraulics.*

2 *See Hutt River Flood Damages.*

a) Disruption

BUSINESS AREAS: AREA OF INDUSTRIAL, BUSINESS AND COMMERCIAL DEVELOPMENT	
What measured	Area of industrial, business and commercial zones
How measured	Determine area contained in these zones located in flood- or erosion-prone areas
Data source	Proposed District Plan zone maps
Scoring	Relative area affected (%)

Assumptions: All relevant zones are assumed to contain full commercial, industrial or business activities. Areas of these activities located outside district plan industrial, business or commercial zones were not counted. No distinction is made in terms of the level of disruption attributable to each type of land use.

RESIDENTIAL AREAS: NUMBER OF SCHOOLS	
What measured	Presence of primary and secondary schools
How measured	Determine numbers of schools located in flood- or erosion-prone areas
Data sources	GIS data; street map directories
Scoring	High schools and intermediates = 2 Primary schools = 1

Assumptions: High schools and intermediates are considered as being generally larger than primary schools, despite some primary schools having similar-size roles. No distinction is made between areas on the basis of ponding depth. Any school sited on the flood extent margin must have 30 percent of the school area covered by the predicted flood extent in order to be counted.

KEY FACILITIES: NUMBER OF HOSPITALS AND SUB-STATIONS	
What measured	Presence of hospitals and sub-stations
How measured	Determine numbers of hospitals and sub-stations located in flood- or erosion-prone areas
Data sources	GIS data; street map directories
Scoring	Relative numbers present in each area (%) Hospitals = 1 Sub-stations = 2

Key facilities are the highly vulnerable parts of emergency and community services and infrastructure. Damage to key facilities will escalate the impacts of flooding.

Assumptions: Hospitals counted incorporated those providing over-night stays, including some rest-home facilities.[3] No distinction is made in terms of the size and significance of hospitals. Sub-stations were given an extra point because of the direct impacts on all valley residents of losing power.

Emergency services or telecommunications facilities were not included because they are able to operate from remote sites. Water supply or sewerage services have also not been counted, though it may be worth considering relative lengths of water, sewerage, energy or telecommunications lines receiving improved protection. Additional reduced disruption effects to the wider region as a measure of benefit (for example, telecommunications and transportation links) were not counted.

b) Stress and Trauma

FLOW, EROSION AND PONDING: AREA OF HAZARD	
What measured	Area of ponding, flow and erosion hazard affecting urban areas
How measured	Determine area affected by varying ponding severity, or flow and erosion located in flood- or erosion-prone areas
Data sources	Flood Extent Maps; River Corridor Plans; Floodplain Flood Risk Area Plans
Scoring	Low ponding (0–0.5m) = 1 Moderate ponding (0.5m–1.0m) = 2 Deep ponding (1.0m +) = 3 High velocities and potential erosion = 4

Assumptions: Population and area multipliers adjust disruption, stress and trauma measures because size and numbers are directly related to social impact.

3. Environmental Benefits

The components to determine environmental benefits are:

a) ecology

b) recreation and landscape

c) heritage.

Environmental benefits receive a 10 percent weighting, with each component comprising 3.3 percent. The variables representing each component combine equally to make 3.3 percent.

3 *Hospitals included were Hutt Hospital, Boulcott Private Surgical Hospital, Bloomfield Medical Hospital, Elderslea Medical Hospital, Woburn Aged Care Complex, and Watsonia Hospital.*

a) Ecology

EROSION PROTECTION: RIPARIAN PLANTINGS AND ROCK LINING	
What measured	Degree of ecological improvement provided by reduced erosion
How measured	Evaluate the difference between current actual and potential erosion levels, and improved erosion protection
Data source	Use expert engineering opinion
Scoring	Low to high: scores 1–3

Assumptions: Rock linings and riparian vegetation enhance in-stream and riparian values. Riparian vegetation provides shading and shelter for fish, and acts as a buffer for pollutant and sediment run-off. Rock linings – and to a lesser degree riparian vegetation – prevent more regular erosion and scour of berm areas. This reduces the input of sediment to the active bed and channel. Rock linings also provide pool areas and additional habitat for fish species.

The current incidence of erosion was measured by combining areas of actual erosion with areas of potential erosion. Potential erosion was determined by considering the existing alignment and current erosion protection. The degree of improved protection was averaged for each reach area. In most cases, areas of high increased future benefit combined with low benefit areas to give an overall moderate benefit level.

Additional reaches downstream of Te Marua not specific to urban areas were included for this assessment, including:

- Melling to Belmont (RB)
- Belmont to Pomare (RB)
- Pomare to Silverstream (RB)
- Silverstream to Moonshine (RB)
- Moonshine to Totara Park (RB)
- Norbert St to Akatarawa Bridge (RB and LB)
- Gemstone Drive (RB).

ECOLOGICAL AREAS: AREAS WITH ECOLOGICAL AND CONSERVATION VALUES	
What measured	Presence of ecological and conservation sites in the river corridor and on the floodplain
How measured	Determine numbers of parks, reserves and KNEs (key native ecosites) with these values located in flood- or erosion-prone areas
Data sources	Department of Conservation Ecosite database; KNE database
Scoring	Relative numbers present in each area (%)

Other Indicators Considered

Increases in Indigenous Species

The Environmental Strategy provides no certainty about increases in the number of indigenous species in the Hutt River environment.[4] The floodplain and river corridor environment are heavily modified, so actual increases in indigenous vegetation cover are likely to be minimal.

Habitat Quality

The Environmental Strategy also provides no certainty about increases in habitat quality. Assessments would not be comparing like with like. Comparing varying reaches provides difficulties assessing differing habitats (for example, comparing habitat values of estuarine areas with those of the middle reaches of the river).

b) Recreation and Landscape

LANDSCAPE DAMAGE: AFFECTED AREA	
What measured	Flood-prone area affected as an indicator of the damage extent
How measured	Determine size of the flood-prone area affected by each suite of works
Data source	GIS calculations
Scoring	Relative area affected (%)

Assumptions: The greater the area, the greater the damage.

SPECIAL AREAS: PARKS AND RESERVES WITH RECREATIONAL VALUES	
What measured	Presence of parks and reserves
How measured	Determine numbers of parks and reserves located in flood- or erosion-prone areas
Data sources	Proposed District Plan listings; street map directories
Scoring	Relative area affected (%)

Assumptions: Parks and reserves have a greater amenity value than other less developed river corridor areas, because they are generally maintained for more intensive recreational use.

No distinction was made in terms of park and reserve sizes. For instance, Fraser Park is intensively used for sports as well as more passive uses. Some smaller parks would not be used to anywhere near that degree.

4 *The Environmental Strategy provides conceptual ideas for enhancing various reaches of the Hutt River, in line with the selected linear park vision. Potential projects exist as ideas at this stage, and require tangata whenua, relevant council committees, user groups and clubs, other agencies, and the wider community to consider and evaluate them before enhancement projects are selected.*

Other Indicators Considered

Capital Expenditure (Capex) Works

Five percent of all capital works expenditure is allocated to environmental enhancements. This expenditure is likely to equate to basic improvements to the river environment. Certain reaches may be more intensively developed for recreational uses than others, so comparing existing amenity with future amenity may be unfair.

The Environmental Strategy provides no certainty about the nature of improved recreational amenity. Placing value on the nature of future upgraded recreational amenity is likely to be very subjective.

c) Heritage

HERITAGE SITES: SITES WITH HERITAGE VALUES	
What measured	Presence of heritage sites
How measured	Determine number of heritage sites located in flood- or erosion-prone areas
Data sources	Proposed District Plan heritage listings; waahi tapu listings in the Environmental Strategy and Phase One investigations' documents
Scoring	Relative numbers present in each reach (%)

Note: The Jackson Street precinct in Petone has not been scored. However, it is an area containing significant values. One solution is to give the overall area a higher individual score (perhaps 10).

4. Present Protection Level

The present level of protection associated with each suite of works is the flood that can be contained by the stopbanks without overtopping or breaching due to structural failure.

5. Area and Population Affected

These are direct measures of areas liable to flooding and the number of people affected by each set of reach works. The area affected was measured from flood extent maps. Population was estimated by multiplying, by four, the number of residential houses in the affected. It should be noted that the flood extent of some reaches overlaps; for example, the Kennedy-Good Bridge to Pomare (left bank) reach overlaps part of the Ava to Kennedy-Good Bridge (left bank) reach.

REFERENCE LIST AND GLOSSARY

A car, illegally dumped on the riverbed near the Whakatikei River confluence, has been submerged in gravel during the October 1998 floods.

REFERENCE LIST

The list includes the technical reports produced as part of the first three phases of the Hutt River Floodplain Management Plan. Other directly relevant reports and publications referred to in *"Living with the River"* are also listed. Each publication / report has been given a reference number and 'layperson's' title in bold. These are used to cross-reference back to the publications in the 'Do you want to know more?' boxes at the end of each chapter.

You can find these publications and reports at the Regional Council office in Wellington.

1 **Climate Change**. *The Potential Effects of Climate Change on River Protection: Case Study on the Hutt River*, D.C.K. Leong, R.S. Jordan & R.R. Ibbitt, National Institute of Water and Atmospheric Research, 1990.

2 **Confirming Non-structural Measures**. *Hutt River Floodplain Management Plan: Confirming Non-structural Measures*, Report to the Hutt River Floodplain Management Advisory Committee (00.460), A. Cross, Flood Protection Group, Wellington Regional Council, June 2000.

3 **Creating Flood Disasters**. Creating Flood Disasters: Water and Soil Miscellaneous Publication No. 77, N.J. Eriksen, National Water and Soil Conservation Authority , 1986.

4 **Demographic Trends**. *Demographic Trends and Projections for the Wellington Region 1981-2021*, J. Newell, Monitoring and Evaluation Research Associates, 1998.

5 **District Plan Monitoring Guide**. *District Plan Monitoring: A Guide to Getting Started*, T. Berghan & A. Shaw, Opus International Consultants Ltd, 2000.

6 **Drafting of Objectives.** *Hutt River Floodplain Management Plan*, Opus International Consultants Ltd, December 1998.

7 **EFP: Floodway Channel Design**. *Ewen Floodway Project Stage II Investigations — Floodway Channel Design*, C.A. Robb & B.D. Paul, Rivers Dept, Wellington Regional Council, August 1991.

8 **Flood Frequency Update**. *An Update of Hutt River Flood Frequency*, C. Pearson & A. McKerchar, National Institute of Water and Atmospheric Research Ltd, May 1999.

9 **Flood Mitigation Options**. *Otaki River Floodplain Management Plan — Phase II Investigations: Development and Evaluation of Flood Mitigation Options*, P.L. Blackwood, Rivers Dept, Wellington Regional Council, November 1993.

10 **Flood Protection Business Plan**. *Flood Protection Operating Plan 2000-2010*, Flood Protection Group, Wellington Regional Council, 2001.

11 **HCC Civil Defence Plan**. *Hutt City Council Civil Defence Plan*, Emergency Management Office, Hutt City Council, 1998.

12 **HCC Corporate Emergency Plan**. *Hutt City Council Corporate Emergency Plan*, Emergency Management Office, Hutt City Council, 1997.

13 **HCC Emergency Planning Guide**. *Emergency Planning Guide — Creating a Prepared Community*, Emergency Management Office, Hutt City Council, 1999.

14 **HCC Flood Activation Flow Chart**. *Hutt City Council Flood Activation Flow Chart*, Emergency Management Office, Hutt City Council, 2001.

15 **Heathcote River Economic Assessment**. *Heathcote River Floodplain Flood Damage and Mitigation Measures Economic Assessment*, Brown Copeland & Co. Ltd, for Christchurch City and Canterbury Regional Councils, 1997.

16 **HRFCSR Presentation**. *Presentation to the Operations Committee, Floodplain Management Planning*, by B.D. Paul, Rivers Dept, Wellington Regional Council, April 1990.

17 **HRFCSR Report**. *Report to the Operations Committee, Hutt River Flood Control Scheme Review*, by B.D. Paul, Rivers Dept, Wellington Regional Council, September 1988.

18 **HRFMP Review**. *Review of Hutt River Floodplain Management Process*, I. Robertson, & A. Sutherland, for Wellington Regional Council, April 1992.

19 **Hutt Environment and Social Impact**. *Hutt Floodplain Management Plan. Phase 1. Hutt River Flood Control Scheme Review: Environmental Investigations; Sociological Component*, Boffa Miskell Ltd, 1990.

20 **Hutt Flood Defences Evaluation.** *Evaluation of Existing Hutt River Flood Defences and Upgrade Concept Design. Volumes I, II and III*, Beca Carter Hollings and Ferner Ltd, 1999.

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Newsletter No. 2, June 1999
Newsletter No. 3: The Design Standard, July 1999
Newsletter No. 4: The Environmental Strategy, November 1999
Newsletter No. 5: Non-structural Measures, April 2000
Newsletter No. 6: The Consultation Draft, March 2001

Other Plans

Hutt City Proposed District Plan
Upper Hutt City Proposed District Plan
Wellington Regional Council Coastal Plan
Wellington Regional Freshwater Plan
Wellington Regional Soil Plan
Wellington Regional Policy Statement

GLOSSARY

Accessory building

A building that is not part of the principal building(s) on the site, the use of which is incidental to the principal building(s) on the site. Where no principal building is erected on a site, it is a building accessory to the use of the principal building permitted on the site. Accessory buildings include, but are not limited to:

- tool or garden sheds
- garages
- playrooms detached from the main building
- recreation rooms detached from the main building
- glasshouses
- swimming pools
- spa pools
- buildings accessory to rural land uses
- buildings for providing utility services
- accessory buildings constructed for industrial or commercial land uses.

Accessory buildings do not include any habitable building or room.

Adverse effect

A negative impact on the environment caused by a particular activity or set of activities; for instance, temporary damage of the river bed habitat that may occur when the Regional Council does *beach-recontouring* work, or the impact of dust and noise on neighbouring landowners when stopbanks are constructed.

Adverse effects can:

- be temporary or permanent
- have a low or high impact
- have a low or high chance of occurring
- be cumulative, arising over time in combination with other effects
- vary in their scale, duration, intensity or frequency.

Minimising adverse effects means taking all practical and reasonable steps to limit adverse effects. This implies allowing minor effects, but does not mean that all adverse effects must be eliminated.

A legal definition of the term 'effect' can be found in Section 3 of the Resource Management Act 1991.

Aggradation

The build-up of gravels and other materials deposited by flowing water in the bed of a river over a moderate to long period of time.

Alluvial erosion area

Land at the top of gravel-based river banks that is being actively eroded by the river. This erosion area has an 80m width, measured from the design channel, except where land strikes rising hillsides or residential homes. For residential properties, the alluvial erosion area extends to the riverward margin of any dwelling. The alluvial erosion area width is based on the effects of two or three large floods occurring in quick succession.

The alluvial erosion area is modified by the extent of the historical river channel from the general period 1930–1975. This period was chosen for two reasons:

- It represents a period when river management and development pressures increased significantly, resulting in the constriction of the active riverbed.
- A series of aerial photos from the period provided an accurate historical record.

See *river corridor.*

Amenity values	Those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness and aesthetic coherence, and its cultural and recreational attributes. Adverse ***amenity effects*** occur when these values are impacted on in a negative way.
Ancillary structures	These include, but are not limited to: • fences • posts • railings • street light poles. Ancillary structures also include any network utility structure, other than a building.
Annualised flood damages	The cost of flood damages averaged on a yearly basis. For instance, a 1 in 100-year flood occurs infrequently, but the total costs of the resulting damages can be represented as an average cost every year.
Anticipated results	Outcomes that the Plan intends to achieve (see Chapter Eight).
Asset management plans	Plans that assist with the physical and financial management of the Council's assets.
Backfilling	Placing rock and soil in trenches, holes or other excavated sites. For this Plan, it usually relates to excavations in stopbanks or river berms for maintaining or installing utility services, such as telecommunications cables. Backfilling in flood protection structures must involve appropriate materials and methods so that the strength and integrity of these structures is not affected.
Bank-edge protection works	Includes rock linings, rail iron, tree and rock groynes, and vegetation or other types of protection provided on the edge of a river bank to prevent its erosion. The land area between the river edge and the stopbanks provides river *berm protection*, which combines with edge protection to provide security for stopbanks (see *structural measures).*
Baserock erosion area	Land at the top of high bedrock-based river banks that is being actively eroded by the river. The baserock erosion area has a 20m width, measured from the cliff base or design channel, whichever is the greater. The exceptions are where this erosion area strikes rising hillsides or areas of residential homes. Flood flows may erode and cause slumping of baserock escarpments. Relatively solid rock faces rise above even the 2800 cumec flood level in some locations, yet can gradually erode away over a long period of time, affecting the stability of land above the rock face. The baserock erosion recognises the instability of river banks along the river, representing the land margin required to manage the river. The width for this erosion area was selected following an evaluation of erosion on the Hutt River escarpments. Typical locations of the baserock erosion area are Moonshine (right bank), Whakatikei Confluence (right bank) and Maoribank to Gemstone Drive (both banks). See *river corridor.*

Batter	The side slope of a stopbank or stream bank edge.
Bed and beach re-contouring	The moving of gravel that has built up on the inside of bends in the river to the outer eroding edge. A bulldozer or digger is usually used to push the gravel across the dry bed. *Bed re-contouring* involves moving gravel across the watercourse, and is also known as cross-blading. Alternatively, *beach re-contouring* only involves disturbing the dry bed. Both methods are short-term, relatively cost-effective approaches to realigning river channels. They are usually undertaken to support willow plantings and bank edge protection work, and as a temporary emergency measure. The riverbed is disturbed, as are the banks, usually with a short- to medium-term loss of habitat and water quality, and disturbance to bird and aquatic life. The normal management practice is to undertake this work when adverse effects will be minimised: outside fish spawning and migration, and bird nesting periods.
Berms	Low-lying flat land adjacent to the river bank. Berms are a natural extension of the main channel, and carry water during floods.
Berm protection	The land area between the river edge and the stopbanks provides river berm protection. It combines with edge protection to provide security for stopbanks.
Breaching	Breaching occurs when flood waters attack and erode stopbanks and floodwalls, eventually breaking through to flow through previously protected floodplain areas.
Channel management works	See *structural measures* and *bank-edge protection works*.
Charter of Understanding (Te Tuutohinga o te Whakaaetanga)	The Charter provides the basis for the ongoing relationship between tangata whenua and the Council. The Charter exists within the context of the Treaty of Waitangi and the legislation that gives the Council its functions, duties and powers.
Community preparedness	An appreciation of the likely effects of flooding and a knowledge of the relevant emergency management readiness, flood response and recovery programmes and procedures. It ensures that the community has the ability to cope with a flood. People who are prepared will respond more appropriately to flood warnings (see *non-structural measures).*
Concept plans (Environmental Strategy)	Plans that show what the river and its environment could look like if the Environmental Strategy is implemented. The Hutt River Environmental Strategy presents concept plans for each reach of the River up to Birchville (see Chapter Six).
Contingency works	The repair of any bank protection works and the re-contouring of the bed of the river necessary to protect permanent dwellings and utilities and bank protection works from an imminent threat of erosion.
Core flooding area	See *river corridor.*
Critical facilities	Essential facilities that add a whole new dimension to the consequences of a flood if those facilities are inundated by flood waters. They include emergency services, emergency assembly points, hospitals, nursing homes, key network utility facilities, hazardous waste facilities, and facilities housing crucial records (see *non-structural measures).*

Crest walls	Walls used to raise the effective height of existing stopbanks. Crest walls will be considered in locations where the existing stopbank is in good condition and the space is limited for widening. These walls are usually constructed of concrete (see *structural measures).*
Cumec	A cumec measures water flow. 1 cumec equals 1 cubic metre of water passing a given point every second ($1m^3$/sec). A ***1900 cumec flood in the Hutt River*** is equal to a 1 in 100-year event. It has about a 1% chance (1 in 100) of being equalled or exceeded in any one year. On average, this is expected to occur once in 100 years, based on past flood records, though in reality it could happen at any time. A ***2300 cumec flood in the Hutt River*** is equal to a 1 in 440-year event. It has about a 0.23% chance (1 in 440) of being equalled or exceeded in any one year. On average, this is expected to occur once in 440 years, based on past flood records, though in reality it could happen at any time. A ***2800 cumec flood in the Hutt River*** is equal to a rare event. It has less than a 0.1% chance of being equalled or exceeded in any one year.
Degradation	The lowering of a land surface (including riverbeds) by erosion over a period of time (see *aggradation)*.
Design channel	The optimum river channel width and alignment to carry floods. A theoretically developed natural and sustainable channel has been refined to match the existing form of the Hutt River as far as reasonable. It is the channel that will be maintained for the Hutt River in order to lessen the potential for berm areas, stopbanks and developed urban areas to be damaged in floods.
Design flood / flow	The flood that most structural measures will be constructed to withstand. In this case is a 2300 cumec flow (see *cumec).*
Design standard	The system of flood mitigation methods designed to contain a flood of a certain size. The design standard for the Hutt River is based on the 440-year flood, which equates to 2300 cumecs flowing at Taita Gorge. The exception is in some local areas where the standard will be 1900 cumecs (see Chapters Three and Four, and *risk-based standard*).
Development	Erecting a building, carrying out excavations, using land or a building, or the subdividing of land. *Infill development* refers to developing vacant blocks of land that are generally surrounded by developed properties. *Greenfield development* refers to developing properties in previously undeveloped areas, e.g. the urban subdivision of an area previously used for rural purposes (see *non-structural measures).*
Effects	See *adverse effect* or *flood hazard effects.*
Emergency management measures	See *non-structural measures*.
Environmental Strategy	The Hutt River Environmental Strategy sets out the long-term vision for developing and managing the Hutt River environment as a linear park. The Strategy provides concept plans and identifies opportunities to enhance the river environs following the linear park vision. Potential opportunities range from improving areas for passive recreation, to developing indigenous ecological habitats.

Existing developed areas	Those areas that are already developed with intensive land uses (see *non-structural measures).*
Flood	A relatively high river flow that overtops the natural or artificial banks in any part of a stream or river (see *cumec).*
Flood defences	Physical structures that keep floodwaters in the river corridor. They include stopbanks and flood walls (see *structural measures).*
Flood hazard	The potential for damage to property or people due to flooding and associated erosion.
Flood hazard effects	The negative impacts of flooding caused by fast-flowing or deep-ponded flood waters. Fast-flowing or ponded flood waters are dangerous for people, becoming more severe where floods affect urban areas. These effects also include damage to the flood protection system, and other structures and buildings by water and debris, or by erosion. See Chapter One for a more detailed explanation. Also see *adverse effects* and *ponding area.*
Floodplain	The portion of a river valley, adjacent to the *river corridor*, which is covered with water when the river overflows during floods.
Floodplain hazard areas	These areas are defined by the standard of proposed structural protection. *Higher-risk floodplain hazard areas* will not be protected by stopbanks. In these areas, there is a significant threat to human life, and the potential for damage to properties and buildings is high. New development can also threaten the integrity of flood defence structures. See Section 5.4 for more detail.
Flood-prone	A term to describe land that would be inundated during a flood. For the Hutt Valley, this term defines land flooded by a 2300 cumec event if no stopbanks were in place.
Flood protection assets	Physical assets (including land) managed and maintained by the Regional Council for the purpose of flood protection, such as stopbanks, river berms, bank-edge works and plantings. These assets are usually owned by the Regional Council.
Flood protection system	The system of structural measures, including physical protection structures and channel management works, that act together to help protect the community against the effects of flooding. Also known as the *flood defence system*.
Flood warning	The process used to warn a community of an impending flood. Warnings to the general public may be provided by methods such as local radio stations and street alarm systems.
Floodway	The area where most water flows during a flood occupying large areas of the *river corridor*. It is often aligned with naturally defined channels. If even partially blocked, floodways can cause a significant redistribution of flood flow, which can then adversely affect other areas. They are also areas of swifter and often deeper flow. The floodway includes land adjacent to the riverbed, required to maintain an adequate corridor for the safe passage of flood waters to the sea.

Gabion basket toe-protection	Elongated wire baskets filled with rock, and placed against a bank toe to help prevent erosion.
Geomorphology	The land form and landscape of a particular place, shaped by physical processes.
Gravel extraction	The selective removal of surplus gravel from the riverbed. Extraction has two main purposes: (1) to maintain optimum flood capacity without worsening bank erosion; (2) to correct misalignments and ease flow pressure against eroding banks. Extraction occurs on the beaches in the riverbed and, excluding river crossings, usually does not involve work in flowing water.
Greenfield areas/development	Include land zoned for development but which is not yet developed, such as residential-zoned land upstream of Birchville, Upper Hutt.
Greenhouse Effect	Warming that results when the Earth's atmosphere traps the sun's heat. The atmosphere allows most of the sunlight that reaches it to pass through and heat the Earth's surface. The Earth sends the heat energy back into the atmosphere, but much of this heat does not pass freely back into space because certain gases in the atmosphere absorb it. Absorbed heat warms the atmosphere, and in turn, warms the Earth's surface.
Groynes	Structures built perpendicular to the river bank to push fast-flowing water away from the bank edge. They are intended to halt erosion and maintain river alignment. **Impermeable rock snub groynes** Consist of rocks that jut into the river at a sharp angle to the flow, in order to deflect the flow away from the bank. They are a highly useful method, particularly where river bank erosion is severe. The decision to use groynes is influenced by the proximity and extent of urban development behind the river edge, and environmental factors. For instance, a length of eroding river edge, backed by a narrow river berm and a large urban floodplain, may be a good candidate for snub groyne protection. **Debris fences** Give a lower strength erosion protection than rock rip-rap, but they are considerably cheaper and, depending on their location and design, quite effective. They consist of rows of railway irons cabled together in herringbone pattern and pointing from 45 to 60 degrees downstream from the river bank. The fences reduce flood velocities and trap silt, resulting in progressive vegetation and sediment build-up around them. Placing rock at the head of the debris fences can strengthen them.
Habitable buildings	Buildings that people use for a range of living activities, containing specific sleeping, central living and dining areas.
Habitat	The place or type of site where an organism or population normally occurs.
Hapu	Sub-tribe.
Hazard	A hazard is created when there is an interaction between a flood event and the human use and development on the floodplain. See *flood hazard effects.*

House raising	The action of raising the floor level on existing houses to reduce potential flood damage.
Hui	A meeting.
Hutt River Asset Management Plan	A plan that sets out how the new and upgraded flood protection assets along the Hutt River will be managed and maintained, including the associated costs. The plan was adopted in July 2000 and will be updated every three years. Its full title is Western Rivers Asset Management Plan Vol. 2, Hutt River Specific (see Chapter Seven).
Hutt River Scheme	The original river scheme started in the 1870s to manage the effects of flooding in the Hutt Valley. The Hutt River Board managed the scheme until 1972, when its functions were taken over by the Wellington Regional Water Board, and then the initial Wellington Regional Council in the early 1980s.
Hydraulic capacity	The maximum water flow (measured in cumecs) that can be carried by the flood defence system.
Hydraulic line	This line marks the edge of the channel area at the Hutt River Mouth that may be excavated to maximise the efficient discharge of flood waters. The line lies along the right bank in the river mouth area of Hutt River, and extends into the harbour opposite the southern end of Port Road (marked on planning map 6 of the Regional Coastal Plan). The part of the line existing on land is marked by a series of posts. Under the Plan, the hydraulic line forms the edge of the design channel on the right bank of the River.
Indicator	A simple measure used to gauge trends, patterns, behaviour or performance; e.g. recording progress towards completing structural works, or surveying the community's response to flooding events (see Chapter Eight).
Infill development	See *development.*
Infrastructure	Networks, links and parts of facility systems, e.g. transport infrastructure (roads, rail, parking) or water system infrastructure (pipes, pumps and treatment works).
Iwi	Tribe or people (see Chapter Two).
Land information memorandum/ Project information memorandum	These contain a wide range of information about a chosen parcel of land, such as the presence of natural hazards, access easements, services such as stormwater drains, or resource consents issued on the property. Including all publicly available hazard information in a LIM or a PIM is a statutory requirement under section 31 of the Building Act and section 44 of the Local Government Act, respectively. Guidance may be given for the way this information is interpreted and presented (see Chapter Five).
Kainga	See *papkainga*.
Kaitiakitanga	Includes guardianship and the ethic of stewardship based on the nature of the resource itself. It is defined by tangata whenua in accordance with tikanga Maori.

Key network facilities	Physical parts of a utility service critical for ongoing function. Damage to these parts would considerably worsen flooding impacts, particularly as they may not be quickly repaired. Examples include electricity transformers and water pumping facilities (see *non-structural measures).*
Land	This includes land covered by water.
Land-use measures	See *non-structural measures*.
Left bank	See *true left/right bank.*
Lifelines	Organisations that provide services essential for the on-going functioning of a community during and following an emergency event. They include utility service providers, such as telecommunications, gas, electricity, water; and transportation network providers (for road, rail, port and airport services). Other essential services include hospitals and medical centres, and emergency services (such as the Police, Ambulance and Fire services).
Linear park	The long-term vision for the river environment determined through the *Environmental Strategy*. The aim of the linear park is to provide a tranquil environment for people to enjoy the natural character of the river (see Chapter Six).
Long-term Financial Strategy	The Regional Council's long-term business strategy covering work priorities for Council funding and expenditure over a 10-year period. It can be revised every three years, with submissions from the community influencing decisions on the strategy (see Chapter Three, Four and Seven).
Mahinga kai	An area where Maori traditionally gather (or gathered) food.
Major stopbanks	Extensive stopbanks protecting the main urban areas of Upper and Lower Hutt (see Chapter Three).
Mana	Prestige, power, authority.
Manaakitanga	The practice of caring for others.
Manawhenua	The customary authority exercised by an iwi or hapu in an identified area (see Chapter Two).
Marae	Traditionally, the central area of a village used for gatherings, councils, etc.
Mauri	The life essence present in all things.
Meander	The natural wave-like pattern of a river on a floodplain.
Mitigation	For this Plan, the act of moderating or reducing the effects of the flood hazard or flood protection works (see *flood hazard effects* and *adverse effects*).

Monitoring	For the Plan, it means measuring the Plan's major outcomes (or anticipated results). Monitoring can involve a wide range of approaches to measure the Plan's results, including measuring water quality and species numbers, gauging flows, recording expenditure and works completed, measuring compliance with consent conditions, recording the costs of flood damage and damages saved, recording ongoing consultation and decision-making, and surveying the community for views, participation and responses (see Chapter Eight).
Moving erosion area	See *river corridor.*
Native (plants)	Produced in or naturally belonging to a particular region or area.
Non-structural measures	Non-structural measures mainly deal with the *residual risk* of flooding. These measures keep people away from flood waters and help the community to cope when flooding occurs. *Land-use measures* influence the way land is used and buildings are constructed. They include *regulatory methods* (policies and rules in district plans) and *voluntary actions* (information and advice to help people to make their own decisions). *Emergency management measures* seek to improve the community's preparedness and response to flooding. Non-structural measures are the most cost-effective flood mitigation approach (see Chapter Five).
Non-structural principles	These are statements guiding how land should be developed and used, and how the community should be supported in a flood emergency. These are provided in Chapter Five.
NSOWG	The Non-structural Options Working Group, which is the group of officers from the three councils who advised on the development of the non-structural principles and will help to develop non-structural measures when the Plan is implemented.
Other buildings	Not habitable buildings, accessory buildings or ancillary structures. They include, but are not limited to: • industrial and commercial buildings • buildings used for education and public assembly, and other buildings that concentrate people • healthcare and emergency service buildings • buildings used for recreation.
Overflow path	The overflow path, also known as the *flow path,* includes areas in and adjacent to the *river corridor* where a large volume of water would flow over a *floodplain* during a major flood event. They are often areas of land that lead fast-flowing water away from the *river corridor* and over the floodplain. The depth and speed of flood waters are such that development could sustain major damage, and there may be potential danger to life. The rise of flood water may be rapid. Evacuation of people and their possessions would be dangerous and difficult, and social disruption and financial loss could be high. A blocked overflow path could potentially cause a significant redistribution of flood flows to other areas of the floodplain. Due to water depths and velocities, overflow paths are generally unsuitable for development, unless adequate flood avoidance and/or mitigation provisions are made (see Chapter Five).

Overtopping	The process of floodwaters flowing over the top of stopbanks and floodwalls (see *breaching*).
Pa	A fortified village.
Papakainga	Communal housing, often based around a marae and consisting of members of an extended family.
Planting	River management relies heavily on willow planting to maintain stable bank edges. Branch growth reduces flood velocities on berms and the willow's dense root mass binds the bank-edge soils (see *vegetation buffer)*. Planting typically consists of willow poles being placed in furrows in the ground. Locations for planting are carefully chosen, with consideration given to the surrounding environment. Hybrid willows that are less susceptible to spreading are used. The willow stands on the banks are maintained by replanting areas where bank erosion has occurred, and periodically cutting and layering mature trees (this thickens stands and promotes new growth). Plantings are also beneficial for river ecology. They reduce the amount of sediment being introduced to the river system, and provide shade for fish species.
Ponding area	Those areas where flood waters would pond either during or after a major flood event. Water speed is slow in ponds, but water levels can rise rapidly. Evacuation of people and their possessions may be difficult, especially on foot, and may need to be by boat. There could be danger to life. Social disruption may be high. Generally, ponding areas are unsuitable for development, unless adequate avoidance and mitigation provisions are made (see *flood hazard effects).*
Probable maximum flood	The largest flood that could, in theory, occur in the Hutt River, which is a flow of around 7,000 cumecs.
Rahui	A restriction on access; a prohibition.
Reach	A short length of river, usually defined by geographic features such as bridges, a change in the river direction, or change in land-use beside the river (e.g. urban to rural).
Real Time Flood Forecasting Model	A computer model that uses data collected on rain as it falls, to predict flood flows in the river before the flows occur.
Regulatory methods	*See non-structural measures.*
Residual risk	The risk of flooding that exists despite the protection provided by flood protection structures. In other words, it is the additional or 'left over' risk due to possible breaching and overtopping of stopbanks (see Chapter Five).
Right bank	See *true left/right bank*.

Riparian management	The management of the riparian zone, which consists of the berms and the floodway. The riparian zone is an important ecological link between the river and land-based ecosystems. Good riparian management is essential for minimising bank erosion, maintaining healthy ecosystems and ensuring good water quality. Typical maintenance of rip-rap involves topping up and tidying the structure. Repairs are generally undertaken by a large hydraulic excavator, working from the adjacent bank, picking up and replacing rocks. Additional rock may be required, and repair work can usually be undertaken without diversion of the river flow.
Risk-based standard	A varying flood protection standard is applied along the Hutt River. The standard varies mostly depending on: • potential damage costs for each area • the area and number of people affected • an area's vulnerability to flooding and erosion. For the Hutt, the standard is based on the 2300 cumec flood, with 2800 cumec stopbanks for principal urban areas (see Chapter Three).
Riverbed	Riverbed is defined in the Resource Management Act 1991: "In relation to any river, the space of land which the waters of the river cover at its fullest flow without overtopping the banks."
River corridor	Includes land immediately adjacent to the river. It is the minimum area able to contain a major flood and enable the water to pass safely to the sea. Because of its location, the river corridor represents a significant flooding and erosion hazard to people and structures, including the flood defences, sited in the corridor. The river corridor extends from the river mouth to the Hutt Gorge. The outer limit is set by: • the outside (landward) toe of all stopbanks • geological features, including the valley walls and cliff-top features • the extent of a 2800 cumec flood (except where erosion hazard areas lie outside the 2800 extent) • the river-side margin of existing houses at Belmont and Bridge Road, Birchville, where those properties extend into erosion hazard areas. The area upstream of Gemstone Drive, Upper Hutt (the top of the scheme), is treated slightly differently because no structural works are proposed for this reach under the Plan. A buffer between potential development and the river's edge, which can move with a migrating river channel (called the *moving erosion area*), defines the area affected by erosion. The river corridor contains: • the *primary river corridor* hazard area, including a: – baserock erosion area – alluvial erosion area – moving erosion area – core flooding area • the *secondary river corridor* hazard area.

	The primary and secondary corridor separates an area of fast-flowing water from an area of slower-flowing and often deeper water. The primary river corridor contains three erosion hazard areas. The *baserock* and *alluvial erosion areas* are fixed, while the *moving area* moves with the migrating river channel, upstream of Gemstone Drive. The *core flooding area* is where the flood waters will move quickly, but the erosion risk is not significant. The depth and speed of flood waters are such that existing development in the corridor could sustain major damage, and there is potential danger to life. Water may rise rapidly, evacuation of people and their possessions would be extremely difficult, and social disruption and financial loss could be very high. Most types of development would worsen the impact of flooding on other properties in the vicinity, posing a potentially significant threat to the safety of flood defences. Even a partially blocked river corridor would cause a significant redistribution of flood flow, likely to adversely affect other areas. The river corridor is compatible with open space, recreation and rural land uses. It is not suitable for intensive developments.
River realignment	Involves moving the existing riverbed by retreating one river bank and reclaiming the other. River realignment works may cause substantial disruption to river users in the affected area, and disturb river habitat and ecology.
Rock lining	Large rock placed directly onto and below the river bank to prevent the river eroding the bank, riverbed and berm area. Disturbance to the environment is minimised by separating the river flows from the work area with bunds (bund construction involves machinery working in flowing water for a short time). Also known as *rip-rap*. Typical maintenance of rip-rap involves topping up and tidying the structure. Repairs are generally undertaken by a large hydraulic excavator, working from the bank, picking up and replacing rocks. Additional rock may be required, and repair work can usually be undertaken without diverting the river flow.
Run-off	The amount of rainfall that ends up as stream flow.
Service	As in *utility service*, is a system and its network infrastructure that supply a community need.
Significant redevelopment	For habitable buildings considered under the non-structural principals, *significant redevelopment* means large extensions or rebuilding 40% or more of existing habitable floor area in any one phase of redevelopment.
Stopbanks	Banks aligned beside the river to prevent floodwaters flowing into floodplain areas. They are also known as *flood defences*.
Strong community reliance	Occurs where the community will experience significant disruption due to flood damages. The community can be reliant on goods and services sold in a building (e.g. major retail centres), employment associated with a building, or services supplied within a building that regularly concentrates people (e.g. education facilities) (see Chapter Five).

Structural measures	Structural measures are structures or other physical works designed to keep flood waters away from existing development. *Stopbanks* and *floodwalls* are obvious examples of structural works. Channel works include *bank-edge works* and channel management. *Rock linings, vegetation buffers* and *groynes* are bank-edge works, which protect flood defences like stopbanks and maintain the channel's position. Other active channel management methods include *bed and beach re-contouring* and gravel extraction. They are used occasionally to reduce the opportunity for the river to erode its banks and damage structural works. Bridge upgrades improve flood capacity and avoid debris dams, helping to preserve a secure flood defence system.
Sustainable management	As defined by section 5 of the Resource Management Act: *Managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety while:* *a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and* *b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and* *c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.*
Tangata whenua	People of the land: the iwi or hapu (sub-tribe) that holds customary authority over a particular area (see Chapter Two).
Taonga	Highly regarded physical or spiritual treasures or property.
Tapu	Temporary restriction or ban on use.
Telemetry	Automatic recording of rainfall and river-level data linked to the Regional Council flood base via a radio network.
Territorial local authority	A city council or district council, in this case Upper Hutt City Council and Hutt City Council.
Te Tuutohinga o te Whakaaetanga	The Charter of Understanding between the Regional Council and the iwi in this region. See *Charter of Understanding.*
Threshold of motion regime	The flow at which sediment transport commences.
Tikanga Maori	Maori customary values and practices.
Tino rangatiratanga	Chieftainship; chiefly authority; full authority.
True left/right bank	The true left bank is the *left bank* of the river facing downstream. The opposite bank is the *true right bank.* Totara Park sits on the right bank of the Hutt River, while Lower Hutt CBD is on the left.
Upper Catchment	The generally hilly and mountainous areas in the headwaters of the catchment that contain the upper reaches of the Hutt River, and the Pakuratahi, Akatarawa, Mangaroa and Whakatikei Rivers.

Urupa	Burial ground (see Chapter Two).
Utility	A service that is essential for a safe, healthy and functioning community. These include – but are not limited to – energy, telecommunication, sewerage and water supply.
Vegetation buffer	A row of vegetation planted along the river edge to help prevent erosion. Willow species are generally used as the first line of defence. Vegetation is used particularly where bank erosion is not so severe, or the adjoining berm area is extensive, or there is limited development on the floodplain behind plantings, or a combination of the three. Also see *plantings*.
Voluntary actions	See *non-structural measures*.
Waahi tapu	A sacred site, as defined by a hapu or iwi who are kaitiaki for the waahi tapu.
Wetland	This includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals adapted to wet conditions.
Whakapapa	Geneology (see Chapter Two).
Zone/zoning	Areas of land classed for a certain range of land uses; e.g. residential zoning specifically provides for residential homes as well as associated structures, such as garages and storage sheds. Activities in these zones must not produce adverse effects on neighbouring properties and the wider environment. Other land uses such as industrial development are not intended for residential zones because they are incompatible.