Foreword

Welcome to our latest state of the environment report.

Measuring up is this report's title, and also its aim. It gives us vital information about the health of the region's natural and physical resources, so that we can gauge how well we are sticking to the course set in our 1995 Regional Policy Statement. This is an accountability exercise, much like the financial report Greater Wellington prepares each year.

In putting together this report we have tried to be up-front and objective. The findings tell us that:

- We are doing some things well – for example, water quality has improved in two streams after sewage discharges were removed, and the shift of dairy shed discharges from streams to land has benefited even more streams.
- We are doing other things less well – for example, there is growing evidence that urban stormwater will cause serious long-term effects on aquatic life in streams and harbours.
- We are better informed now about the state of our air and soil quality than we were six years ago, but we still need to measure natural character in the coastal environment and the state of the ecosystems.

This edition of *Measuring up* is the first step of our full review of the Regional Policy Statement for the Wellington Region. Now that we've assessed progress towards achieving the objectives, our next step is to work out what has been effective, and what hasn't.

Next year we will be reporting on the effectiveness of the provisions in the Regional Policy Statement, and asking the community for its views on our progress.

With this report, you too can measure whether the way we live in this region is sustainable.

Ian Buchanan
Chairperson


CRUISES

Contents

Introduction

The aim of *Measuring up 2005* is to find out if we are achieving the objectives in the Regional Policy Statement. The objectives are at listed the start of each chapter of this report, followed by our assessment of where we are doing well, and where improvement is needed.

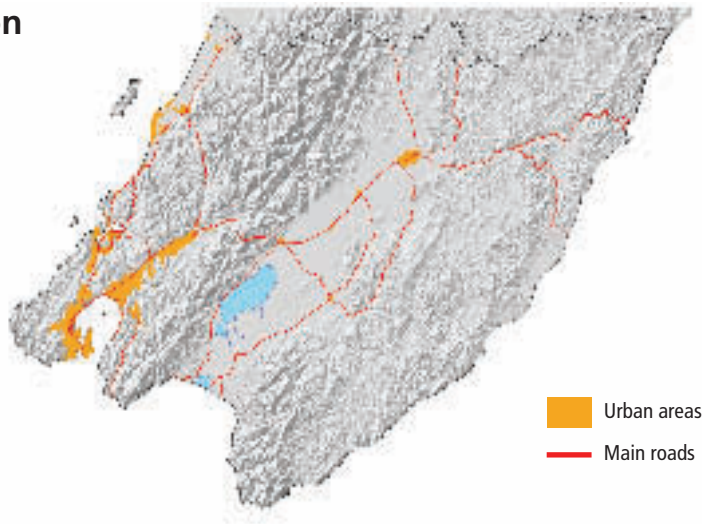
Promoting sustainable management of the natural and physical resources in the region is fundamental to our work as a regional council. Monitoring is essential to our effective management of these resources. We need to know the state of the environment, why it's in that state, and whether it's getting better, getting worse or staying the same. Finally – and this is absolutely essential – we need to know whether the management of the region's resources needs to be done differently.

Greater Wellington produces a state of the environment report every six years. The last was in 1999. *Measuring up 2005* is the beginning of a review of our Regional Policy Statement. The review process will give us the chance to propose any changes that might be needed.

Each chapter in this report – one for each chapter of the Regional Policy Statement – is based on an extensive background report that contains detailed analysis of all available data. These background reports are referenced at the end of each chapter and are available from our library and on our web site.

We have also produced a set of summary report cards. These present our key findings in a way that can be understood by a wide range of people.

The Wellington region



The iwi environmental management system

Objectives

1. A mutually satisfactory relationship is developed and maintained between the Wellington Regional Council and the iwi of the region.

2. The principles of the Treaty of Waitangi are taken into account in resource management.

3. There are increased opportunities for tangata whenua to exercise kaitiakitanga in the region.

4. There are increased opportunities for the cultural aspirations and tikanga of tangata whenua with regard to natural and physical resources to be met.

Doing well

- Iwi and Greater Wellington are positive about the relationship and both parties feel it has matured over the last ten years.
- Some of the factors seen as important to the relationship are:
  - Strong commitment from the Chairperson and senior managers, kaumatua and iwi leaders.
  - Recognition that the relationship needs to be both among 'rangatira' and at the operational levels.
  - Recognition that the relationship needs to be between the Council and each iwi.
  - A willingness to acknowledge on-going differences of opinion and priority.
  - A commitment to resourcing for resource consent handling, and participation in working parties and technical exchanges.

Must improve

- Greater Wellington is not taking the principles of the Treaty into account in a systematic way in resource management decision-making.
- Education and awareness of the Treaty principles need to be improved so that they can be taken into account more effectively.
- There is not enough communication about how iwi views have been taken into account or acted on.

Introduction

Maori know the Wellington region as a special place: Te Upoko o te Ika a Maui – The Head of the Fish of Maui. Over the centuries, many different tribes have lived here and the lands around Wellington Harbour, or Te Whanganui a Tara, saw much upheaval.

The first European settlers landed at Petone in 1839, a year before the Treaty of Waitangi was signed. Today, the Treaty finds expression in most legislation, including the Resource Management Act 1991 (RMA), which requires regional councils to:

- take into account the Treaty's principles
- recognise and provide for, as a matter of national importance, the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu, and other taonga (precious things)
- have particular regard to kaitiakitanga (the exercise of guardianship).

After the RMA was enacted, Greater Wellington established a relationship with six tribes in the region:

- Ngati Kahungungu o Wairarapa
- Te Atiawa/Taranaki ki te Upoko o te Ika a Maui
- Ngati Toa Rangitira
- Te Atiawa ki Whakarongotai
- Ngati Raukawa ki te Tonga
- Rangitaane o Wairarapa.

While preparing the Regional Policy Statement, Greater Wellington talked to representatives of these tribes about resource management issues of importance to tangata whenua, and what to do about them.

Together, we set the objectives for this chapter, and the Council adopted policies and methods to achieve them. Iwi also contributed to other chapters – although only the Coastal Environment chapter has an objective specifically recognising tangata whenua.

Ara Tahi, November 2005.

What's being done

Greater Wellington and tangata whenua work together on resource management issues through Ara Tahi, an inter-iwi representative group made up of two representatives from each iwi authority and two from the Council. The group's first Chairperson, the late Te Pehi Parata, suggested the name, which means *"The group proceeding down one road."*

Tribes are represented by the following organisations:

- Ngati Raukawa ki te Tonga by Te Runanga o Raukawa Inc.
- Te Atiawa ki Whakarongotai by Te Runanga o Ati Awa ki Whakarongotai Inc.
- Ngati Toa Rangatira by Te Runanga o Toa Rangatira Inc.
- Te Atiawa/Taranaki ki te Upoko o te Ika a Maui by the Wellington Tenths Trust (Nga Tekau o Poneke) and Te Runanganui o Taranaki Whanui ki te Upoko o te Ika a Maui Inc.
- Ngati Kahungunu by Ngati Kahungunu o Wairarapa.
- Rangitaane by Rangitaane o Wairarapa Inc.

Ara Tahi meets at least five times a year, allowing tangata whenua to discuss resource management policy and strategic environmental management issues. Over the last two years, Greater Wellington has used the forum to engage with tangata whenua on other, non-environmental issues.

In 1993, Greater Wellington and the region's tangata whenua signed a Charter of Understanding. Since the last *Measuring up* in 1999, tangata whenua and the Council reviewed the terms of the Charter and signed an updated document in November 2000. This was at the request of Ara Tahi who advocated for stronger recognition of the Treaty of Waitangi, and its application to all Greater Wellington business.

The revised charter goes beyond environmental management under the RMA to include all of Greater Wellington's activities - from the planning and management of rivers, parks, and public transport to water supply. Although the Charter was signed collectively, it recognises the fundamental relationship between the Council and each of the tangata whenua tribes and their independence from one other.

Greater Wellington has two Maori policy advisors who continue to provide a key link with iwi. Their role was expanded after changes to the Local Government Act 2002. The policy advisors:

- liaise with tangata whenua and support the relationship between each iwi and Greater Wellington's operational staff on operational matters
- advise the Council on specific issues of tikanga
- provide policy advice and support to Ara Tahi
- provide policy advice to Greater Wellington about Treaty implications and obligations.

In resource management decision-making, Greater Wellington provides iwi with copies of all non-notified resource consent applications in their rohe so they can provide feedback to staff considering the application. Assessing consents takes time, and this is paid for by Greater Wellington. Maori commissioners on most resource consent hearings ensure that iwi matters receive greater attention in consent applications.

Capacity funding has streamlined the working relationship with iwi by ensuring they are resourced to be available to Greater Wellington to discuss matters beyond resource consents.

This helps staff understand the implications of their decisions on tangata whenua.

Iwi are only occasionally involved in environmental monitoring. Two examples are when Te Ati Awa ki Whakarongotai monitored shallow bores on the Kapiti coast, and when Te Runanganui o Taranaki Whanui led manual weeding of Waiwhetu Stream.

Iwi have also been involved in the development of all five of the Council's regional plans, and in subsequent plan changes.

Tangata whenua and Greater Wellington share a common interest in sustainable resource management and better environmental performance. For tangata whenua, however, sustainable resource management is important for cultural, social and economic development, and they don't always have the resources to participate effectively.

Greater Wellington has recognised this and responded with an iwi project budget, to which Ara Tahi members can apply for resource management project funding. The budget has funded work by the Wellington Tenths Trust and Rangitaane o Wairarapa on geographic information systems (GIS) mapping projects, work towards the development of an iwi management plan for Te Atiawa/Taranaki ki te Upoko o te Ika a Maui, a groundwater monitoring project undertaken by Te Atiawa ki Whakarongotai, and a walkway to an urupa by Ngati Toa Rangatira.

Dane Rimene and Joseph Potangaroa at the controls of the computer based GIS system they used to record 250 historic sites.

Each year, there is a programme of technical workshops for Ara Tahi. These are to share information between Greater Wellington staff and iwi representatives on issues such as environmental monitoring and indicators, geographic information systems, water management, transfer of powers under the RMA and management of aquaculture under the RMA.

Besides Ara Tahi, iwi and Greater Wellington also relate through iwi presence on advisory groups, for example for flood protection, and recently through representation on standing committees such as the Regional Land Transport Committee.
Greater Wellington departments such as Parks and Forests, Consents Management, and Flood Protection are in regular, informal contact, and technical workshops offer iwi ways to improve their involvement at all levels of Greater Wellington business.

In 2004, Greater Wellington, with the city and district councils in the region, began working together under a joint committee known as the Wellington Regional Strategy Forum. The Forum's aim is to build an internationally competitive region, and at the same time, enhance the quality of life of people who live here. Iwi - via Ara Tahi - are partners in this process.

Te reo Maori and seminars about the Treaty of Waitangi have been offered to staff over the past five years, but uptake, which is voluntary, remains quite low.

Over the past decade, critical innovations have been the:

- Ara Tahi Committee
- Charter of Understanding
- establishment of the Maori Hearing Commissioners
- technical workshops for Ara Tahi
- establishment of two Maori Policy Advisor positions
- extension of the Treaty response by Council to areas of Greater Wellington activity outside the RMA.

Where we are now

When the Regional Policy Statement was being developed, Greater Wellington's relationship with iwi was new and something of an arranged marriage. We wanted to find out what iwi and Greater Wellington staff thought of this relationship ten years down the track, and whether it's as "mutually satisfactory" as we aimed for.

Representatives of Ara Tahi, some Greater Wellington staff and two councillors gave their views on whether we're meeting the Regional Policy Statement objectives.

A mutually satisfactory relationship

A mutually satisfactory relationship is fundamental to Greater Wellington and iwi working together to address resource management issues of significance to iwi – their participation in RMA processes lies at the heart of our relationship.

All those interviewed were positive about the relationship, and felt it had matured over the last ten years.

Iwi noted that the length of the relationship, the adoption of the Charter of Understanding, consultation through Ara Tahi, and funding for resource management advice and iwi projects have all helped improve the way we work together. Some commented that staff they regularly deal with now have a better understanding about what iwi do and the role they have.

Two iwi commented that their relationship with Greater Wellington was better than with other local authorities.

Some suggested the relationship could be improved with regular reviews of the Charter, to keep it a living document, and by looking at ways to build capacity together with training and increased resourcing.

Greater Wellington staff and councillors felt there was greater trust between the two parties, and some felt that a better understanding of Greater Wellington issues and processes on the part of iwi would allow them to become even more involved in resource management matters.

There were both iwi and Greater Wellington interviewees who commented that in the early days of the relationship, councillors and iwi had robust arguments and discussions that helped us grow and learn about each other. There was some feeling that things have quietened down and the relationship is no longer growing. Some felt that the relationship needs to extend beyond certain "iwi-friendly" staff members into the organisation as a whole.

Mist on Rangitumau – tears of the tupuna of Rangitaane cloak the earth and her secrets. Rangitaane believe that when they die their spirits first ascend their tribal mountain – Rangitumau, before travelling on to Te Rerenga o Reinga (Cape Reinga).

The principles of the Treaty

The RMA requires the principles of the Treaty to be taken into account in resource management decisions as a bottom-line statutory obligation.

The preference of all iwi was that the objective should refer to the actual Treaty text, instead of the principles, but that the principles provide a good starting point. The point was made that taking the principles and adding them to local government protocols was fine for regional councils, but that it doesn't do anything for Maori.

Two iwi commented that the central principle was partnership, and one said the basis of partnership was a good relationship. Another felt that despite genuine efforts, the partnership principle still wasn't taken into account in resource management

decision-making. In the context of partnership, one stated that Greater Wellington was all talk and no action. For example, Maori have always been against discharging sewage to water, and Greater Wellington could demonstrate partnership by standing with Maori on this matter.

It was commented that Greater Wellington could do more by recognising and understanding the principles, and developing policy in line with them. Two iwi felt that education and awareness of the Treaty principles needs to be improved for both iwi and Greater Wellington, so they can genuinely be considered from a common understanding. Another felt that education should extend to the public as well.

Greater Wellington's five regional plans were made operative between 1999 and 2001, providing a framework for resource consent decisions. Greater Wellington processes most consent applications – more than 95 per cent – without public notification, but they are passed to iwi for their information so they can raise any concerns.

Greater Wellington staff tend to view this process as a sign of our commitment to the principles of partnership and consultation.

Levels of feedback about non-notified consent applications has dropped. Most iwi said this was because they either receive no feedback from Greater Wellington about how their views have been taken into account, or their views have been ignored.

One commented that Greater Wellington needs to monitor consent conditions that have been specifically requested by iwi, and that the results of that monitoring should be relayed to iwi.

For their part, the response from Greater Wellington interviewees ranged from a professed ignorance of the principles through to acknowledgment that we don't accommodate them in any procedural way. No one thought the principles were fully understood and taken into account in a systematic way.

Publicly notified applications are decided by a hearing committee and, since 2000, Maori commissioners have sat on almost all hearings. Some Greater Wellington interviewees saw the involvement of Maori commissioners as demonstration of working within the principles.

One example of how the principles were taken into account in resource management is the decision on applications by Kapiti Coast District Council in 2001 to take groundwater from beside the Otaki River to supply water to Waikanae. In its decision, the hearing committee said that *the way in which the WRC [Wellington Regional Council] will take into account the principles of the Treaty of Waitangi are set out in the Regional Policy Statement, the Regional Freshwater Plan and the Charter of Understanding.*
It went on to say

> *The Regional Policy Statement and Regional Freshwater Plan incorporate provisions that are pertinent to the interests of Ngati Raukawa and Nga Hapu o Otaki in the Otaki River environment and they should be given due weight - they are significant in this case.*
>
> *Ngati Raukawa's response to the proposal is clearly understood - its conclusions have been arrived at after careful consideration and are sincere. Knowing that, a consent authority that acted to disregard those conclusions, could not be said to be actively protecting tangata whenua interests in the terms explained in the Charter of Understanding.*

The committee declined the applications because the proposal was not consistent with the purpose of the RMA. One factor in its decision was that relevant matters set out in Part II of the RMA, which includes section 8 - Treaty of Waitangi, took precedence over the need to supply water to Waikanae.

Apart from isolated examples of major consent applications like this, it seems that consultation is the measure by which many at Greater Wellington consider we accommodate Treaty principles.

While a lot of work is going on, we recognise that Greater Wellington is not taking the principles of the Treaty into account in a systematic way. Greater Wellington needs to look into how meeting this objective can be improved.

Exercising kaitiakitanga

Kaitiakitanga (the exercise of guardianship) is an inalienable part of what it means to be tangata whenua – being a kaitiaki is not so much a role as an identity. The RMA requires regional councils to have "particular regard" to kaitiakitanga, and Objective 3 of the Regional Policy Statement looks to maximise opportunities for tangata whenua to exercise that right in the region.

This is an enabling, if challenging, objective with a positive, relationship-building intent, yet it drew the strongest reaction from iwi. They were unimpressed at the apparent inference that Greater Wellington could somehow influence kaitiakitanga – a right to be exercised regardless of whether the Greater Wellington provided opportunities for it or not.

The iwi view was that kaitiakitanga is and always will be their own responsibility, therefore Greater Wellington's role in this process will always be limited. They felt Greater Wellington shouldn't get involved in processes it has no control over.

One commented that iwi lack the capacity for 'total' guardianship, so options like co-management need to be investigated. Another expressed frustration because, to be an effective kaitiaki, tangata whenua need control over the entire process of resource management decision-making.

In 2004, Greater Wellington helped Ngati Toa improve this path from the marae to the urupa. It is now wider and easier to carry people to their final resting place overlooking the sea.

There is plenty of scope to improve on the status quo. For example, acknowledging the history at Battle Hill Farm Forest Park means letting the Iwi tell their story and practise kaitiakitanga without Greater Wellington influence. There was also a view that there is not a lot of understanding within the community about the role that iwi play in resource management, and Greater Wellington should take some responsibility for changing that.

The responses from Greater Wellington people generally reflected that they could not see any ways for Greater Wellington to increase opportunities for tangata whenua to exercise kaitiakitanga. One thought we could take steps towards this objective by integrating water management plans with Iwi Management Plans, but acknowledged that to date, there had been no moves to do this.

Cultural aspirations and tikanga

The exercise of tikanga over natural resources is clearly bound to kaitiakitanga, and taken together, the two represent a way of articulating the Maori environmental management system. The notion of cultural aspirations has been presented to allow room for iwi future visions to be included in resource management. Practically, this is meant to allow iwi to exercise their Treaty right of self-determination.

As could be expected iwi comments on this objective revolved around tikanga, as they feel that cultural aspirations are a part of that concept. Tikanga guides everything they do as Maori – and it is their responsibility to dictate what is appropriate, and for what circumstances.

Iwi hope, not only that Greater Wellington will recognise a greater role for tikanga in the future, but for a clearer Maori expression of life in all areas of Greater Wellington's business in the future, even as they recognise that negative media portrayal of tikanga influences Greater Wellington's openness to its inclusion.

Greater Wellington interviewees wanted to understand tikanga, but were unsure as to how to pursue this. It was clear from Greater Wellington staff and councillor interviews that understanding the different world views of Maori and non-Maori can be difficult. Greater Wellington understands the processes that Maori wish to observe, such as karakia and mihimihi at significant events, but not all of them recognise those processes as a reflection of a spiritual world view that will integrate into all levels of decision-making.

Where to from here?

For more than a decade, the region's tangata whenua and Greater Wellington have worked hard to build the framework for an ongoing working relationship.

Continuity of leadership in Greater Wellington, both at the governance level and among senior council officers, has been critical. There are sometimes tensions in the relationship at both governance and operational levels, but there is also a reservoir of goodwill on which the parties draw to manage those tensions. The tangata whenua consider that Greater Wellington is showing very real leadership to city and district councils in the region.

Several factors appear to be important in generating and maintaining successful relationships:

- Greater Wellington's acknowledgement that the Treaty of Waitangi is their responsibility, not just a Crown responsibility
- strong commitment to the relationship from Greater Wellington's Chairperson and senior managers, kaumatua and iwi leaders
- recognition that the relationship between tangata whenua and Greater Wellington needs to be both among rangatira and at the operational levels
- recognition that the relationship between tangata whenua and Greater Wellington needs to be between the Council and each iwi
- willingness among all parties to acknowledge on-going differences of opinion and priority, but to respond to the others' concerns
- Greater Wellington's commitment to funding, fees and resourcing tangata whenua for resource consent handling, and participation in working parties and planning and technical exchanges.

Now, in 2005, Greater Wellington and iwi are involved in reviews that seek to move forward and address the concerns identified in the interviews. These reviews include the ongoing Iwi Relationships Review, the Consents Review and Hui-a-Ara Tahi. Hui-a-Ara Tahi is a meeting of all iwi who relate to Greater Wellington to discuss and agree pan-tribal responses to Greater Wellington's work.

The challenge ahead lies in enacting the commitments captured in the revised Charter of Understanding, particularly around the effective engagement of tangata whenua in decision-making and resource planning.

More information

Cameron, Graham. 2005. *The Iwi environmental management system – background report*. Greater Wellington.

Local Government New Zealand, Te Puni Kokiri. 2002. *Local Government Relationships with Maori*.

Fresh water

Objectives

1. The quantity of fresh water meets the range of uses and values for which it is required, safeguards its life supporting capacity, and has the potential to meet the reasonably foreseeable needs of future generations.

2. The quality of fresh water meets the range of uses and values for which it is required, safeguards its life supporting capacity, and has the potential to meet the reasonably foreseeable needs of future generations.

3. Freshwater resources of significant or of high value for cultural, spiritual, scenic, ecosystem, natural, or other amenity reasons are protected or enhanced.

Doing well

- Despite occasional shortages, we have enough freshwater water for now, but only just.
- We now have better ways of estimating safe yields for groundwater.
- The number of major discharges to fresh water has dropped.
- Water quality has improved in the Ngarara Stream, near Waikanae, and the Wainuiomata River after the removal of sewage discharges.
- Work has begun with city and district councils on a stormwater action plan for the region.
- Greater Wellington's programmes that benefit fresh water, such as *Be the Difference, Take Care, Take Action, Wetland incentives*, and *Streams Alive*.

Must improve

- Demand for fresh water in the region is increasing and there is a limited amount available. New ways need to be explored to ensure water is allocated efficiently in the future.
- The lower reaches of the Mazengarb Drain and the Waitohu, Mangaone, Ngauranga, Waiwhetu, Mangaroa, Mangatarere and Whangaehu streams have poor water quality.
- Impacts of stormwater discharges on urban streams and the effects of land use on rural streams need to be reduced.

Getting things clear

Fresh water is integral to our health, wellbeing, livelihood and culture. It helps drive our economy, defines our landscape and sustains ecosystems. We use and enjoy it in countless ways, yet we often take fresh water for granted – assuming it will always remain clean and plentiful.

But demands on fresh water are growing, and like any other natural resource, there are limits to how much use – or abuse – fresh water can sustain. So what is the state of our fresh water? Is it still clean? Is it still plentiful?

Where we are now

Uses and values of fresh water

There are two types of freshwater values and uses. The first is "instream" uses – such as swimming or the value of healthy aquatic ecosystems that don't remove water from its natural source. The second is taking – or "abstracting" – water for public supply, irrigation or other needs. In the Wellington region, public water supply, stock, irrigation, industry and vineyard frost protection are the biggest water consumers.

People value clean fresh water for many reasons – recreational, aesthetic, ecological and cultural. Greater Wellington doesn't monitor for aesthetic or cultural values, but it does audit the ecological health of water and its suitability for recreation. Generally, results are satisfactory, but there is still room for improvement in some places.

Normally, water use is restricted only during dry spells, though some rivers and groundwater zones are fully allocated, and takes from these are curbed any time demand exceeds supply.

Water for public use is taken from a variety of surface and groundwater sources in the region. Large drinking water suppliers typically draw good quality "raw" water from forest catchments, then treat it to meet the New Zealand Drinking Water Standard.

Some drinking water for farm stock comes from rivers and streams. Water quality monitoring, described later in this chapter, shows that 61 per cent of streams draining rural catchments failed Australia New Zealand Environment and Conservation Council (ANZECC) guidelines for stock drinking water quality.

Minimum flows in rivers

Minimum flows, set by Greater Wellington, help safeguard the life supporting capacity of aquatic ecosystems in 14 of our rivers. These are based on water quality, historical flow records and instream habitat surveys. Sometimes, though, levels fall below these limits because flows fluctuate naturally and we still have to keep drawing water from rivers, even during dry spells. Flows below minimum may not necessarily harm a river's life-supporting capacity – as long as they are temporary.

Since the Regional Freshwater Plan set minimum flows, levels for instream habitats have been reviewed on the Waikanae, Hutt and Wainuiomata Rivers.

These reviews found that the minimum flow for the Waikanae River is appropriate, setting flows at different locations on the Hutt River is an option, and a higher level might need to be considered for the Wainuiomata River to provide adequate trout habitat.

Many rivers in the region have no official minimum flows, but limits – based on historical flows rather than instream needs – may be imposed as conditions of resource consents. Priority rivers for establishing minimum flows and allocation amounts are shaded green in Table 2.2.

Safe yields for groundwater

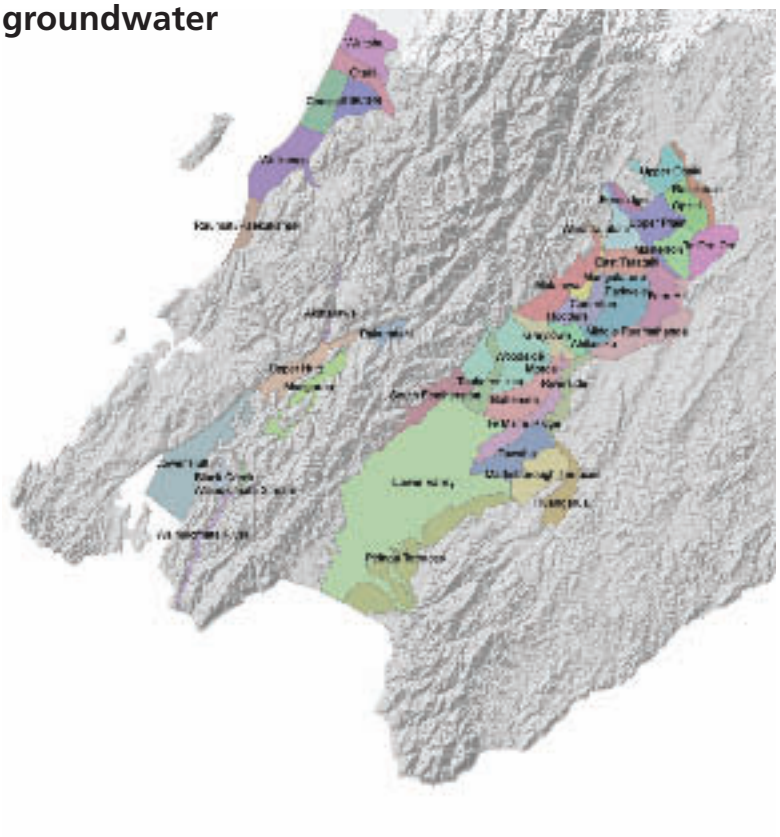


Figure 2.1: Groundwater management zones in the region. Elsewhere in the region, groundwater is not present in sufficient quantities to be used.

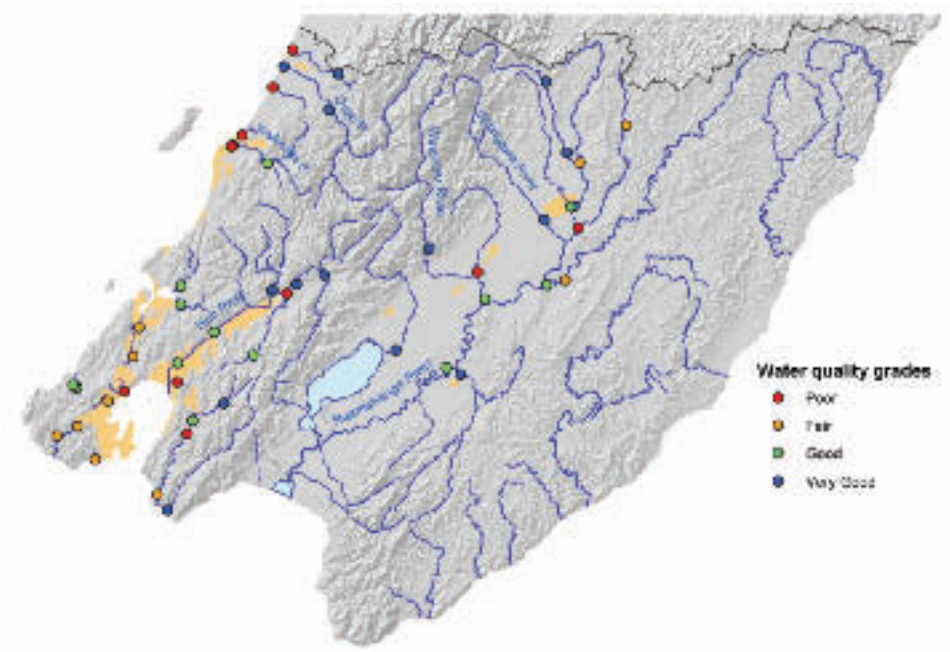
Figure 2.1 shows the region's groundwater. The Regional Freshwater Plan sets extraction limits, called safe yields, for all aquifers in these zones. These safe yields identify the amount of water that can be taken from an aquifer while still preserving flow and quality.

Greater Wellington has indicated there should be no additional water takes from the Parkvale, Martinborough Terraces and Kahutara (a sub-zone of the Lower Valley zone) groundwater zones, because levels are falling in these zones and we now believe our safe yields are too high (see *Pressures from water abstraction, page 33*).

Healthy aquatic ecosystems

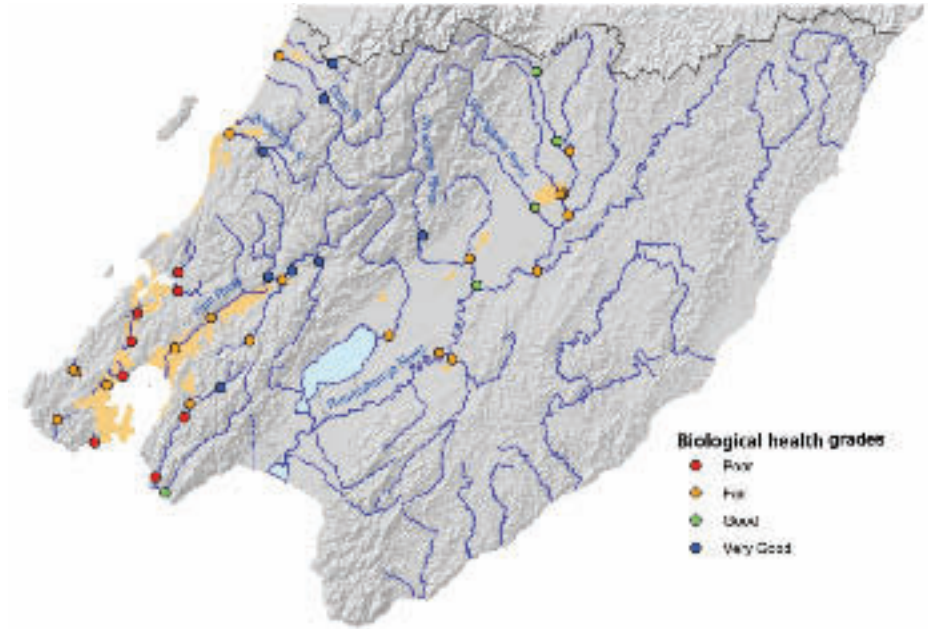
Water quality grades of 51 sites sampled monthly from 1997 to 2003 are shown in Figure 2.2. Grades are based on clarity, dissolved oxygen, nitrate-nitrogen, dissolved reactive phosphorus, ammoniacal-nitrogen, and faecal coliforms. Some monitoring sites were changed in 2003 and results since then are not reported here because the period of record is too short.

Figure 2.2:
How water quality rated at 51 sites monitored between 1997 and 2003 using six key water quality indicators.



We also monitored aquatic life in rivers annually at 42 sites between 1999 and 2003, using macroinvertebrate communities (small creatures without backbones like snails and insect larvae) as an indicator of their biological health (See Figure 2.3).

Figure 2.3:
Biological health as measured using macroinvertebrates at 42 sites monitored between 1999 and 2003.



We found a correlation between water quality and biological health – seven of the nine sites in very good biological health also had very good water quality. Of the other eight sites which had very good water quality, five enjoyed good biological health and four were rated fair. Two of the fair sites were in lowland streams, and the other two were downstream from dairy, sheep and beef farms.

Only a few sites showed any significant change in water quality over time. In most cases, changes were small and only showed up in one or two of the quality indicators. Two sites that showed a clear improvement in water quality were the Ngarara Stream on the Kapiti coast and the Wainuiomata River. In both cases the improvement was because treated sewage discharges upstream had been stopped.

Figure 2.4 shows the decrease in nutrients (dissolved reactive phosphorus concentrations) in the lower Wainuiomata River since late 2001 when the discharge of treated sewage from Wainuiomata to the river stopped.

The water in the Mangaone Stream on the Kapiti Coast has also improved - in this case the improvement was because ammoniacal nitrogen concentrations fell after five dairy sheds along the stream stopped discharging to water.

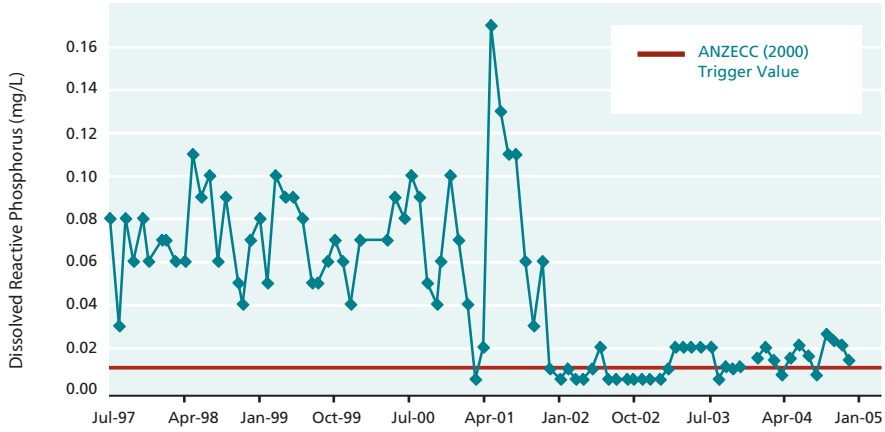


Figure 2.4:
Levels of dissolved reactive phosphorus (DRP) in the Wainuiomata River dropped dramatically after the discharge of treated sewage was stopped in late 2001. The red line shows the guideline/trigger value for aquatic life – DRP levels should be under this line.

The region is home to a healthy diversity of native freshwater fish: 22 species including the inanga – one of the five "whitebait" fish – eels, mudfish and several species of kokopu. Many of these fish migrate between freshwater and the sea, but often find their way blocked by culverts, weirs and other obstructions in river beds. In partnership with community groups, iwi and government agencies, Greater Wellington has been promoting "fish passes" to allow fish back to ancestral spawning grounds.

The Taupo Stream fish pass, installed in 2005, helps native fish like inanga and giant kokopu get upstream into Taupo Swamp once again.

The Waiohine River at the gorge is one of our monitoring sites that has grades of "very good" for its water quality and biological health.

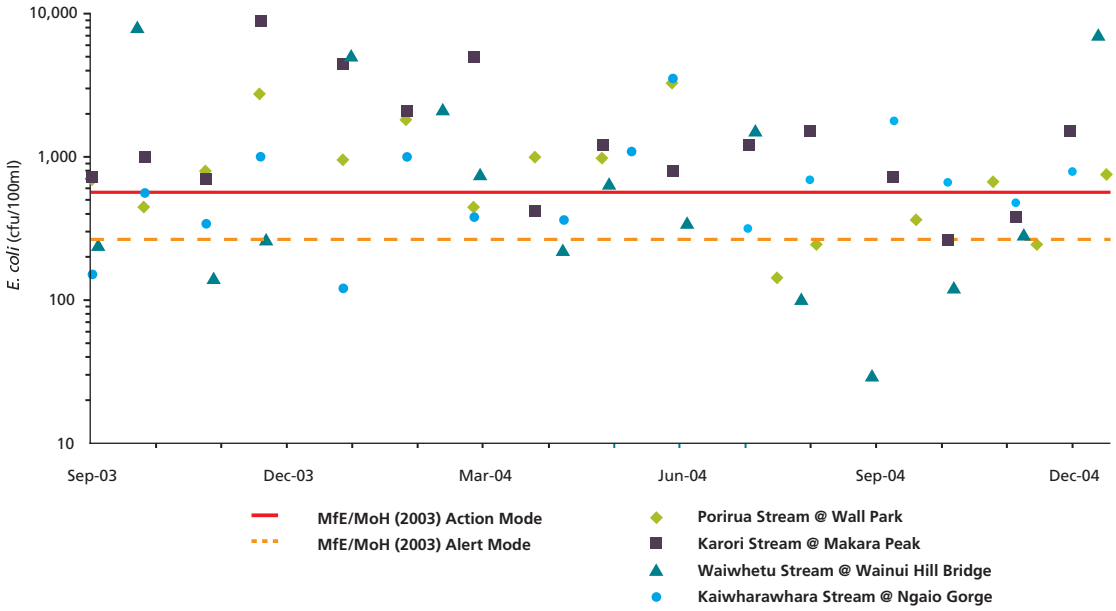
Brown trout, a prized sports fish, is an exotic species that inhabits the region's lowland rivers and lakes. Trout fishing is a popular activity in the region, and the Regional Freshwater Plan identifies which rivers to manage for trout habitat. We monitor 19 sites in these rivers as part of our water quality, biological and flow monitoring programmes. Fifteen of the 19 sites have water quality that is "good" or "very good". The remaining four sites have either "fair" (Kopuaranga and Taueru rivers) or "poor" (Mangaroa River and Mangatarere Stream) water quality.

Urban streams

Since 2001, Greater Wellington has been investigating impacts on urban streams and coastal environments from stormwater discharges. We found bacteria counts well above recommended microbiological water quality guidelines in many of our urban streams (see Figure 2.5). Although these streams are not generally used for swimming, high levels of *E. coli* bacteria still pose a health risk to children playing in the water, people biking through, or people collecting watercress.

Polluted urban streams also empty into the sea where they can affect swimming beaches.

Figure 2.5:
E. coli counts recorded in some urban streams between August 2003 and December 2004 were often above guideline levels for "action", which means there is a high risk of illness from contact with the water.



We also measured concentrations of metals, hydrocarbons and pesticide residues in urban stream water and sediments. The following contaminants were found to be above ANZECC guidelines:

- Heavy metals, notably copper and zinc, in stormwater at most sample sites, and in stream bed sediment at some sites.
- Poly-aromatic hydrocarbons in stormwater and in stream bed sediment at some sites.
- Organo-chlorine pesticides such as DDT, lindane and dieldrin in stormwater at one site and in stream bed sediment at others.

These pollutants were most abundant in catchments flowing to Wellington and Porirua harbours. Rain washes pollutants from roofs, roads and the land into the stormwater pipes. They are carried quickly to streams and then to the coast where they build up in the marine sediments (see **Coastal Environment**).

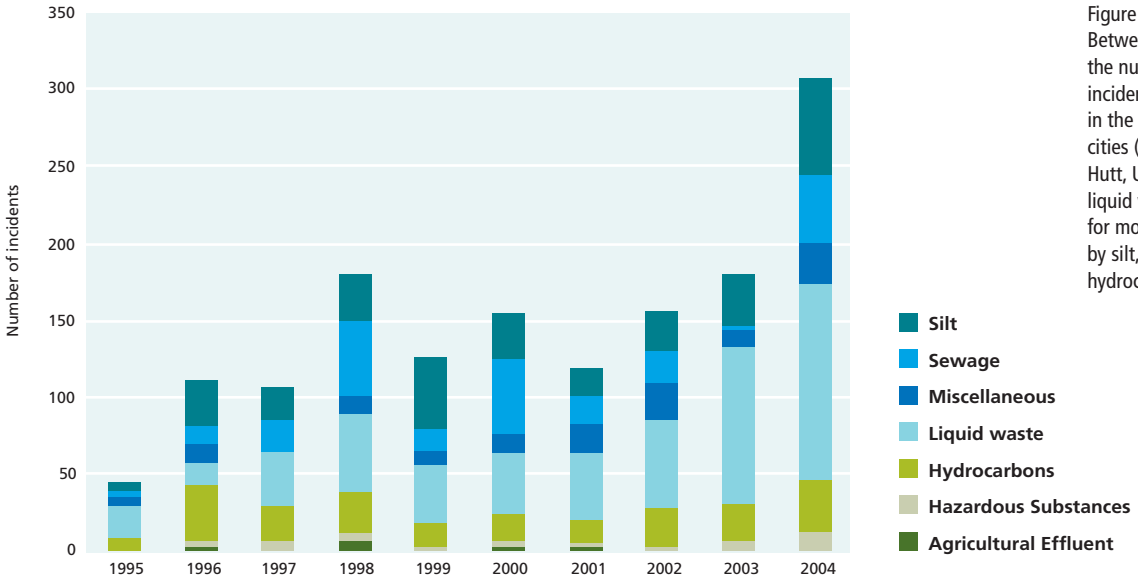


Figure 2.6:
Between 1995 and 2004, the numbers of pollution incidents affecting streams in the region's four largest cities (Porirua, Wellington, Hutt, Upper Hutt) show that liquid waste is responsible for most incidents, followed by silt, sewage and hydrocarbons.

In 2003 and 2004 we surveyed the ecology of urban streams at 61 sites in 40 streams in Kapiti, and the cities of Porirua, Wellington, Hutt and Upper Hutt. This has given us valuable information against which we will be able to measure future trends. This investigation was later extended to urban streams in the Wairarapa but those results were not available for this report. Our work confirms that urban streams need special management.

Recreational and ecological values

Greater Wellington keeps watch on water quality and its suitability for recreation at 23 river sites around the region (see Figure 2.7). These swimming holes are popular with swimmers and kayakers. The water at these sites is tested every week during summer for the presence of *E. coli* bacteria.

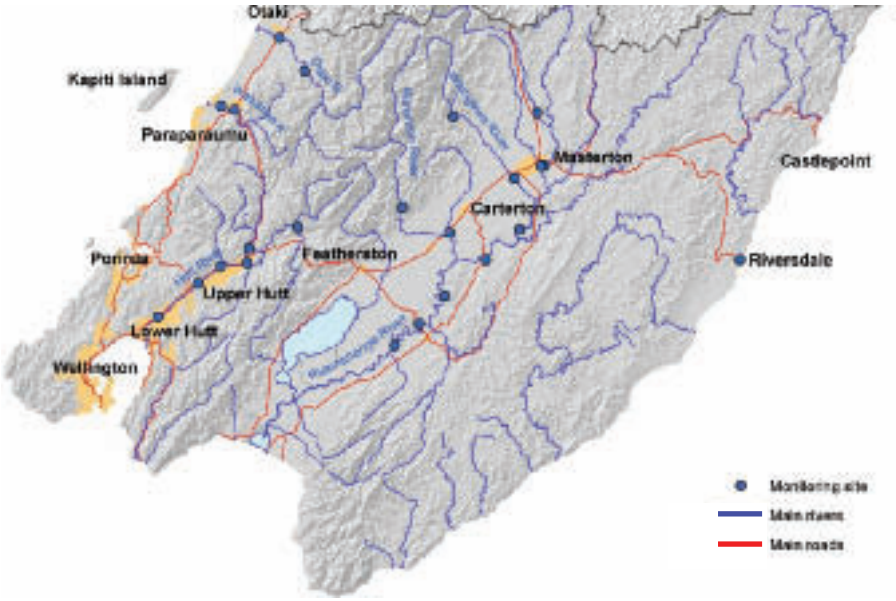


Figure 2.7:
These sites are sampled throughout the summer and tested for compliance with the recreational water quality monitoring guidelines. Weekly results are posted on our web site.

The green, orange and red colours in Figure 2.8 work in a similar way to traffic lights. When water quality is within the green "surveillance" level, there is little risk of illness from bathing. The orange "alert" indicates an increased risk, but still within an acceptable range, while the red "action" means a high health risk from bathing. At this point, people are advised not to swim.

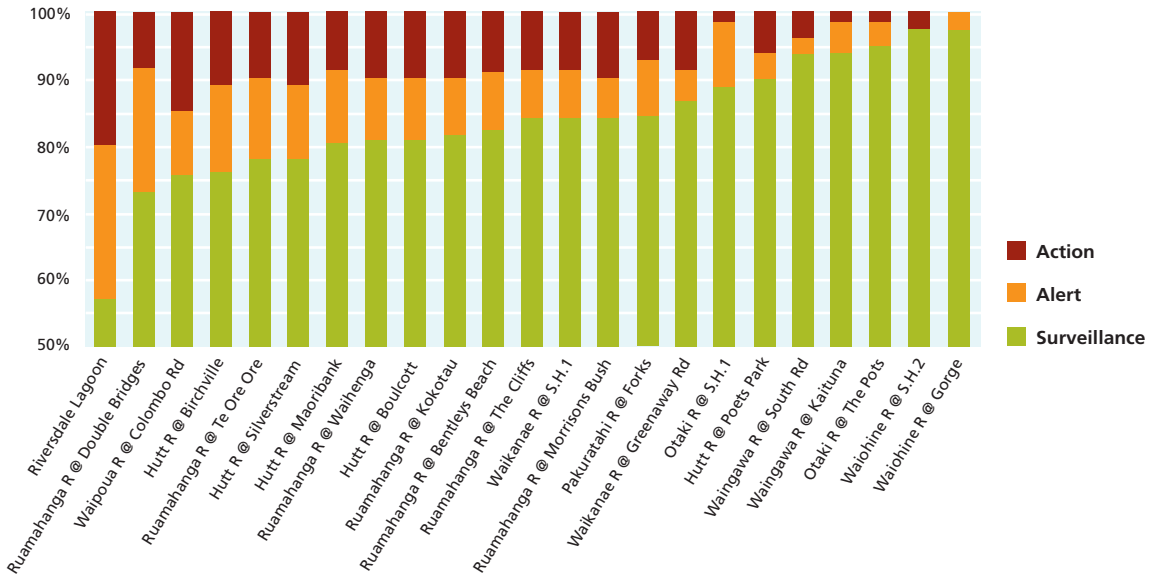


Figure 2.8:
Compliance with the surveillance, alert and action levels of the Ministry for the Environment – Ministry of Health recreational water quality guidelines, expressed as a percentage of total samples over the last four summer seasons.

Only six of the 23 sites met the guidelines for more than 90 per cent of summer samples. Compliance was highest where there was no influence from people, notably the Waiohine River at the Gorge, the Waingawa River at Kaituna and the Otaki River at The Pots. All these sites are surrounded by bush.

Rivers flowing through agricultural catchments were in a poorer state. Riversdale Lagoon, the Waipoua River at Colombo Road, and the Hutt River at Silverstream and Birchville all fell to "action" status several times.

Compliance was best during the dry summer of 2002-2003 and lowest over the much wetter 2003-2004 summer. Weather records show that all action level (red) occurrences in Kapiti coincided with rain, while rainfall appears to account for 90 per cent of action level occurrences in the Hutt Valley and Wairarapa. Because of this link between rainfall and high bacteria counts, people are warned to avoid swimming and other activities during heavy rain, and for two days afterwards.

Lake Wairarapa – a special case

Lake Wairarapa and its environs make up the largest wetland complex in the southern North Island and are a vital habitat for native plant, bird and fish communities. They are also very important for recreation, culture and heritage. Flood protection works, which are part of the Lower Wairarapa Valley Development Scheme, are a major influence on the lake and its wetlands.

Minimum water levels for Lake Wairarapa have been set in the Regional Freshwater Plan and are consistent with the National Water Conservation (Lake Wairarapa) Order. Over the last five years, the lake was well above target levels for most of the autumn, winter and spring, but sometimes fell short during summer.

The lake's water quality has been consistently poor throughout the last decade. High nutrient levels and algal biomass combined with low water clarity all point to a highly modified system. This is likely to be a consequence of Featherston's sewage discharge and runoff from pastoral land.

Monitoring shows the biological health of the lake is holding up. However, we know nothing about the state of its margins and the effects of controlled lake level fluctuations on them. We suspect their ecology is probably altering, but we can't measure this change without vital data on things like wading bird numbers and wetland turf communities.

Table 2.1:
Regionally significant water resources and their state according to our monitoring of their water quality, biological condition and flow. All except Lake Wairarapa are meeting their management goals. We don't have information about the state of the margins and wetlands of Lake Wairarapa and so its overall state is unknown.

Management purpose	Water body	State
Natural features/natural state, indigenous vegetation or habitats of indigenous fauna	Waiohine River (gorge and above) Otaki River (gorge and above) Hutt River (Kaitoke Gorge and above) Upper Wainuiomata River Upper Orongorongo River Lake Wairarapa	✓ ✓ ✓ ✓ ✓ ?
Landscape and scenic qualities	Ruamahanga River (gorge and above) Waiohine River (gorge and above) Otaki River (gorge and above) Hutt River (Kaitoke Gorge and above) Orongorongo River (upper reaches)	✓ ✓ ✓ ✓ ✓
Landforms and geological characteristics	Otaki River, upstream of Pukehinau Stream Ruakokopatuna Gorge	✓ ✓

Leaving enough behind

We can't predict whether there will be enough water for all uses in the future, or whether freshwater ecosystems will be healthy. But we can comment on where special care is needed now to protect people's future needs.

We know that water abstraction is on the increase, and that many of our water resources are already at, or close to, full stretch. Yet demand is predicted to keep growing. We know enough about population growth and consumption to plan for future water supply needs, but the same information is lacking for other uses. We don't know, for instance, how much irrigation will draw in the years ahead. To protect future needs, we need to know a lot more about future demand.

Figures 2.2 and 2.3 show that water quality and biological health in some of our rivers is poor, although since the last *Measuring up* in 1999, the halting of sewage and dairy discharges has brought some improvements. Meeting the needs of future generations means protecting rivers from pollution, protecting urban streams from stormwater discharges and limiting the impacts of rural land use.

Pressures on fresh water

A variety of pressures affect the quality and quantity of fresh water. Some, like the weather, can't be controlled, but we can manage land use, water consumption and discharges. All bodies of water – lakes, rivers, aquifers, wetlands – experience natural fluctuations. But rainfall doesn't just determine water levels; it affects quality too, when it washes contaminants off the land.

Groundwater is recharged by rain that filters through the soil, but even during dry spells groundwater levels can rise when water leaks from rivers, lakes and wetlands. Geology also influences groundwater quality. The taste of groundwater is affected by where it comes from because it picks up the flavour of the aquifer. Water from shallow zones of active flushing (recharge areas) is very different to old, sluggish water.

These days, we know more about the way climate cycles affect our freshwater resources. The Southern Oscillation – with its two phases El Niño and La Niña – brings distinct weather patterns. We use the Southern Oscillation Index (which charts fluctuations in air pressure between Tahiti and Darwin) to develop models to predict drought. These models need ongoing testing, but they are proving to be a valuable tool for easing pressure on water resources.

Human activity, such as burning of fossil fuels, releases greenhouse gases into the atmosphere, causing it to heat up. This is predicted to alter the region's climate in a number of ways. Between 2070 and 2099, it's been forecast that:

- average summer rainfall will rise by five to 10 per cent in Kapiti and in Wellington, Porirua, Hutt and Upper Hutt Cities, but will decrease by up to five per cent in eastern Wairarapa
- summer droughts are more likely in the Wairarapa
- average winter rainfall will climb by 10 to 15 per cent in Kapiti and in Wellington, Porirua, Hutt and Upper Hutt Cities, but will drop by up to 10 per cent in the Wairarapa
- the risk of heavy rain is expected to increase across the region. Specific changes are likely to depend on catchment characteristics and the amount of temperature increase
- temperatures will rise by between 0.8° C and 2.7° C throughout the region.

Water shortages will likely hit hardest in the east of the region, where less rain will lower river flows and slow recharge to groundwater systems. We don't yet know enough about climate variability to estimate drought risk in Kapiti, but higher summer temperatures will almost certainly drive up water demand.

Pressures from land use

Runoff from agricultural land (which covers 55 per cent of the region) can carry bacterial contamination, nutrients and sediment into rivers and lakes. A high proportion of our rivers fail guidelines for stock drinking water because bacteria in animal effluent get into the water. Livestock access to rivers and stock crossing streams can aggravate these impacts.

Dairy farms and piggeries produce large volumes of effluent and contaminated wash water. Prior to 1994, this effluent was routinely discharged into rivers and lakes. Nowadays, however, this waste is applied to land.

Stock trampling stream banks releases soil into the stream, and their effluent pollutes the water with bacteria and nutrients.

Land cover is a good indicator of land use, which can have a direct bearing on water quality. Of the 15 sites with very good water quality in Figure 2.2, all but one were covered in indigenous vegetation, whereas pasture or urban development cover all but one of the ten poor sites.

In urban areas, runoff from earthworks and hard surfaces like roads, tar seal, and concrete contaminates urban streams. The amount of impervious cover in a catchment is a useful and accurate indicator of urban pressure on water quality – research shows that stream health declines when impervious cover exceeds 10 to 15 per cent. No regional estimates have been done, but impervious cover in our urban areas is likely to be higher than that.

Greater Wellington monitors groundwater at 80 sites in the region, and we've found water quality to be highly variable. Water quality is determined mostly by natural processes, but at 17 monitoring sites there is some evidence of farming or horticulture influences.

Animal effluent, fertilisers and soil cultivation can push up levels of nitrate, ammonium, phosphorus and potassium in groundwater. Pesticides and herbicides also find their way into aquifers. The use of nitrogen-based fertilisers has increased markedly over the past 12 years as the agriculture sector strengthens – there has been an increase of urea-based fertiliser in the region of roughly 900 per cent between 1992 and 2004. Contamination from septic tanks is suspected at a number of locations, including Riversdale Beach and Te Horo.

While we haven't detected any significant deterioration in the region's groundwater quality, care is still needed, because groundwater is very slow to respond to contamination – anything from two to more than twenty years. The current monitoring network is being reviewed because it may not detect changes early enough to stop deterioration.

Pressures from water abstraction

At December 2004 there were 659 resource consents to take water in the region – 200 for surface water and 459 for groundwater. Most of these are in the Wairarapa (just over 150 surface water consents and 318 groundwater consents). Irrigation is the single largest use of water there. In the western part of the region, abstraction is mostly for public water supply, with some irrigation in Kapiti.

The amount of surface water allowed to be taken in the region has risen since 1999. Prior to 2003, much of the increase arose from irrigation demand. More recently we've seen a notable jump in surface water allocated to vineyard frost protection around Martinborough – a relatively new water use in the region.

Currently, 539,101 cubic metres per day of groundwater is allocated regionally, nearly double the 1996 volume. Figure 2.9 gives allocation trends in different parts of region over the last nine years. The Wairarapa accounted for almost all groundwater allocation growth. The only notable exception is an increase in Kapiti in 2004, with the granting of the District Council's water permit for a new public supply wellfield. Greater Wellington has recommended that no additional water be taken from seven surface water management zones in the Wairarapa.

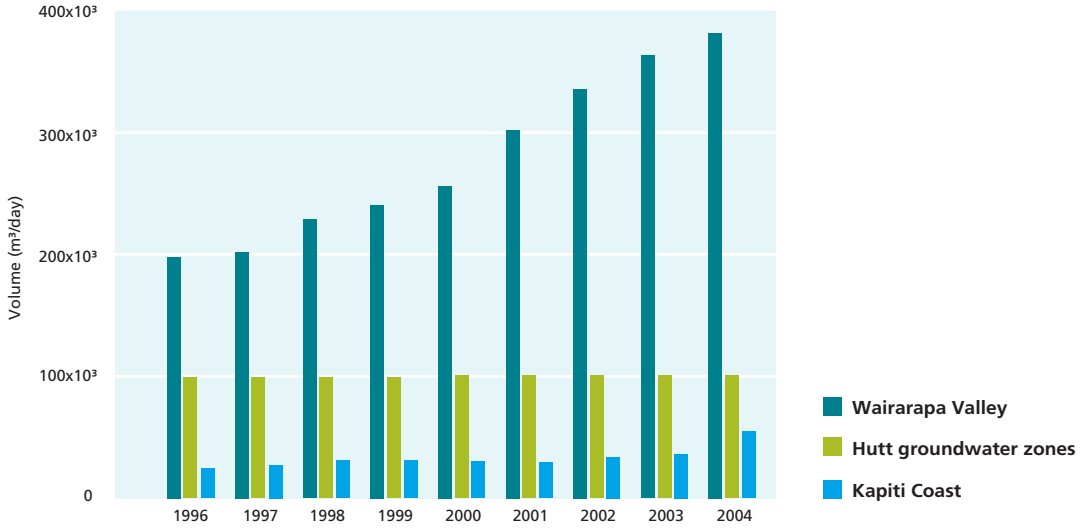


Figure 2.9:
Volumes of groundwater allocated for use in the Wairarapa, Hutt Valley and Kapiti from 1996 to 2004.

We expect more water will be needed for public supply as our population increases. For example, in Wellington, Porirua, Hutt and Upper Hutt cities, the population is predicted to grow from 367,600 to 377,000 by 2008. We also expect demands on water for irrigation and vineyard frost protection to increase, particularly in the Wairarapa.

Table 2.2 shows rivers shaded blue that are allocated through minimum flows and/or allocation limits in the Regional Freshwater Plan. Of the 13 sections of rivers with allocation limits, 10 are more than 80 per cent allocated. All four sections of rivers managed solely by minimum flows are also fully allocated.

Rivers shaded green in Table 2.2 do not have minimum flows or allocation limits set in the Regional Fresh Water Plan, but are considered to be under pressure from abstraction and are the highest priority for setting minimum flows and allocation limits.

Table 2.2:
Allocation of water from rivers in the region. Some consents specify that abstraction can only occur at high flows. Their abstractions do not affect the allocation limit, which applies at low flows. The rivers in bold may also be affected by streamflow depletion from nearby groundwater abstractions.

Rivers	Allocation limit (litres/sec)	Total amount allocated (litres/sec)	Percentage of allocation limit used
Dock Creek and tributaries		207	
Huangarua River, Ruakokoputuna Stream		244	
Kopuaranga River	125	125	100 per cent
Makahakaha, Mangahuia, Maringiawai Streams		46	
Mangatarere River	320	276	89 per cent
Otakura Stream, Battersea Drain		74	
Papawai Stream, Tilsons Creek		226	
Parkvale Stream and tributaries, Booths Creek		279	
Ruamahanga River from its headwaters to the confluence with the Waiohine River	800	1171	97 per cent
Ruamahanga River from Waiohine River confluence to CMA boundary	1500	1223	81 per cent
Tauherenikau River, Murphys Line Drain, Taits Creek	405	472	84 per cent
Tauweru River and Kourarau Stream		215	
Waingawa River, Hyslops Drain, Kells Stream	1040	1089	100 per cent
Waiohine River	740	734	99 per cent
Waipoua River	90	209	88 per cent
Whangaehu River (northern)		28	
Hutt River to the confluence with the Pakuratahi River	Not specified	1850	
Hutt River from Pakuratahi River confluence to CMA boundary	300	131	44 per cent
Orongorongo River and its tributaries	Not specified	1132	
Wainuiomata River, Gollans Stream	Not specified	999	
Mangaone Stream	25	28	100 per cent
Otaki River	2120	24	1 per cent
Waikanae River and tributaries	Not specified	478	
Waitohu Stream	57	32	56 per cent

Aquifers in several of our groundwater zones are fully allocated or close to it. The volume of water set aside for public water supply from the Waikanae and Lower Hutt groundwater zones is more than 80 per cent of their safe yields.

In the Wairarapa, shallow aquifers in the Tawaha, Riverside, and Ruamahanga groundwater zones are also more than 80 per cent allocated, as are the deep groundwater aquifers of the Kahutara (a sub-zone of the Lower Valley groundwater zone), Martinborough Terraces, and Parkvale.

Investigation of the Parkvale, Kahutara and Martinborough Terraces groundwater zones prompted us to review the way we estimate safe yields in the region. The abstraction of groundwater is depleting these aquifers. Figure 2.10 is an example of declining groundwater levels from a well in the Kahutara zone due to taking water over the last 12 years. The red and blue dots respectively denote the annual minimum and maximum groundwater levels in the well.

Underestimating the recharge to deep groundwater systems means the depletion of aquifer storage and lower well yields. We now believe a better way to estimate safe yields is to look at how much water is discharging from an aquifer, rather than how much is going in.

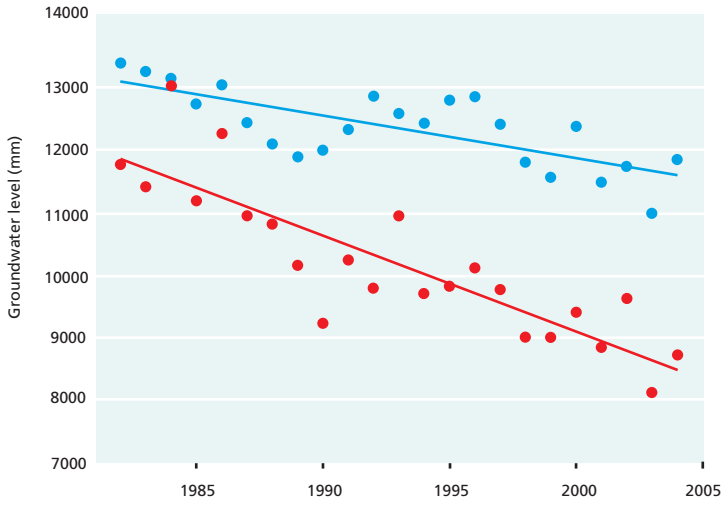


Figure 2.10:
A well in the Kahutara groundwater zone in the Wairarapa shows changes in the annual maximum (blue) and minimum (red) groundwater levels. The reduction of groundwater levels over the 12 year period indicates that current yields are not sustainable.

We already use discharge models for the Lower Hutt aquifer and the shallow groundwater resource in the Paraparaumu-Waikanae area. The Lower Hutt safe yield is mainly designed to prevent sea water intrusion, but it does illustrate the discharge from an aquifer usually limits the amount of water that can be taken.

The relationship between groundwater takes and safe yields is based on the volumes allowed by resource consents. Because very few takes are metered, actual groundwater use is poorly known. Those takes that are metered are typically read before and after an irrigation season to give a bulk value.

Actual and consented takes for metered wells are shown in Figure 2.11, which shows the actual use compared with allocated use as a percentage. The limited data we have indicate that around 20 per cent of the allocated volume is actually being used – a finding consistent with other regional councils. This discrepancy arises partly because irrigators typically apply for the amount of water they estimate they might need to get them through dry spells, which only occur infrequently. Consequently, unused but allocated water is effectively locked up for the rest of the time. Although this lends a margin of safety, it does prevent any new groundwater users.

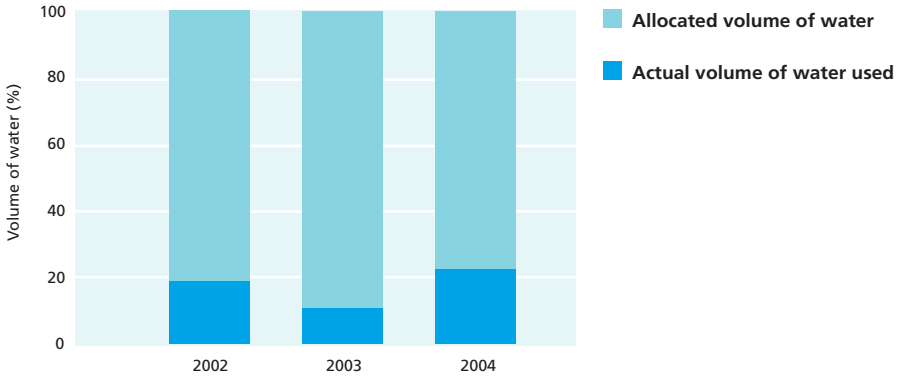


Figure 2.11:
Actual use compared with the amount of water allocated by resource consents for Wairarapa groundwater users. Only about 20% of water allocated in resource consents is actually used.

It may be that there is room for more efficient allocation and use. One way would be to meter all consented water takes, which would enable us to better correlate actual and allocated use. Another possibility is to promote water trading, so that another irrigator can make use of a consent holder's unused water. The paradox of trading however, is that everyone wants the water when it is most scarce.

Irrigation studies in the Wairarapa suggest some water is wasted. Movement of irrigation water through the soil profile was monitored in different substrates. At the vast majority of sites, more water was being applied than could be held in the soil, which meant that a proportion of irrigated water recharged the shallow groundwater. To stop such waste, we need to better understand water requirements under differing crop, soil and climatic conditions.

Discharges to surface water

At December 2004, there were 175 resource consents to discharge to surface water. Around 30 applications have been granted each year over the last decade. Most are for small or infrequent discharges of minor impact, such as temporary construction.

These oxidation ponds, which treat Featherston's sewage, discharge to fresh water.

Larger, more disruptive discharges in the region come from municipal wastewater (sewage), wet weather sewer overflows, urban and industrial stormwater, dairy effluent, water treatment plants, landfills, major earthworks and large flood protection schemes. The number of resource consents granted for these discharges has fallen in the last ten years. Treated sewage discharges to the Wainuiomata River and Ngarara Stream have ended and the Mangatarere Stream now only receives treated sewage from Carterton during winter. Over the same period, dairy shed discharges to water have plummeted – from 63 to just three.

Water quality is at its best in the headwaters of many of our rivers, typically in unmodified mountain ranges. As the rivers flow through lowland pasture and urban areas to the sea, their quality deteriorates because of discharges from municipal wastewater (in the Wairarapa), urban stormwater, and runoff from agricultural land.

The Ruamahanga, our longest river, is a case in point. It rises on the northern boundary of the region and flows through the Wairarapa valley to the coast in the south. We sample the Ruamahanga at five sites (shown in Figures 2.2 and 2.3) and the water quality and biological health slips from very good at the top of the catchment to fair at the lowest site.

Along with treated sewage from Rathkeale College north of Masterton, four of the five main Wairarapa urban centres discharge wastewater loaded with nutrients (nitrogen and phosphorus) directly into the Ruamahanga River or its tributaries. Figure 2.12 shows the phosphorus and dissolved reactive phosphorus concentrations increasing at consecutive monitoring sites along the river. The dashed lines in the Figure represent corresponding target values for aquatic ecosystem health.

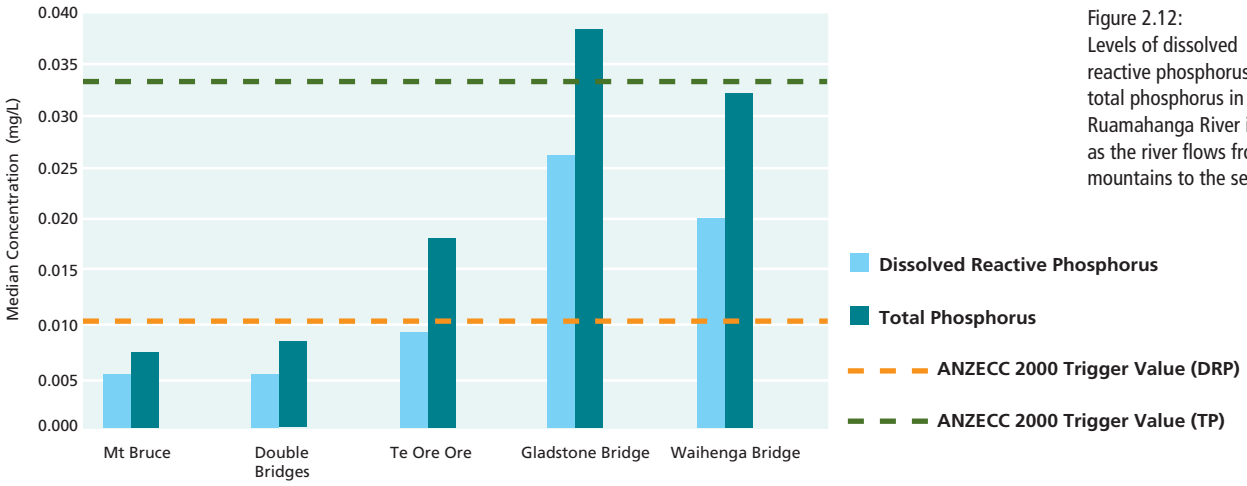


Figure 2.12:
Levels of dissolved reactive phosphorus and total phosphorus in the Ruamahanga River increase as the river flows from the mountains to the sea.

What's being done

Water quantity

Our Regional Freshwater Plan includes the following provisions which aim to reduce abstraction pressures on fresh water:

- allocation limits and minimum flows for certain rivers and streams
- collection of information to set minimum flows and allocation limits in other rivers liable to water shortages
- target levels for Lake Wairarapa
- safe yields for all groundwater zones
- a priority for public water supply over other uses
- a maximum allocation of water for irrigation of 350 m^3/ha/week
- preferring groundwater use as an alternative to surface water use.

The Plan allows up to 20 cubic metres of water per day to be taken without consent (except for water taken from the Hutt groundwater zone). All other abstractions need resource consents.

River flows, lake levels, groundwater levels and water abstraction are monitored around the region as part of our regular monitoring programmes.

Since the last *Measuring up* in 1999, instream habitat assessments have been completed on the Wainuiomata, Hutt, Waikanae, Waipoua, Kopuaranga, Mangatarere and Upper Ruamahanga rivers. We have a programme in place to maintain flows for instream values and set allocation limits in those rivers under abstraction pressure. Priority rivers are shaded in green in Table 2.2.

For groundwater, reviews of safe yields for the Waikanae, Hutt, Martinborough, Parkvale and Kahutara groundwater zones are complete or in progress. Safe yields for the Waikanae and Hutt groundwater zones are satisfactory, but results from the Wairarapa groundwater zones hint at flaws in previous methodology, and have prompted a comprehensive review of Wairarapa's groundwater availability.

Water quality

The quality of water in a number of the region's lakes and rivers could be improved, and these are identified in the Regional Freshwater Plan. The Plan allows the discharge of a few minor contaminants and the discharge of stormwater subject to conditions. All others require resource consents.

We follow up all reported pollution spills, and draw on enforcement procedures in the Resource Management Act 1991 (RMA) when necessary.

The impacts of stormwater discharges in urban streams and coastal waters are being investigated to see whether they meet the minimum standards of the RMA. In addition, Greater Wellington is committed to the preparation of a stormwater action plan for the region, in partnership with city and district councils.

In 2002, the Council adopted a riparian strategy to minimise impacts of rural land use on freshwater. It includes pilot projects at the Enaki Stream near Carterton, the Kakariki Stream near Waikanae and the Karori Stream in Wellington City. The Strategy also directed us to target financial assistance to high quality catchments, which we are now doing through our *Streams Alive* programme. Ration and Glendhu creeks, the Waitohu, Karori, Owhango and Waihora streams and the Otaki, Mangaroa, Wainuiomata, Kaiwhata, Waiohine and Upper Ruamahanga rivers all qualify for funding through the *Streams Alive* programme. In other catchments, Greater Wellington provides landowners with information and advice about riparian management.

Results from the pilot projects show health improvements in two of the pilot streams (Enaki and Kakariki) within two just years of fencing and planting. The third project site on the Karori Stream, did not respond so quickly – a reflection of the dominating impact of contaminated stormwater from the large residential area upstream.

Through Greater Wellington's social marketing campaign *Be the Difference* we have raised awareness of the harmful effects of urban stormwater on streams and promoted personal action among residents to help keep streams clean.

Regional councils around the country are parties to the Dairying and Clean Streams Accord with Fonterra, the Ministry for the Environment and the Ministry of Agriculture and Forestry. In the Wellington region, Fonterra and Greater Wellington have drawn up an Action Plan to implement the Accord.

Greater Wellington established the *Take Care* programme to fund and support community environment projects. Currently, there are 25 fresh water projects such as riparian planting and wetland restoration. Fresh water is a major focus of *Take Charge*, a pollution prevention programme to improve the environmental performance of small and medium sized businesses.

Take Action is Greater Wellington's environmental programme for schools – a five to six week programme aimed at eight- to 12-year olds. Our environmental educators work with school children, showing them how to care for water and the environment in their daily lives.

Where to from here?

Despite occasional shortages, we have enough surface and groundwater to meet our needs for now, but water use is at a critical stage. We must look at some new management approaches if we're to meet people's needs in future. In the short term, we can:

- Require metering of resource consents for all water takes from fully- or close to fully-allocated water resources.
- Review safe yields for fully-allocated groundwater in the Wairarapa, using a revised methodology based on aquifer discharges.
- Develop minimum flows and water allocation for the rivers shaded yellow in Table 2.2.
- Get a clearer picture of water demand in the Wairarapa to provide for the needs of future generations.

In the longer term, we can:

- Use our improved understanding of climatic cycles to manage water better.
- Develop minimum flows and water allocation limits in all rivers where water is taken.
- Ensure that irrigation water is used efficiently.
- Develop ways of estimating Wairarapa crop soil requirements based on soil and climate.
- Look at systems for transferring and/or trading of water permits.
- Develop models for stream flow depletion caused by groundwater abstractions near rivers and streams.

Surface water quality is generally staying the same but we have recorded some improvements. The number of major discharges to rivers has decreased. There are some notable improvements as a result of removing sewage discharges from the Wainuiomata River and the Ngarara Stream in Waikanae.

By June 2005 there were there were only three discharges of dairy effluent made directly to water compared with 63 discharges ten years ago.

While improvements in water quality can be identified in some rivers, in other rivers it has not improved. There is growing evidence that stormwater discharges are having significant adverse effects on urban streams, our coast, and especially our harbours (see **Coastal Environment**). We are currently working with city and district councils to work out how to reduce the effects of these discharges. Increased awareness of the effects of stormwater discharges is being highlighted by people's growing interest in urban streams, and their desire for streams to be healthy.

Streams and rivers flowing through rural land are showing bacterial numbers over guideline levels for stock drinking water, with seven of the ten sites that we have classified as having "poor" water quality being rural streams. In some rural areas, land use is intensifying and discharges of animal effluent and nitrogen fertilisers to land have increased. We need to work closely with landowners to make sure that these things happen at a rate that the land can take.

Our freshwater resources are now being helped by actions that were not in place when we prepared *Measuring up* in 1999. Greater Wellington's *Be the Difference* social marketing campaign, Care Groups, programmes aimed at schools (*Take Action*) and small to medium sized industry (*Take Charge*), the Fonterra Accord, and our *Streams Alive* programme for riparian plantings are all supported by communities. They will all lead to greater community involvement in the management of our water bodies.

More Information

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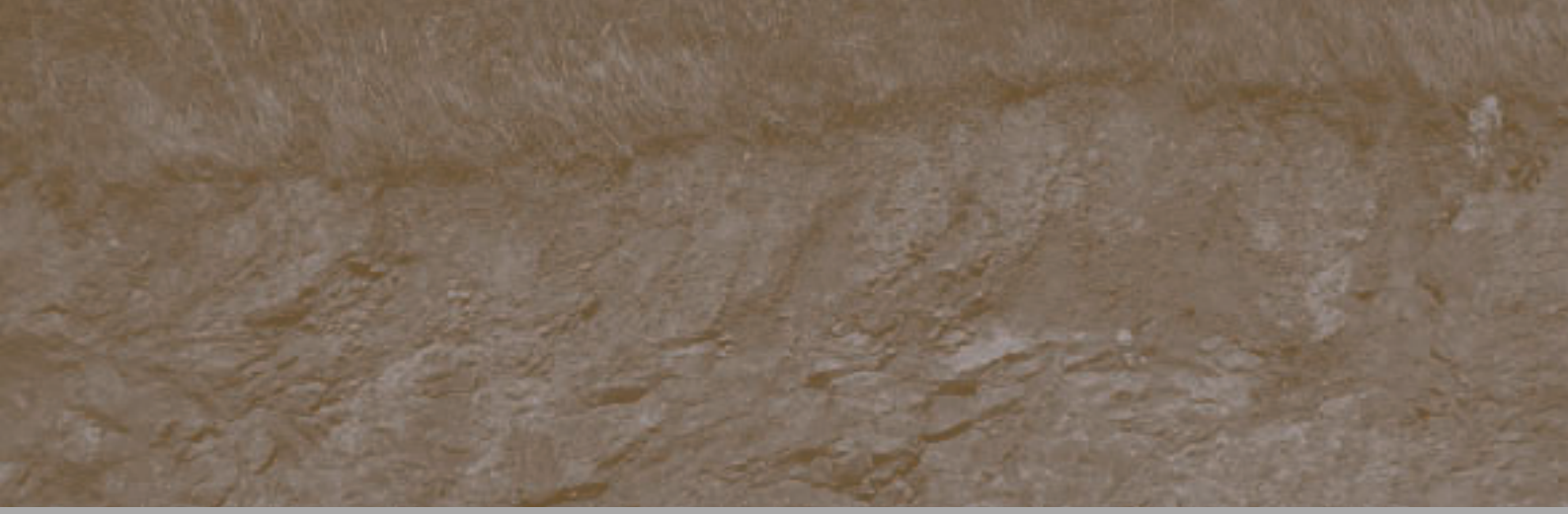
Soils



Objectives

1. The soils in the Wellington region maintain those desirable physical, chemical, and biological characteristics, which enable them to retain their life supporting capacity and to sustain plant growth.

2. Land degradation is limited to that for which there is no feasible remedy.

Doing well

- About one third of the soil sites tested in the region have good soil quality.
- Over 98 per cent of the region's soil is 'intact' – meaning it is not currently eroding.
- Background levels of heavy metals in soils are within the range expected for uncontaminated soil.

Must improve

- Sixty per cent of erosion-prone land (140,000 hectares) has no woody vegetation.

Earthly wealth

Soils are crucial to life on Earth. Without them, most of the world's plants could not have evolved. They are the foundation of all terrestrial food chains and ecosystem health and are a more complex phenomenon than people might first realise. A healthy soil is more than just dirt or mud – it contains air, water and organic matter, formed over eons by climate and geology.

The region's soils are vital to our economic wealth, so Greater Wellington aims to conserve and protect soils by controlling the way we treat them. In this chapter, we look at if, and how, we are meeting those objectives.

Soil quality

Anyone with a veggie patch knows the value of good soil, which rewards good management with years of healthy harvests. Greater Wellington aims to mimic that notion on a regional scale, preserving soils so they go on sustaining the plant growth and animal productivity we need to live.

Soil quality is a relative notion and we can say that, at best, it describes how well a particular soil stacks-up with an intended land use. Growing grapes for example, doesn't require soils of high quality – some of the region's best wine is grown on soils that would be described as having moderate to low quality.

Only about one per cent of the region's soil might be regarded as high quality – mostly found in and around Otaki. Between one and four per cent of the Wellington region is made up of soils of moderate quality – meaning they need some fertiliser to maintain productivity – while the remainder is quite poor.

This is a typical soil-profile found in many western parts of the region – greywacke rock overlain by yellow-brown (loess) siltstone with pasture. The greywacke is highly fractured and broken. The loess – a clayey silt blown in during last Ice Age – sits on top. The break between the two represents a geological time gap of some 200 million years. The loess has moderate to low quality.

Where we are now

Soil quality monitoring

In the last *Measuring up* in 1999, we said that Greater Wellington lacked up-to-date information on soil quality in the region. Since then, we have started surveying our soils. The first foray into soil monitoring was when Greater Wellington joined the *500 Soils Project* – a Ministry for the Environment, Landcare Research, and Crop and Food Research, led initiative. This nationwide project has now finished, but Greater Wellington has continued doing soil tests using the same monitoring criteria developed by the project. Under *500 Soils* Greater Wellington monitored 50 soil sites, and since the project finished in 2001, has added another 67 monitoring sites.

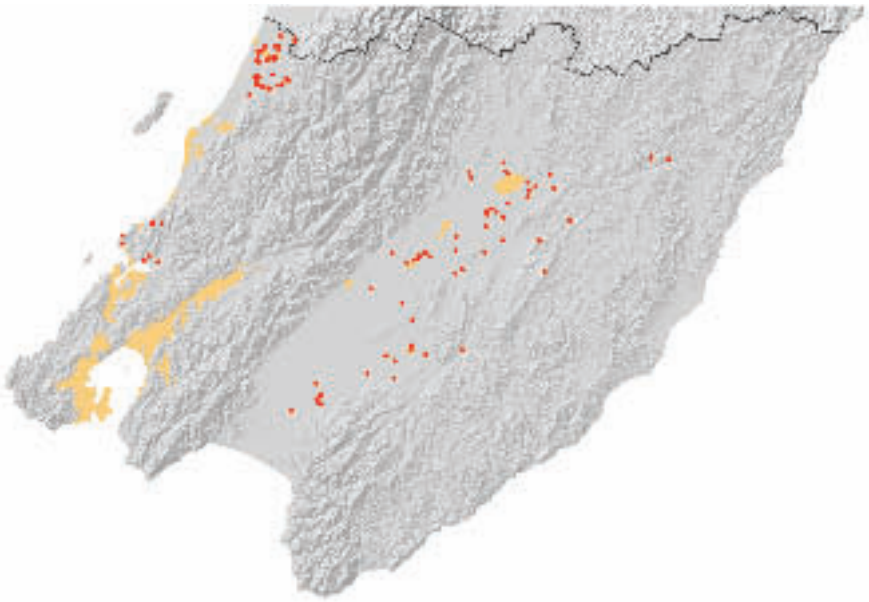


Figure 3.1:
These are the sites where we have checked soil quality. But 117 soil sampling sites in a region of 8,136 square kilometres (or 813,600 ha) only gives us pinpoints of information about soil quality. The sampling programme assesses how different soil types are coping under different land uses.

We tested for soil quality against three main criteria: physical, chemical and biological properties. The physical criteria measure – structure, density and porosity. The chemical criteria measure – pH (is the measure of a soils acidity or alkalinity), carbon and nitrogen contents. And finally biological criteria measure the organic content of a soil. Data were sorted according to land use and soil type, and soil quality indicators were compared against a standard target scale. Analysis gave a comparison of soil quality in the Wellington region with the rest of the country.

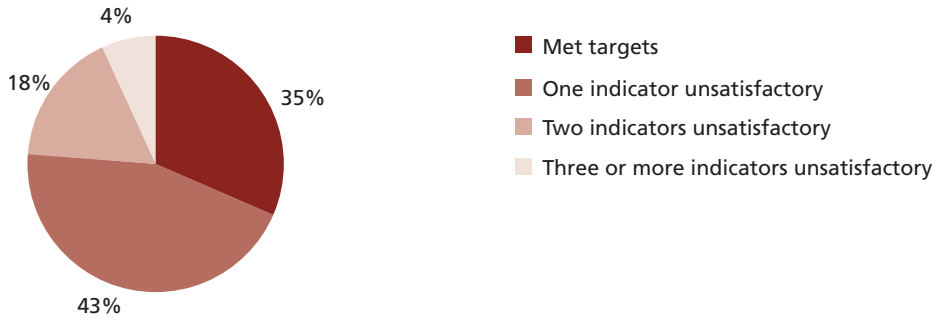


Figure 3.2:
Thirty-five per cent (40 sampling sites) met all soil quality targets. A further forty three per cent (50 sampling sites) had one indicator that failed to meet the target range. Eighteen per cent (21 sampling sites) failed on two indicators, while just four per cent (four sampling sites) failed on more than two indicators.

A closer look at the soil quality target indicators is shown in Figure 3.3. Soil compaction (the compressing of soil particles by heavy machinery or heavy hoofed stock) was the most common reason for a site not meeting its soil quality target (41 per cent of sites sampled). Higher fertility measured by Olsen-P (means the soil has excessive plant available phosphate) occurred on 24 per cent of the sites samples. The fertility levels on these pastures were well in excess of the amounts needed for maximum agronomic benefit.

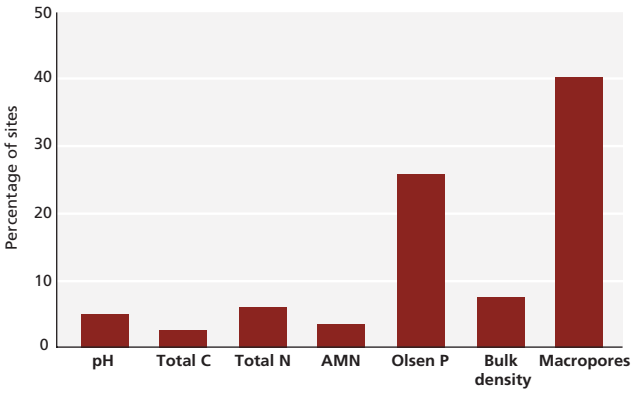


Figure 3.3: Proportion of sites not meeting target ranges for seven key soil quality indicators.

Sampling sites on cropping land showed low levels of aggregate stability, high Olsen–P, and low bulk density. This suggests the soil is over-cultivated with high rates of fertiliser application. The soil may be subject to further wind erosion if left fallow at different windy times of the year.

The proportion of sites that met soil quality targets in the region (35 per cent) was slightly greater compared with the proportion in other parts of New Zealand (32 per cent). This proportion is affected by the sites that are chosen for sampling. If other regions sampled more 'at risk' sites (these are sites known to be under stress from different land uses) then it is likely that a greater proportion would not meet the soil quality targets.

Weaknesses found in the Wellington region were reflected elsewhere, suggesting most regions are experiencing similar problems. The most common concern, soil compaction, afflicted 41 per cent of Wellington sites. Soil compaction is a problem because it reduces the air spaces (termed macroporosity) in a soil and so inhibits water (and nutrients) getting into the lower soil profile. As a consequence, overland flow can increase and there is less recharge of shallow groundwater. Soil compaction can be caused by continuous tracking of heavy machinery or from heavy hoofed stock standing in one

area for long periods. Research has found that if macroporosities get below 10 per cent, pasture production is hindered. Pastoralism is the largest single land use in the region, so any loss of pastoral soil quality has major implications.

Soil compaction was often coupled with very high fertility – well above optimum production levels. By putting so much fertiliser on the soil, farmers can eventually harm the water quality of shallow groundwater aquifers, while rain washes excess nutrients into streams where they exacerbate weed growth (see **Freshwater**).

Figures 3.4, 3.5, and 3.6 show the soil quality data for the three major land uses in the region; pastures, plantation forestry, cropping and horticulture. The seven soil quality indicators are shown for each land class.

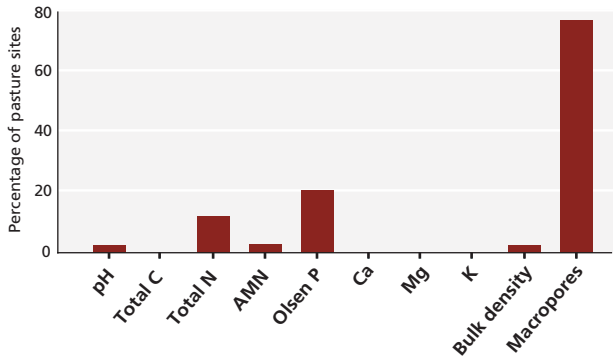


Figure 3.4:
Compaction (lack of macropores) is the biggest problem in pasture sites sampled. Over 70 per cent of sites showed moderate levels of compaction.

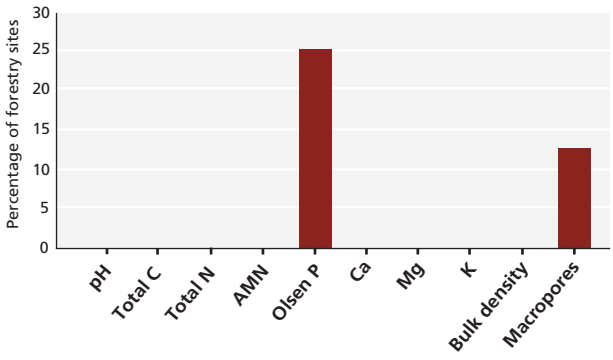


Figure 3.5:
Under plantation forests we found higher than usual levels of Olsen-P. We are not entirely sure why this should be, but it could be due to the previous land use – pasture.

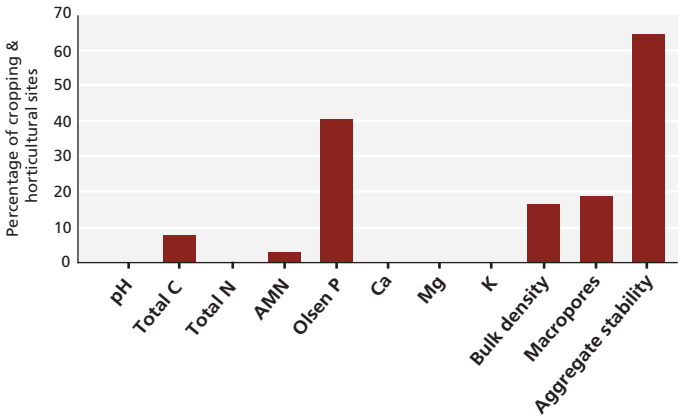


Figure 3.6:
High Olsen-P, low levels of bulk density, and very high aggregate stability (means the soil is too friable and won't hold together), were all issues for soils under cropping and horticulture.

Heavy metals in our soils

Heavy metals are found naturally in soils. Normally they occur at such low concentrations that they pose no threat to human health, but there are a few exceptions. Upper North Island volcanic soils are high in heavy metals – in the Auckland isthmus, nickel is present at levels that exceed current Australia and New Zealand Environment Conservation Council (ANZECC) guidelines.

There is some evidence that past intensive land use in parts of the Hutt Valley and Wellington city may have left them abnormally high in heavy metals. Copper, for example, was used extensively in orchard sprays, and this might be still present in Hutt Valley soils.

Greater Wellington checked heavy metal concentrations in the region's main soil groups in 2003. We found background concentrations of heavy metals in all five groups were very low compared with others around New Zealand, and all met health guidelines.

High levels of cadmium were found in dairy pasture, with slightly lower concentrations in drystock soils – probably from phosphate fertilisers – but these were still within human health guidelines.

Pressures on soil quality

Urban expansion and inappropriate land use are the main pressures on soil quality in the region. Urban development in particular has an irreversible effect, because it removes soil and locks up the land under buildings, roads, and other hard surfaces.

Sealed off this way, the soil is denied vital rainwater and cannot function as it should. The Hutt Valley was once very fertile and nourished a thriving patchwork of market gardens, but those rich soils have vanished beneath the urban landscape we see today.

Also under threat are the high quality soils around Otaki, Te Horo, Masterton and Carterton. These are the last naturally fertile soils in the region, but urban expansion could see them lost (see the Built Environment chapter for more information on the pressures from subdivision).

Poor farming practices can sap the soil quality of good productive land. Left unchecked, over-stocking and over-cultivation can damage soil structure, lowering crop yields and pasture growth and aggravating erosion.

Most of us assume that planting trees helps to stabilise soils and protects them from erosion. This is true to a certain extent, but trees – especially pine plantations – can alter the nitrogen and phosphorous levels in soils, and logging brings a greater risk of erosion, sometimes cancelling out the benefits from planting in the first place. Unless logging is done with care, silt can run into watercourses (see the Freshwater chapter for more information about freshwater streams in the region).

What's being done

Greater Wellington is not doing any soil quality protection work in the region, but will keep monitoring soil quality. Re-sampling is needed at least three – and preferably five – times for long-term detection and prediction of soil trends. This sampling will be extended to soils under scrub – an important land cover in our region.

Soil conservation

Soil conservation is all about managing land use to prevent erosion and soil loss. Erosion happens for all sorts of reasons; there are natural causes like heavy rain and flooding leading to slips, and there are human ones like over-grazing and poorly managed earthworks.

Earthworks can produce vast amounts of sediment. If allowed to run into waterways, this sediment robs fish and invertebrates of a vital habitat. Sediments eventually settle out into low-energy environments like lakes, wetlands and coastal estuaries, smothering habitat for fish and other marine life (see **Freshwater**). Objective two aims to protect land from further erosion.

Where we are now

Figure 3.7 summarises the results of a Greater Wellington study into soil impacts from different land uses and natural events. On stable land (see first circle of Figure 3.7) about 45 per cent (366,120 ha) of the region has 'intact', soils – meaning the soil has a cover – pasture or bush. Of these intact soils, 7 per cent (56,950 ha) has been disturbed in some way or another – cultivation and harvesting, grazing pressure, logging, roads, drainage and pond excavations. The actual percentage of bare soil on stable land is only 0.6 per cent (4,880 ha) of the region's area.

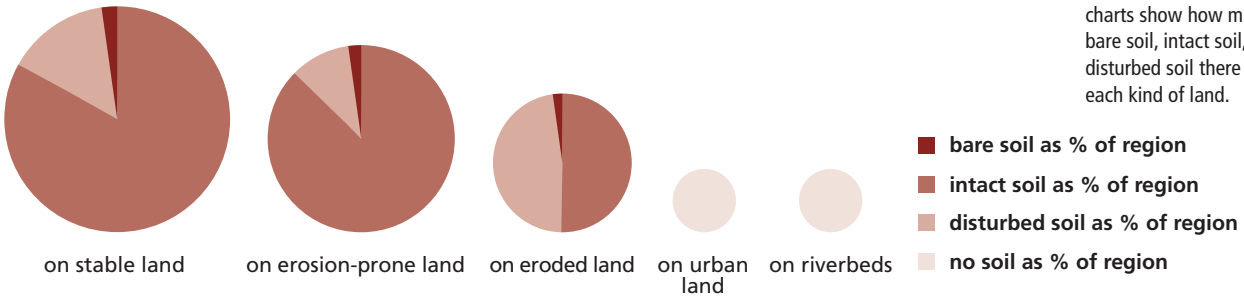


Figure 3.7:
These proportional pie charts show how much bare soil, intact soil, and disturbed soil there is on each kind of land.

We can say about 31 per cent (252,200 ha) of the region has erosion-prone land and that is currently stable. Of the 31 per cent, about 27 per cent (219,600 ha) contains intact soils, and only 4 per cent (32,500 ha) contains soil disturbed by land uses. The actual percentage of exposed soil is 0.4 per cent (3,250) of the region.

About 18 per cent of the region is eroded land that bears landslides, scouring of streambanks, sand blowouts in coastal areas, rockfalls, and recent scree slopes. We can see that about 9 per cent (73,000 ha) of it is now recovering, which means erosion scars have started to revegetate. The other 9 per cent (73,000 ha) has fresh scars interspersed with natural or modified plant cover. Only 0.4 per cent (3,250 ha) of eroded land is actually bare soil.

So what do these figures tell us about the state of the intactness of our land? About 1.4 per cent (11,390 ha) of the region's soil is currently bare enough to be in need soil conservation measures. Of this percentage, 0.4 per cent (7,300 ha) has been caused by poor management, and the remaining 0.4 per cent (3,250 ha) is caused by exposure to natural forces.

Pressures on soil conservation

Greater Wellington uses indicators to estimate how much bare land – under various land uses – is susceptible to erosion and soil loss, thus allowing for future comparisons. We can say the larger the area of exposed ground, the greater the risk of erosion.

Figure 3.8 shows the proportion of bare land under different land covers. To see whether any pressures can be influenced or controlled, it's helpful to split survey results into land under conservation use (natural cover), and land under rural use (mostly human development). Within each, there are estimates of the proportion of bare soil from natural and human influences.

Figure 3.8 shows, that 37 per cent (310,000 ha) of the region is under natural cover – forest, scrub and mountain vegetation – or semi-natural cover such as exotic scrub, coastal vegetation or wetland. Almost all of this land is considered intact. Just 0.1 per cent (800 ha) has been bared by human activities such as scrub clearance or roading, while a further 0.2 per cent (1600 ha) has been exposed by natural erosion processes like slips.

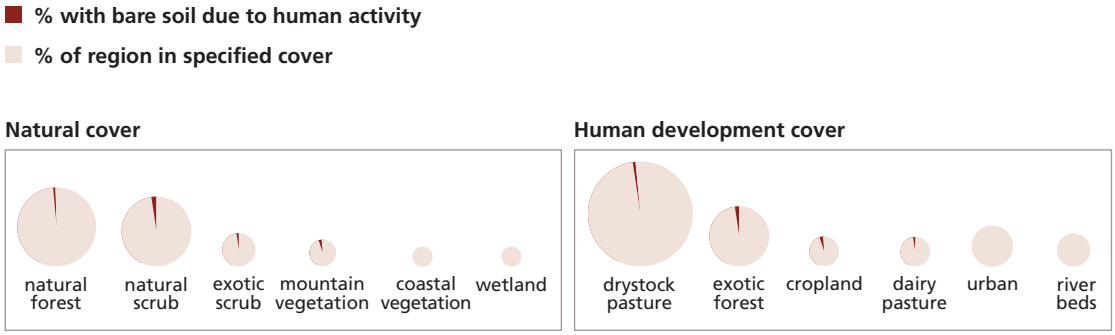


Figure 3.8: Proportions of bare soil under different land covers in the region.

Fifty seven per cent (463,750 ha) of the region is under some form of human-made land cover, mostly cropland, dairy and drystock pasture, and exotic forest. Of this, 0.8 per cent (6,500 ha) has been exposed to weathering effects by human activities, such as cultivation, livestock grazing, roads and tracks. Nearly three quarters of bare ground comes from just one land use - drystock pasture. Natural erosion bares another 0.2 per cent, again mostly in drystock pasture. The remaining 6 per cent of the region is covered by urban areas, river beds, and roads.

What do these figures tell us about the pressures on our land? Human activity currently exposes about 0.9 per cent (7,300 ha) of the region's land. Only 0.1 per cent of this occurs in natural covered land, where control is unnecessary or difficult – the remaining 0.8 per cent is on modified land where damage can be reversed by changes in management. Natural erosion exposes 0.4 per cent of our region's land – half of it in mountainous areas where control is not needed. The remainder occurs on farmland and forest plantations, where land management controls are necessary to remedy any erosion.

What's being done

We can let degraded soils heal naturally by leaving hillsides to revegetate, or we can use better pasture management and tree plantings. Responses differ from one land use to the next. The best remedy in dairy pastures, for instance, could be better cultivation and grazing practices – on drystock pasture, there might be some return to natural cover and changes to grazing management. Within the region, the most common strategy, however, is to plant trees with assistance from Greater Wellington.

Conservation planting programmes have been under way for some years now, targeting erosion-prone farm land in consultation with landowners. Figure 3.9 shows the extent of conservation cover on stable land – that is, vegetation dense enough to protect soil from exposure by land use. Cover is generally dense (lighter in the pie graphs below) in dairy and drystock pasture. One area of concern is the amount of sparse cover – freshly cultivated fields and emerging crops (darker in the pie graphs below) – on cropping and horticultural land. Another is the sparse cover in exotic forest plantations – harvest sites and recent plantings with no closed canopy. In native forest, scrub and tussock, sparse cover isn't a concern.

Figure 3.9:
The density of vegetative cover on stable land in the region.

Despite high soil exposure, there is little risk of erosion on cropping land as most of the land is low-lying and soil is only exposed for short periods. If left for any longer, however, high wind will increase that risk. A 1984 survey found that roughly 88,532 hectares of Wairarapa plains land was at risk from wind erosion. To counter this, Greater Wellington began a shelterbelt scheme to protect arable land. A total of 217.6 kilometres of shelterbelt shelter has so far been planted on 110 farms, protecting 15,028 hectares, or 17 per cent, of vulnerable soils.

Figure 3.10 shows the extent of conservation cover on unstable land. Unstable drystock farming and plantation forestry land covers 29 per cent of the region (235,940 ha). Grass does little to stabilise soil against erosion in these areas, whereas the deeper roots of woody vegetation hold soil longer.

By measuring the proportion of woody vegetation on different land uses, we can see where planting is needed. Forty per cent of drystock pasture on unstable land contains woody vegetation – half of it from natural regeneration. The other half comes from Greater Wellington conservation plantings. Eighty per cent of plantation forestry has woody vegetation on unstable land. Most are private plantings, though Greater Wellington funds about 4,000 ha of conservation woodlots or conservation forests. The remainder shows sparse natural reversion in canopy gaps, or young tree plantations that haven't yet closed over.

Dairying and cropping have woody conservation cover on half or less of their unstable land, which makes up 0.6 per cent of the region. Native forest, scrub and tussock on unstable land are a much larger part of the region – 37 per cent. Fortunately, more than three-quarters of it is covered in woody vegetation offering good protection from erosion.

Figure 3.10: The density of vegetative cover on unstable land in the region.

In summary, natural regeneration and private - and Greater Wellington-funded tree planting have adequately covered two-fifths of unstable land in drystock pasture, and about four-fifths of unstable land in plantation forest. Nevertheless more plantings are needed, particularly on drystock pasture.

Prospects for soil conservation

A typical erosion scene in the Wairarapa hill country – removal of the original cover has allowed water penetration into the lower soil layers accelerating the production of shallow slip movements like this one. The topsoil has been transported to the base of the slip and left as a humpy deposit. The slip scar will eventually heal, but will take many decades. Slips and scars reduce the production potential of the land, and result in loss of income for the land owner.

Human-induced erosion can be avoided by ensuring appropriate, compatible land use, but there will always be some natural erosion no matter how much cover the land has. Through policies and methods in the Regional Policy Statement, earthworks and vegetation clearance consents, farm conservation plans and assisted tree-planting, retirement fencing and pest control, we are gradually meeting objective two. There is still scope, however, for much more conservation cover on drystock pasture in the region's hill country.

One perceived problem with restoring land to its former state – or at least to a state acceptable to land users – is the time it takes. Recent work by Greater Wellington highlighted the issue of short-term views and reporting intervals that rarely fit comfortably with nature's more expansive timetable.

Greater Wellington needs to persevere with soil objectives over the long term. There is still work to do if we're to ensure that land management practices are sustainable across all uses.

More information

Denton, Paul, 2005. *Soils and minerals – background report*. Greater Wellington.

Coastal environment

Objectives

1. The natural character of the coastal environment is preserved through:
   (1) The protection of nationally and regionally significant areas and values;
   (2) The protection of the integrity, functioning and resilience of physical and ecological processes in the coastal environment;
   (3) The restoration and rehabilitation of degraded areas; and
   (4) The management of subdivision, use and development, and the allocation of resources in the coastal environment so that adverse effects are avoided, remedied or mitigated.

2. Existing provisions for public access to and along the coastal marine area remain and appropriate opportunities are taken to enhance public access.

3. Coastal water quality is of a high standard.

4. There are increased opportunities for the aspirations of the tangata whenua for the coastal environment to be met.

Doing well

- Most nationally and regionally significant areas are protected. Some by regional or district plan measures, some by covenants, and some by public ownership.
- Greater Wellington has supported 13 community groups in their efforts to restore weedy and eroding areas of the coast.
- For more than 75 per cent of the time over the last four summers, water quality was suitable for swimming at all 76 bathing beaches surveyed.
- Greater Wellington, the Wairarapa district councils and iwi have prepared the Wairarapa Coastal Strategy. This provides guidance on managing development pressures and impacts on natural character.

Must improve

- Plimmerton, Paremata and Titahi Bay beaches, both arms of Porirua Harbour, and Hataitai and Petone beaches regularly failed water quality guidelines over the last four summers. Sometimes bacteria levels were more than a hundred times over the limit.
- Stormwater is causing levels of DDT, copper, lead, and zinc in marine sediments of the Onepoto arm of Porirua Harbour to be high enough to harm aquatic life.
- Sedimentation rates in the Pauatahanui Inlet are climbing, and whether the amount of sediment entering the harbour can, or should be, slowed down is unknown.
- Opportunities for tangata whenua to meet their aspirations for the coastal environment are frustrated by the lack of coordination between the various government bureaucracies with their different roles and responsibilities.

“I must go down to the sea again…”

To grow up a New Zealander is to build sandcastles, eat mussels off a makeshift barbecue, dig in Lions Club treasure hunts and watch the surf life savers sprint for the sea.

The beach culture is part of the character of our coast, but natural elements – geology, ecology – also help to shape it. Preserving that natural dynamism while providing for people’s use and enjoyment needs delicate management.

Tangata whenua have especially strong links with the coastal environment, value its mauri and all it offers.

The Regional Policy Statement set four objectives for the coastal environment. These reflect our expectations for maintaining our connections with this special place, while keeping its natural character.

Preserving natural character

Where we are now

What appears at first to be a single, contiguous coastline is in fact an ever-changing mosaic of different environments, from the rugged, largely unmodified Wairarapa coast to the highly developed urban beaches of Wellington city.

In this environment, how do you define such an esoteric quality as “natural character”? For lack of any rigid prescription, it might be judged by the extent an area is still unmodified by humans – highly modified sites have a low degree of natural character, while pristine sites rate highly.

Sometimes modifications are obvious – a building or seawall, or a carpet of introduced weeds – but we can disturb the natural order in more subtle ways, interfering with processes like coastal deposition and tidal flushes. Modification of any kind inevitably dilutes an area’s natural character, but increasingly, people are working through community projects to rid the coast of weeds, remove rubbish, replant native vegetation and reverse the decline.

Under the Resource Management Act 1991 (RMA), preserving the coast’s natural character is a matter of national importance. It must be recognised and provided for in the New Zealand Coastal Policy Statement, regional policy statements, regional and district plans, and when making decisions on resource consent decisions.

Protecting significant areas

The Regional Policy Statement lists those coastal sites that are nationally or regionally significant for their ecological, landscape, seascape or geological values. Some are publicly owned and largely unmodified by development, while some privately owned sites are protected by covenants or other measures.

Provisions in district plans and the Regional Coastal Plan do a good job of protecting landscape and geological values, but they cope less well with ecological values, which are in a state of constant flux from pressures like weeds or human recreation. Regular checks are needed if we’re to know whether we’re meeting the objectives of the Regional Policy Statement.

Kohekohe on the Paekakariki escarpment. The Regional Policy Statement identifies coastal escarpments and small beaches from Paekakariki to Owhiro Bay as landscapes and seascapes of regional significance. With help from Greater Wellington, most of this escarpment was legally protected in 2001, and it has since been fenced to exclude stock.

Protecting physical and ecological processes

We disrupt the coast's special ecological processes by building inappropriate structures, through behaviour like driving on dunes and beaches – and by pollution. Three investigations give an idea of how the region's coastal ecosystems are coping with these pressures.

Life on Wellington Harbour beaches

Sandy beaches and river estuaries are an important part of our coastline – a home for shellfish, wading birds, and coastal wetland plants. Here, the saline environment of the sea meets the freshwater of the land. River estuaries, living larders of shellfish, worms, sand hoppers and snails for migratory wading birds, mostly feature along sandy parts of the coast. Unfortunately, we know little about most of them except for the Waikanae River estuary and Pauatahanui Inlet in Porirua.

Variable oystercatchers nest on sandy and shingle beaches. This makes them and their chicks vulnerable to injury and death if vehicles are driven on the beach. Photo: Dave Hansford.

Over the last two summers, Greater Wellington surveyed the beaches and river estuaries of Wellington Harbour, the south coast and Kapiti coast (Wairarapa coastline surveys are planned for 2005-06). Sites were sampled for nutrients, heavy metals and the presence and abundance of macroinvertebrates – small animals without backbones like sandhoppers. Petone beach supported the biggest variety of organisms, particularly in the intertidal zone. Lowry Bay had very few bivalve shellfish, but a similar range of worms to Petone. Fitzroy Bay, an exposed gravel beach at the harbour entrance, featured sand hoppers and one species of worm. The Hutt River estuary is dominated by pipi, cockles and a variety of worms. Results from the Kapiti coast were not available for this report.

Sediments provide food and habitat for many coastal invertebrates but heavy metals can undermine their vitality. Sediment quality guidelines from the Australia New Zealand Environment and Conservation Council (ANZECC) set out tolerances for heavy metal concentrations. The survey sites comfortably met ANZECC guidelines, probably because the coarse nature of their sediment allows heavy metals to filter straight through them.

Neither were there any obvious signs of excessive nutrient enrichment.

The study found our intertidal sandy beaches and river estuaries in Wellington Harbour in good overall health. Human impacts like stormwater discharges appear to be localised, and not threatening the health of these ecosystems.

Pauatahanui cockles

The Guardians of Pauatahanui Inlet, partnered with the National Institute of Water and Atmospheric Research, have surveyed the inlet's cockle population every three years since 1992. Their findings are compared with results from a study by the then New Zealand Oceanographic Institute in 1976, which reckoned cockle numbers at between 438 and 608 million.

The first Guardians' survey in 1992 estimated Pauatahanui's cockle population at around 220 million, and each subsequent census has returned a similar figure.

Adult cockles have declined slightly since 2001, but the number of juveniles has jumped, which bodes well so long as they enjoy reasonable survival. If they do, we'll know whether the inlet could sustain a bigger population, or if whatever caused the decline between 1976 and 1992 has permanently diminished its carrying capacity.

Guardians of Pauatahanui Inlet out counting cockles at Motukaraka West. Done every three years since 1992, theirs is possibly the longest running and most comprehensive series of cockle surveys undertaken by community volunteers in New Zealand. Photo: Dave Hansford.

Ecological effects of sediment contamination

Contaminants in stormwater discharges affect the animal and plant life of estuaries and shallow harbours. The sheltered Onepoto arm of Porirua Harbour, which drains highly urbanised catchments, is particularly vulnerable.

In 1997, we sampled sediments at 11 sites around the shores of both arms of Porirua Harbour and tested for contamination. We found that the sediment in two sites near the mouth of the Porirua Stream in the Onepoto arm had lead and zinc at levels high enough to start affecting aquatic life. The shellfish we sampled from that part of the harbour had high copper levels, but not over guideline levels.

Heavy metal levels in sediments around the shores of the Pauatahanui arm and the rest of the Onepoto arm were lower, and did not exceed any guideline levels.

In 2004, we sampled marine sediments in five more locations in Porirua Harbour, this time the subtidal sediments away from the shore. We found levels of copper, lead and zinc potentially high enough to harm the aquatic life of the Onepoto arm of the harbour. DDT has accumulated in both arms of the harbour to levels where it may harm aquatic life.

While mercury levels are a concern in the sub-tidal sediments of the Onepoto arm – as is copper in Browns Bay in the Pauatahanui arm – concentrations of arsenic, cadmium, chromium, mercury, nickel and silver in both arms of the harbour were all below guideline limits. All metals except cadmium were higher in the Onepoto arm than the Pauatahanui.

This sort of study is being repeated every two or three years, to keep a watching brief on contaminant levels in the harbour. We need to find out how fast these contaminants are building up, and when they will be high enough to permanently affect the ecosystem. At the same time we have to work out how to stop that happening.

What's being done

Preserving natural character

In 2004, Greater Wellington, the Wairarapa district councils and iwi produced the *Wairarapa Coastal Strategy*, which looks at, among other things, what communities value about the coast and how they want it managed. The Strategy recognises the need to preserve the coast's natural character and its policies and guidelines aim to help manage development pressures and impacts on that character.

Greater Wellington and the Wairarapa district councils contracted landscape consultants Boffa Miskell to identify sites of high ecological significance on the Wairarapa coast against criteria such as:

- a predominately indigenous vegetation
- a native plant community past pioneering stage
- offering a long term habitat for indigenous fauna
- the presence of duneland systems or estuaries.

Boffa Miskell found 64 significant sites covering 1544 hectares – around ten per cent of the Wairarapa coastal environment. Many of them are on private land and have no formal protection. The study found that nearly three quarters of the Wairarapa coast retains moderate to high natural character – in fact, it gave no low rankings anywhere except within residential areas.

Information from the *Wairarapa Coastal Strategy* has been used in the development of the Wairarapa combined district plan, and will be used in the upcoming review of the Regional Policy Statement.

Restoration of degraded areas

Greater Wellington established the community environmental care programme *Take Care* in 2000. Since then we have supported 13 voluntary groups who are restoring and rehabilitating degraded coastal sites.

The Eastbourne Care Group have been removing marram grass, boneseed, and horned poppy from these dunes since 2004, and have nearly eradicated the invasive tree medick. Now the group is planting native grasses and returning natural character to this part of the coast.

Over the last five years the Waitohu Stream Care Group has been protecting the dunes near the mouth of the Waitohu Stream, replanting with spinifex and pingao from their own nursery. Managing rabbits and dune buggies provide a greater challenge.

Care groups at Otaki, Paraparaumu, Days Bay, Island Bay, Castlepoint and Riversdale Beach are tackling dune erosion by fencing them off and replanting with the native sand binding grasses spinifex and pingao.

At the Waikanae Estuary scientific reserve, Paekakariki escarpment, Eastbourne and the Motuwaireka Estuary at Riversdale, volunteers have concentrated on weed removal, replacing them with native plants.

City and district councils take on coastal restoration and rehabilitation projects of their own – Wellington City Council's cleanup of the old Moa Point sewage outfall and purchase and restoration of land around the Owhiro Bay Quarry are just two examples.

Projects like these are helping return natural character to areas of the coast. They benefit the coastal ecosystems, and bring enjoyment to everyone who visits.

Understanding sedimentation of Pauatahanui Inlet

In 2000, Greater Wellington and Porirua City Council adopted the Pauatahanui Inlet Action Plan to "enhance the quality of the environment by protecting the integrity of existing ecosystems and by restoring degraded ecosystems wherever possible." The Pauatahanui Inlet Community Trust was established in 2002 to oversee the implementation of the Plan.

The Plan aims to tackle a variety of concerns raised by community groups, the most serious of which is sedimentation. Most inlets receive sediment – some may even fill up over time – but large-scale earthworks can accelerate the process and disrupt ecological flows.

In 2004, Greater Wellington and Porirua City Council commissioned two interrelated studies to better understand the impacts of land use in the Pauatahanui catchment, and the consequences of sedimentation for the inlet.

The studies found that sedimentation rates had climbed from a pre-human one mm per year to the current 4.6 mm in the wake of forest removal, conversion to pasture and other developments.

Strong prevailing winds that stir up and re-suspend the sediment, and a vigorous tidal flush that effectively changes the water every four days, help to slow the rate of deposition, but the study concluded that those influences are no longer coping with the increasing amount of sediment entering the inlet.

Where to from here?

Subdivision, and a subsequent shift from rural to residential land use, is the most pervasive pressure on the coast's natural character, including its ecosystems and how they function. Since 1999, coastal land has been split into 4,481 new lots, mostly along the Kapiti coast, where the District Council has dealt with the effects by putting a coastal dune environment zone in its district plan. Proposed coastal subdivisions must meet prescribed standards and a coastal reserve must be set aside if the new lots are small (less than four hectares).

Nearly half the new lots in the Wairarapa since 1999 were created at Riversdale in a single year – 2005. Mitigation works included revegetation and rehabilitation of gullies and wetlands. If development pressures increase there over the next decade, more protection will be needed for areas high in natural character. This could be secured through policies in a combined district plan being prepared by the Wairarapa district councils.

Since 1999, Greater Wellington has granted 287 permits for activities in the coastal marine area – essentially anywhere seaward of the high tide mark. Only nine permits were granted in the Wairarapa, and those were mainly for erosion protection works. The rest were mostly for work around Wellington Harbour, including development of the new beach at Oriental Bay and changes to the Wellington Waterfront.

Associated with these development pressures is people's ongoing use of the coastal environment. Driving on most beaches in the region is allowed in the Regional Coastal Plan, but needs a resource consent in some areas of significant conservation value (like Pauatahanui Inlet), and is prohibited on one beach (Titahi Bay in Porirua).

Greater Wellington has not assessed vehicle impacts on coastal fauna, but we know that the eggs and chicks of shore-nesting birds are particularly vulnerable to being crushed, as are cockles and other shellfish, which start life in the upper shore and migrate toward the sea as they grow.

The combined effects of the many activities on the coast's natural character are not well known in the Wellington region. The kind of study done on Wairarapa's coast needs to be extended around the entire coast. This would help us know if areas with high natural character or ecological value are at risk from human influences.

Coastal water quality

City and district councils, and Greater Wellington keep regular watch on coastal water quality at 76 sites around the region's coastline. These sites are popular with swimmers, surfers and boaties.

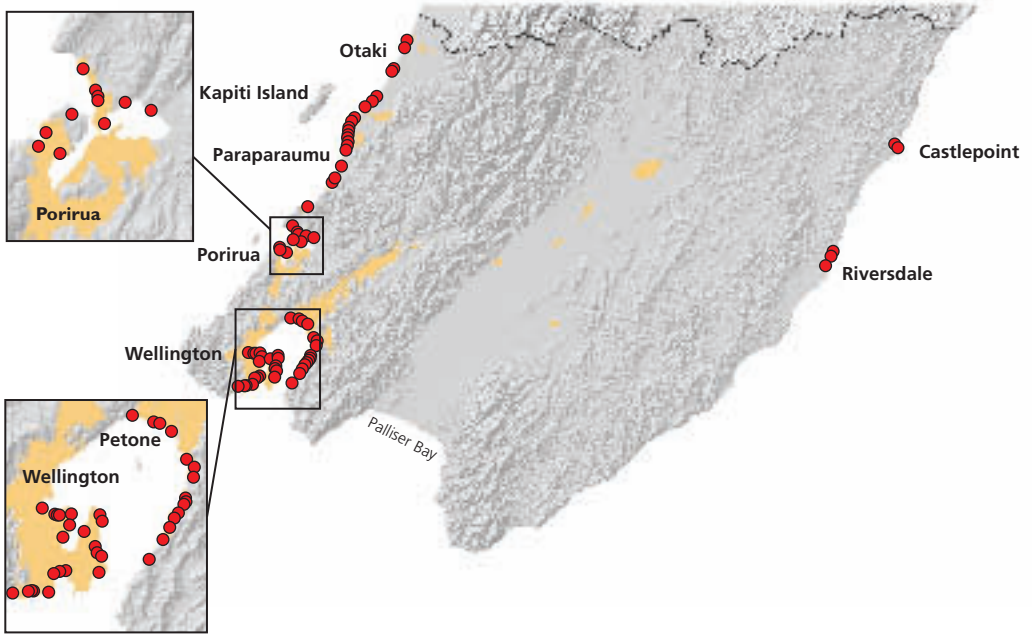


Figure 4.2:
These bathing beaches are sampled throughout the summer and tested for compliance with recreational water quality guidelines. Weekly results are posted on our website.

Sites are sampled every week during summer – and at least monthly for the rest of the year – for the presence of enterococci (bacteria that live in the gut of all warm-blooded animals, including humans). High enterococci counts point to bacterial contamination from sewage, or from effluent from other animals, and a subsequent risk of illness.

Ministry for the Environment and Ministry of Health guidelines set two thresholds for enterococci levels with actions for when those levels are reached. The guidelines recommend a three-tier (traffic-light) management framework where:

- Green, or surveillance mode, denotes low or no public health risk (single sample enterococci count ≤ 140/100ml)
- Orange is an alert mode that requires follow-up monitoring until levels return to green mode (single sample enterococci count > 140/100ml)
- Red calls for an action response – the beach must be closed to avoid a likely health risk (two consecutive sample enterococci counts >280/100ml).

Where we are now

Some key points from the results of the last four summers are:

- Only one site – Paekakariki Beach surf club – had all samples at the surveillance level (green) during the last four summer bathing seasons. This site also achieved 100 per cent compliance with the surveillance level during routine winter monitoring from April 2002 to October 2004.
- Fifty-nine sites complied with the surveillance level (green) on more than 90 per cent of summer sampling occasions.
- The sites with the lowest compliance with the surveillance level (green) were Plimmerton's South Beach, Titahi Bay both at Bay Drive and the south beach access road, Pauatahanui Inlet at Browns Bay, and Porirua Harbour at the Rowing Club.
- The sites with the most action level (red) occurrences were Titahi Bay at Bay Drive, Pauatahanui Inlet at Browns Bay, Plimmerton's South Beach, Porirua Harbour at the rowing club, and Plimmerton Beach at Bath Street.

A surfer at Lyall Bay. The three Lyall Bay sites were within guideline limits for more than 90 per cent of tests over the last four summers. Most breaches happened after rain, especially at the Tirangi Road end.

Weather records show that most action level (red) occurrences coincided with heavy rain, implicating sewage-contaminated stormwater or streams contaminated with agricultural runoff as the likely sources of bacterial contamination. But this wasn't always the case. For example, Plimmerton's South Beach had three action level events during dry spells.

The reason for dry weather breaches is unclear. Sewage could be getting into stormwater systems via illegal connections, some streams could be polluted by agricultural or other animal discharges, or high wave energy could be stirring up contaminated sediment.

As well as our bathing beach monitoring, coastal water quality is monitored at seven sites to check its suitability for shellfish gathering. Three sites are on the Kapiti coast (Otaki, Peka Peka, and Raumati beaches) one in Porirua Harbour (near Te Hiko Street), and three in Wellington Harbour (Sorrento, Mahanga and Shark bays).

Sites are sampled weekly over summer, and at least monthly during the rest of the year to coincide with recreational water quality sampling at six of the seven sites.

Shellfish are unsafe to eat if there are high levels of bacteria in the water. This is usually the case after heavy rain.

Samples are tested for the presence of faecal coliforms and compared with guideline levels. These guidelines apply only to bacteria levels in the water; low faecal levels in the water is still no assurance that shellfish are actually safe to eat.

Some points of interest over the four summers since 2001-2002:

- The three Wellington Harbour sites – Sorrento Bay, Mahanga Bay, and Shark Bay – were the only ones that consistently complied with the seasonal median guideline.
- The three Kapiti sites – Otaki, Peka Peka and Raumati beaches – had the worst record and came in above the median guideline value for all summers except the 2002-2003 summer.
- The median faecal coliform count recorded in Porirua Harbour at the Te Hiko Street site over the 2001-2002 summer was well above the median guideline value but the site has only been tested monthly since then. Shellfish collected from this area are likely to be unsafe to eat.

Overall, winter and summer, the Wellington Harbour sites had the lowest median faecal coliform counts.

What's being done

Sewage and stormwater discharges are a big influence on coastal water quality. Since 1995, the three sewage treatment plants serving Wellington, Upper Hutt, Hutt, and Porirua cities – all of which discharge to the sea – have been upgraded. Water quality around Moa Point, Pencarrow and Rukutane Point south of Titahi Bay has improved as a result.

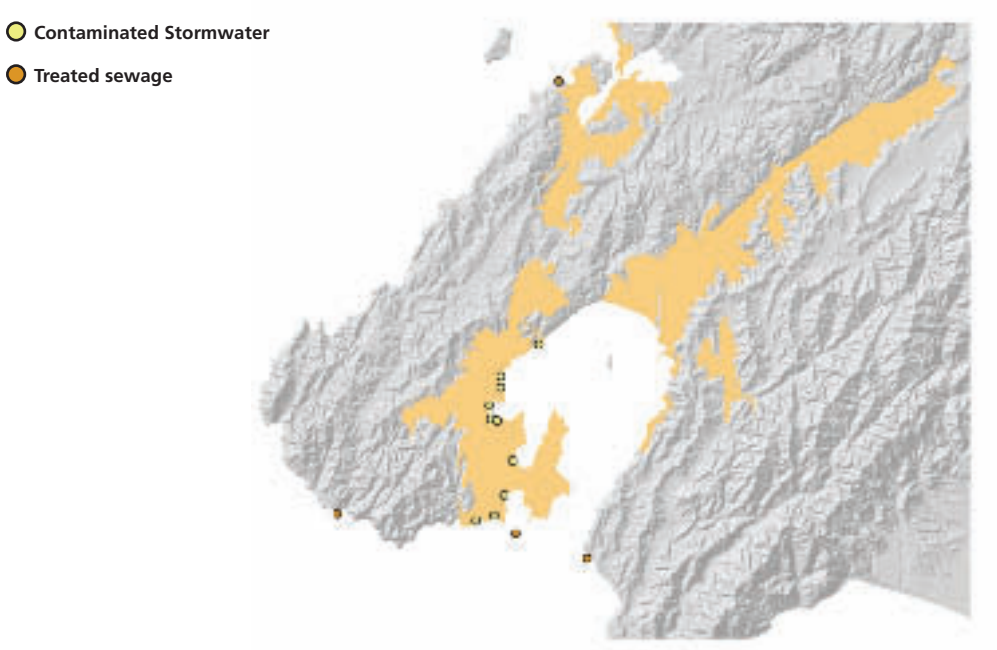


Figure 4.3:
Discharge points for sewage and stormwater. Treated sewage effluent from Wellington, Upper Hutt, Hutt and Porirua cities is discharged at four places around the coast. Stormwater contamination from sewage is decreasing because of work done through Wellington City Council's sewage pollution elimination programme. Nevertheless, these and other stormwater outfalls may be delivering high levels of heavy metals and other contaminants to the coastal environment.

Stormwater discharges are a permitted activity in the Regional Coastal Plan, subject to conditions concerning their effect on aquatic life. Along with the nutrients and dirt that stormwater washes off roofs, roads and driveways, comes more dangerous contaminants like heavy metals. These accumulate in seabed sediments, where they can put the life-supporting capacity of marine environments at risk.

When the Plan was prepared in the 1990s, Greater Wellington had little information about pollutants in the region's stormwater, or their influence on coastal water quality or ecology. In 2001, we started investigating contaminants from 11 stormwater catchments around the region, looking mainly for heavy metals.

Levels of zinc dissolved in the stormwater were highest, especially from the two industrial catchments in Seaview and Paraparaumu. Zinc was high again in the stormwater sediments, along with chromium, copper, lead, and nickel.

Most zinc in stormwater comes from galvanised roofs and car tyres, and ends up in sediments at the bottom of harbours and sheltered beaches. Our preliminary studies of Porirua Harbour have showed that heavy metals are already accumulating in the marine sediments to levels that could harm aquatic life. We need to at least slow down this passage of contaminants if we're to protect the harbour's ecology.

Stormwater pipes like this deliver more than rainfall runoff to the coast. Along with the rain comes dirt and grime from the city streets, and more worryingly, pollutants like zinc from galvanised roofs and car tyres. In some areas, these pollutants are already building up in seabed sediments to levels that threaten aquatic life.

In 1994, bacteria levels in the water at the Overseas Passenger Terminal near Oriental Bay were higher than around some sewage outfalls – the median faecal coliform count for that year was 38,500/100ml. The reason was sewage getting into the stormwater system.

Wellington City Council's response, worked out through the resource consent process with Greater Wellington, called for extensive works to the stormwater system. Their sewage pollution elimination programme has reduced both dry weather leakage and wet weather overflows, although some sewage is still getting through. Bacteria counts at the Overseas Passenger Terminal have reduced as a result and the median level in 2004 was down to 1,500/100ml. This work is continuing because bacteria counts are still elevated at times, especially after heavy rainfall.

Where to from here?

Greater Wellington and the city and district councils began work on a regional stormwater action plan in 2004. The Plan will describe the actions each of us will take to improve stormwater quality and reduce its impact on the coastal environment. It is expected to be finished by the end of 2006.

Public access

No one in the Wellington region lives further than 60km from the coast and many of us live in coastal towns and cities. People have a strong connection with the coast and they expect easy access to at least some part of it.

But ensuring or encouraging public access can compromise the very qualities people go there to enjoy. A successful public access policy will keep that delicate balance between securing thoroughfare and protecting the coast's essential character. This might mean restricting access to ecologically sensitive or culturally treasured places.

City and district councils are responsible for securing public access rights in any proposed coastal developments. Information on the state of public access to the coast is lacking, so we cannot tell where it's working well and where it's not. As a snapshot, there is road access to and along most of the west coast beaches – Otaki, Te Horo, Peka Peka, Waikanae, Paraparaumu, Raumati, Pukerua Bay, Plimmerton, and Paremata. There is also access at Titahi Bay, Whitireia Park and to most of both arms of Porirua Harbour.

From Owhiro Bay, a public road lends good access virtually all the way round to Pencarrow Head, interrupted only by marinas and the CentrePort complex.

In the Wairarapa, the coastal road offers good beach access from Ocean Beach to Cape Palliser. North of Cape Palliser, access is limited to just seven roads leading to the coast.

We know less about coastal access across private land. Access between Titahi Bay and Makara is restricted by private ownership, but an almost continuous paper road runs around the south coast between Makara and Owhiro Bay. In 2002, Wellington City Council prepared the South Coast Management Plan for nearly 25 km of this stretch of coast – much of it reserve – between Karori Stream in the west round to Port Dorset in the east.

The plan recognised that the area's conservation and recreational values were not being fully realised. The plan now provides for greater public enjoyment through upgraded tracks and footpaths, wayfinding signs, and interpretation through brochures, signs and maps.

Aspirations of tangata whenua

The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu and other taonga is identified as a matter of national importance in the RMA. This relationship must be recognised and provided for in the New Zealand Coastal Policy Statement, regional policy statements, regional and district plans, and when making decisions on resource consent applications.

Objective 4 of the Regional Policy Statement recognised this relationship by seeking to increase opportunities for the aspirations of tangata whenua for the coastal environment to be met. We asked representatives of Ara Taha if they thought this was happening.

Lack of co-ordination

The coastal aspirations of tangata whenua can be broadly described as a desire for kaitiakitanga. All of our region's iwi have a large coastline that they are actively seeking to manage as kaitiaki. In doing this, they must work with local and central government agencies.

Local government (regional, district and city councils) controls the use of land, water and air in the coastal environment under the RMA. The Department of Conservation (DoC) has RMA responsibilities in the coastal marine area that are exercised jointly with regional councils, and has responsibilities for marine reserves and marine mammals under separate legislation. DoC also manage land in the coastal marine area on behalf of the Crown. The Ministry of Fisheries is responsible for the sustainable utilisation of fisheries. Iwi work with them all, but feel they are the only ones interested in the overall holistic management of the coast – everyone else sticks to their compartmentalised responsibilities. Even within Greater Wellington different departments appear to be operating with different mandates.

In general, iwi have found that multiple agencies makes for blurred responses and difficulties in applying their own kaitiaki responsibilities. The narrow focus of each agency means they tend to forget about connected matters.

Many iwi thought that Greater Wellington could contribute by facilitating a collaborative approach. One observation was that Greater Wellington's kaupapa was environmentally focussed, so it is well placed to coordinate other agencies who are more commercially driven. Another expressed this in terms of travelling down the track together – tangata whenua and bureaucracy.

Managing coastal development

All iwi are concerned about coastal development, particularly the effects of subdivisions on the character and natural processes of the coastal environment. One put it plainly, saying there is "too much politics and talk while the beaches continue to disappear."

Some effects of coastal development that are concerning iwi in terms of their aspirations for the coast were

- changes to streams and wetlands near the coast
- possible changes to aquifers that feed the toheroa beds
- the strain on the water resources of the Kapiti Coast
- the effects of sewage
- the increased pressure on fisheries.

These were seen as areas where Greater Wellington and the city and district councils could do more to recognise the relationship of Maori and their culture and traditions with the coastal environment.

Some coastal development has been sympathetic to Maori matters. For example, there have been opportunities for iwi to become involved when there have been wahi tapu discoveries. This has been positive in terms of learning more about the history of the coast.

Understanding the coast

In some areas iwi lack access to information about the coastal environment. For example, iwi were asked to comment on the effects – from a cultural perspective – of sinking a ship at Mana Island, but felt they had limited knowledge and information.

In another example, iwi have to present information in support of rahui applications to decision-makers, but struggle to collect this information. It was felt that Greater Wellington could help with the monitoring, as could the Ministry of Fisheries, while the iwi contribute the cultural methodology. In these situations, and in wider coastal monitoring such as the state of coastal habitat and the health of kaimoana resources, it was felt there could be a future in monitoring the coastal environment together.

Despite these gaps, it was observed that traditional knowledge is still held, and is a source of protection for the environment. Tangaroa (god of the sea) has the power to remind us all that we are part of the system, not the boss of it.

More Information

Forsyth, Kirsten. 2005. *The Coastal Environment – background report*. Greater Wellington.

Milne, Juliet. 2005. *Recreational water quality monitoring technical report*. Greater Wellington.

Air quality

Objectives

1. High quality air in the region is maintained and protected, and there is no significant deterioration in air quality in any part of the region.

2. Air quality is enhanced in those areas with degraded air quality.

3. The adverse effects of the discharge of contaminants into air on human health, local or global environmental systems and public amenity are avoided, remedied or mitigated.

4. The output of gases which potentially promote climate change is at a level which is consistent with central government climate change policy.

Doing well

- Carbon monoxide levels have been "excellent" (less than 10 per cent of the limit set in the National Environmental Standard) in suburban areas for more than 90 per cent of the time and "good" (between 10 per cent and 33 per cent of the Standard) for the rest of the time since 2002.
- Nitrogen oxide and nitrogen dioxide levels have been "excellent" in suburban areas more than half the time and "good" for the rest of the time since 2002.
- Fine particulate levels have been "good" in suburban areas more than 70 per cent of the time since 2002.

Must improve

- Fine particulate levels have failed the limit set in the National Environmental Standard several times each winter in Wainuiomata, Upper Hutt and Masterton since monitoring began.
- Fine particulate levels have been "good" for 55 per cent of the time in inner city Wellington, and only "acceptable" (between 33 per cent and 66 per cent of the limit set in the National Environmental Standard) the rest of the time since March 2004.
- New Zealand's greenhouse gas emissions are increasing, with carbon dioxide emissions in 2003 about 37 per cent higher than they were in 1990.
- About 40 per cent of our carbon dioxide emissions come from transport - mostly private cars. Transport is one of the biggest growth areas of New Zealand's greenhouse gas emissions.

"All I need is the air that I breathe …"

Consider for a moment the immense improbability of your existence. Of all the planets we know, ours is the only one with an atmosphere that can support life like us. And even that could be called a stroke of luck, because for a vast time, the earth's atmosphere was mostly methane and ammonia – a very toxic brew indeed.

The methane and ammonia eventually broke down into nitrogen, hydrogen, and carbon dioxide, and water vapour broke down to hydrogen and oxygen.

Considering this immense good fortune, we treat our precious atmosphere rather shabbily. Around the world, industry pours out tonnes of pollutants, but even the most mundane actions – driving cars, lighting the fire, taking the kids to school, burning rubbish in the backyard – come at a cost to the air and our health. According to the US Environmental Protection Agency, more people die in that country from air pollution than in car accidents – specifically from agitated asthma, bronchitis, emphysema, lung and heart diseases.

On top of this, we're changing the outer skin of the atmosphere. The vital ozone layer is thinning because of chemical reactions with waste gases. The planet is warming, at least in part because we've filled it with carbon dioxide, methane and other greenhouse gases.

Where does our pollution come from?

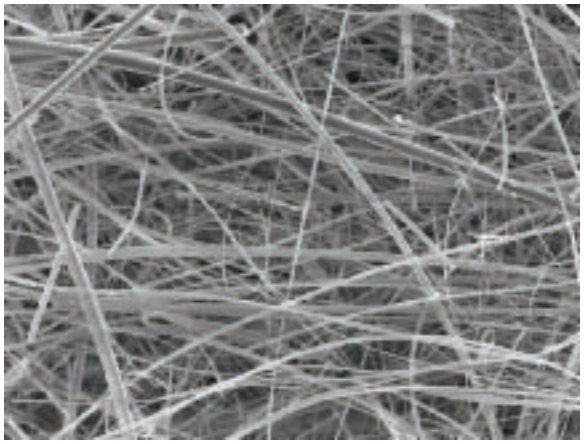
"Clean" air is a mixture of about 78 per cent nitrogen and 21 per cent oxygen. The remaining one per cent is made up of gases such as argon, carbon dioxide, methane, hydrogen and carbon monoxide.

In 1998, Greater Wellington worked out how much pollution was getting into the air and where it was coming from. This is known as an "emissions inventory". Emission inventories are used to predict how changes in particular activities, such as traffic flows, will affect total volumes of pollutants discharged by that activity. We can then work out whether the changes will threaten air quality, and if it will, develop programmes to manage these changes.

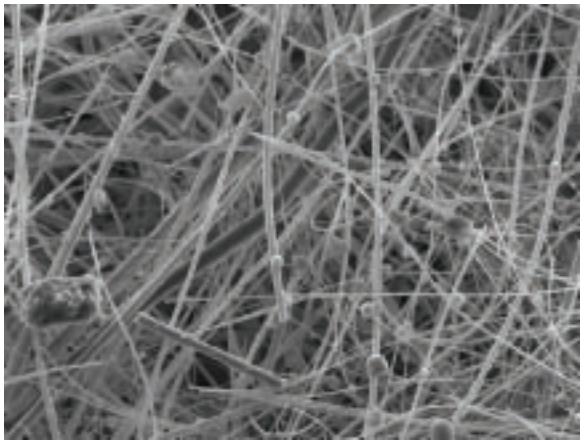
There are less than 150 discharges to air from industry in the region. These are controlled by conditions on discharge permits and most only affect the immediate area of the discharge. We wanted to know the extent of air pollution generally, from the sources that don't require discharge permits.

We checked for sources of non-methane volatile organic compounds (NMVOC), nitrogen oxides (NOx), sulphur dioxide (SO2), carbon monoxide (CO), carbon dioxide (CO2) and what we call particulate matter – a mixture of liquid droplets and solid particles. Coarse bits of particulate matter come from windblown dust and seasalt, while fine particles (smaller than 2.5 micrometers) mostly come from home fires and motor vehicle exhaust fumes. These fine particles are so small that many thousands of them would fit on the full stop at the end of this sentence.

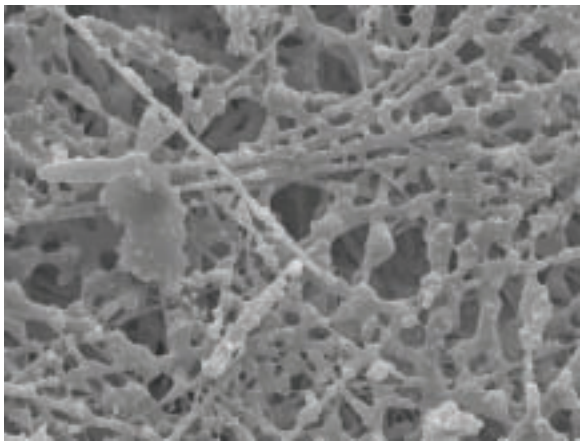
A scanning electron microscope shows us what we are dealing with.



A clean, unused filter, composed of closely matted glass fibres that collect particles from the air.



A filter we used to collect particles during summer – you can see a few particles here and there, mainly from wind blown soil, dust, seasalt and pollen.



A filter we used to collect particles in winter at Masterton on 12 August 2004. Fine particle concentrations that day were measured at 77 micrograms/m^3 , exceeding the limit of 50 micrograms/m^3 set in the National Environmental Standard. The filter is completely coated – and your lungs would have trapped the same fine particles if you'd breathed in Masterton's air that winter morning.

From our inventory, we found that, with the exception of fine particulate matter, exhaust fumes from motor vehicles are to blame for most (over 80 per cent) of the polluting chemicals in the air. Most fine particulate matter comes from home fires, which release nearly 85 per cent of the annual load of these particulates every winter.

Permanent air quality monitoring stations like this one in inner city Wellington are continuously sampling the air for pollutants. This station also monitors air temperature, relative humidity, and wind speed and direction to help us interpret the results.

Where we are now

Air quality monitoring

In the Wellington region, we test for particulate matter (PM_{10}), carbon monoxide (CO) and nitrogen oxides (NOx) because they are harmful to human health and the environment.

PM_{10} is particulate matter that's smaller than 10 micrometers across – small enough to enter the tiniest passages of our respiratory systems. In our region, PM_{10} has been linked to poor health, winter smog and dust nuisance.

Carbon monoxide can replace oxygen molecules in the blood, and so is a major health threat. Carbon monoxide is in vehicle exhaust fumes, and smoke from domestic fires and industry.

Nitrogen oxides – discharging from vehicles, domestic fires and industry – contribute to the smog that clouds our city air, and combine with other compounds to make acid rain. They can attack the body's mucous membranes and respiratory system.

Carbon monoxide and nitrogen dioxide typically concentrate around busy roads, rising to dangerous levels when confined by tall city buildings.

In 1997, the Ministry for the Environment (MfE) set up Environmental Performance Indicators and air quality categories to help us interpret the results of air testing. The categories (see Table 5.1) show whether the air is approaching guideline levels or is within safe limits.

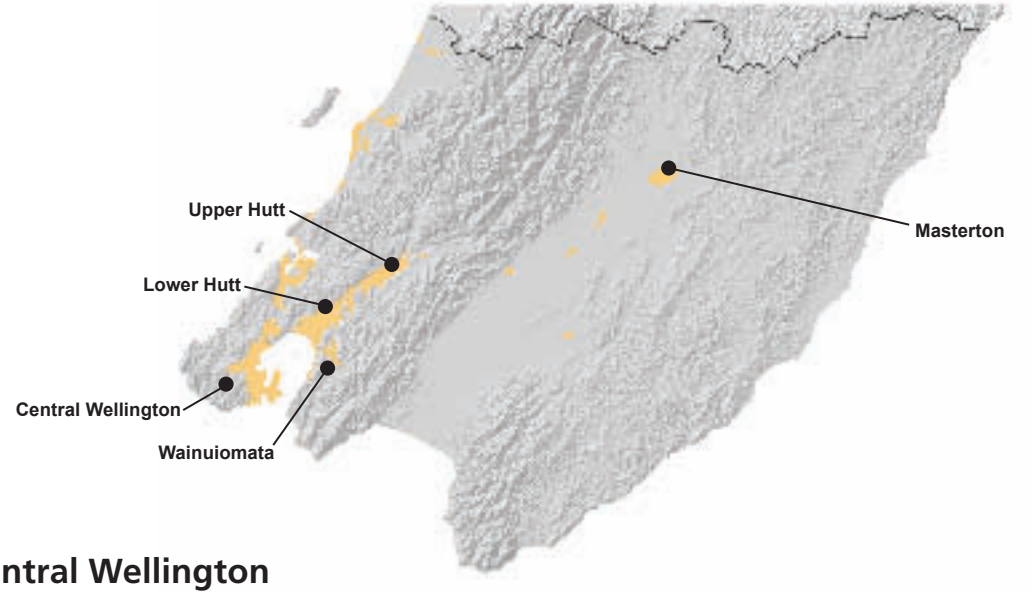
Category	Maximum Measured Value	Comment
Action	Exceeds guideline	Completely unacceptable by national and international standards.
Alert	Between 66 per cent and 100 per cent of the guideline	A warning level which can lead to guidelines being exceeded if trends are not curbed.
Acceptable	Between 33 per cent and 66 per cent of the guideline	A broad category, where maximum values might be of concern in some sensitive locations, but are generally at a level that does not warrant dramatic action.
Good	Between 10 per cent and 33 per cent of the guideline	Peak measurements in this range are unlikely to affect air quality.
Excellent	Less than 10 per cent of the guideline	Of little concern.

Table 5.1:
Air quality categories.

Air quality monitoring results

Air tested on still winter nights in Masterton, Wainuiomata and Upper Hutt is more likely to fail the National Environmental Standards than at other times. This is because on still winter nights, the earth rapidly cools, and cold air is trapped at ground level beneath a warmer layer.

Cool air under a layer of warm air is called a 'temperature inversion'. Temperature inversions seal in air pollutants at ground level. On cold nights home fires and vehicles add more pollutants, which sometimes accumulate until they pose a health risk. Temperature inversions most commonly happen in valleys where the surrounding hills help concentrate the pollution. Areas like Wainuiomata are particularly vulnerable to trapped air pollution.



Central Wellington

In 2004, Greater Wellington set up an air quality monitoring station on the corner of Vivian and Victoria Streets in downtown Wellington. We chose this major traffic intersection to gauge the impact of vehicle emissions on local air quality. Our other stations are in quieter suburban settings so we can find out what the air quality is like around people's homes.

The Victoria Street station recorded the highest concentrations, on average, of carbon monoxide and particulate matter in the region, but peak levels have stayed within the National Environmental Standards and air quality guidelines. We will need a few more years of monitoring before we have a full picture of central city air quality.

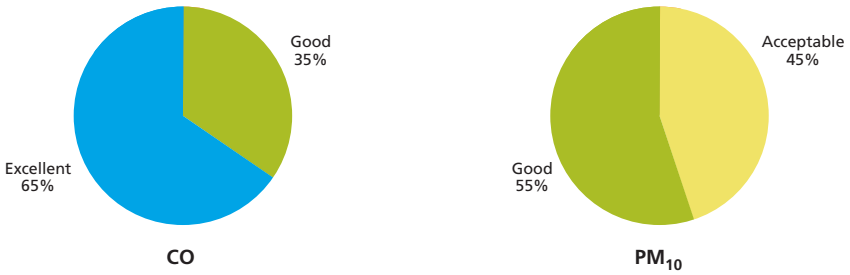


Figure 5.1:
Victoria Street, Wellington during 2004. Carbon monoxide 8 hour average. PM_{10} 24 hour average.

Wainuiomata

Greater Wellington has been monitoring PM_{10} at Wainuiomata Bowling Club since September 2000. Fine particulate concentrations have exceeded the National Environmental Standard several times each winter. Peaks came during cold, calm weather when pollutants were slow to disperse. Home fires are the likely source of most of Wainuiomata's air pollution.

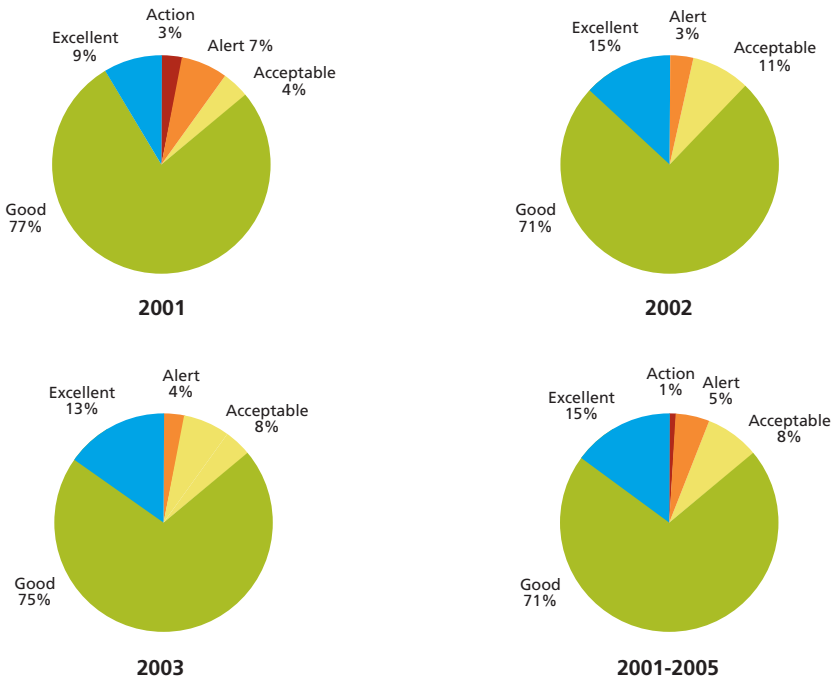


Figure 5.2: Wainuiomata bowling club 2001-2005. PM_{10} 24 hour average. The action level (red) happened in winter 2001. The alert level (orange) has been reached each winter since we started monitoring.

Hutt City

A permanent monitoring station has been operating at Birch Lane in Hutt City since February 2001. It shows us that while nitrogen dioxide and carbon monoxide levels jump in winter, they stay within safe health limits. The peaks coincide with similar recordings at Upper Hutt, confirming the influence of still, cold weather on pollution from cars and home fires.

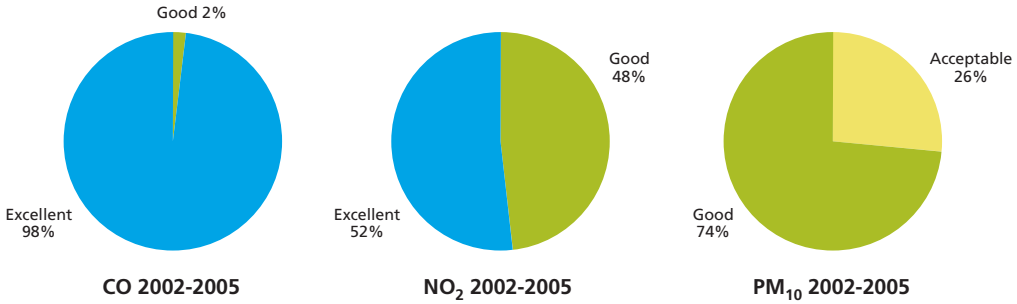


Figure 5.3: Birch Lane, Hutt City 2002-2005. Carbon monoxide 8 hour average. Nitrogen dioxide 24 hour average. PM_{10} 24 hour average.

Upper Hutt

Since June 2000, a mobile station at Trentham Fire Station has been showing the Hutt Valley's susceptibility to winter pollution from particulate matter, carbon monoxide and nitrogen dioxide.

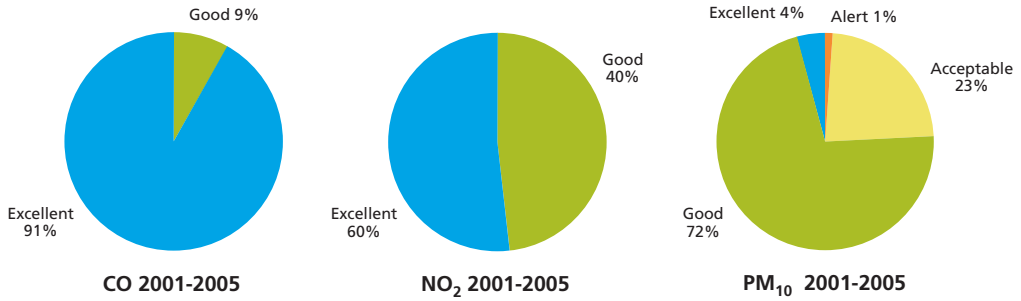


Figure 5.4:
Trentham Fire Station, Upper Hutt 2001-2005. Carbon monoxide 8 hour average. Nitrogen dioxide 24 hour average. PM_{10} 24 hour average.

Masterton

A permanent monitoring station installed at Wairarapa College in Masterton in October 2002 has revealed that fine particulate pollution from home fires causes levels set in the National Environmental Standard to be breached several times each winter.

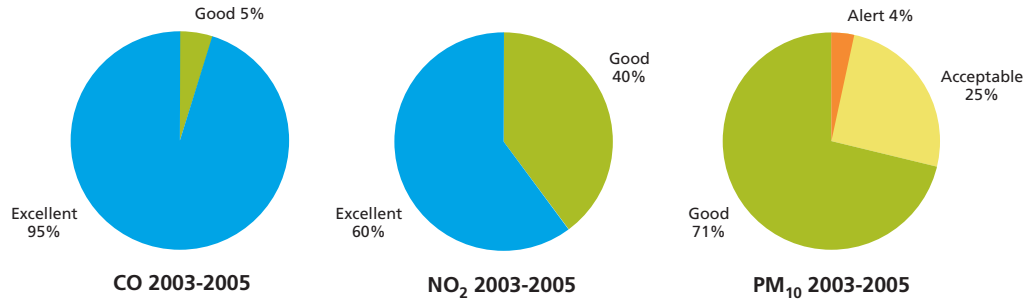


Figure 5.5:
Wairarapa College, Masterton 2003-2005. Carbon monoxide 8 hour average. Nitrogen dioxide 24 hour average. PM_{10} 24 hour average.

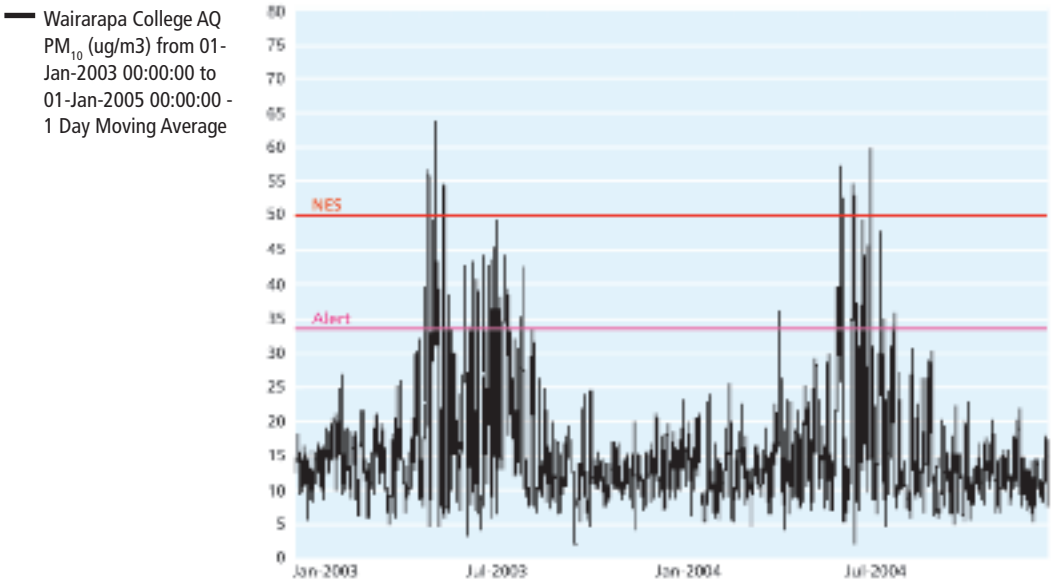


Figure 5.6:
Low summer recordings rise in winter to breach the National Environmental Standard (shown as a red line). Pollution from home fires trapped under temperature inversions is the culprit.

It might make for a dramatic sunrise, but the pall of smoke over Masterton on many winter mornings conceals tiny particles that people breathe into their lungs, causing respiratory diseases and other illnesses – worst affected are children and the elderly.

Air pollution complaints

People expect clean fresh air to breathe. Over half the complaints to Greater Wellington's Pollution Hotline are about air, and most of those are about unpleasant odours. Sometimes, odours can travel considerable distances, channelled by prevailing wind and topography. For example, certain conditions routinely trigger complaints of odour from Wellington's Southern Landfill near Brooklyn.

While unpleasant odours can be hard to live with, it is the more insidious low level pollution from fires and cars that can actually harm people's health.

What's being done

The Regional Policy Statement identified that lack of data about air quality was a significant resource management issue in the region. Ways to address this included setting up an ambient air quality monitoring programme, and preparing a Regional Air Quality Management Plan.

Since 1995, we have identified the sources, scale and distribution of air contaminants and looked at how the region's meteorology and topography influence its air quality. We have also developed a meteorological database.

We set up a pilot air quality testing programme with a mobile monitoring station in 1998 and tested the air in Otaki, Hutt City and Masterton. The results indicated that fine particles could be a problem in winter, and that permanent monitoring was needed to assess the actual extent of the pollution and whether national guidelines were being exceeded. We now have monitoring stations at five sites around the region (Upper Hutt, Hutt City, Wainuiomata, Masterton, and inner city Wellington).

In 2004, the Ministry for the Environment (MfE) released National Environmental Standards to manage air quality. The Standards set down maximum allowable levels of carbon monoxide (CO), fine particles (PM_{10}), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ozone (O_3) and ban any practice that exceeds those limits. There is also an emission standard for home wood burners.

The National Environmental Standards require regular testing for pollutants wherever they might threaten public health, and require regional councils to publicly notify all exceedences of the Standard. Greater Wellington is required to develop strategies to improve air quality in areas that do not comply.

In 2004 and again the following year, Greater Wellington's social marketing campaign *Be the Difference* ran advertising and information campaigns about motor vehicle emissions and home fires.

Rules in the Regional Air Quality Management Plan, adopted in 2000, have largely addressed industrial emissions. Most discharges from industrial and trade premises require discharge permits.

Climate change

In 1997, delegates of 150 countries met in Kyoto, Japan to discuss climate change and to agree on binding reductions for greenhouse gases. The outcome was that developing countries would continue with voluntary reduction targets, and that 39 industrial countries would aim, by 2008-2012, to meet specific targets upon ratification of the Kyoto Protocol. New Zealand ratified the Kyoto Protocol in December 2002. It came into force on 16 February 2005.

New Zealand's target is to reduce its greenhouse gas emissions to what they were in 1990, or take responsibility for excess emissions. In 2005, the New Zealand Climate Change Office released the *New Zealand Greenhouse Gas Inventory 1990-2003*. This showed that New Zealand's emissions are increasing, with carbon dioxide emissions in 2003 about 37 per cent higher than they were in 1990.

Carbon dioxide is released into the atmosphere when we burn fossil fuels, such as oil and coal. About 40 per cent of our carbon dioxide emissions come from transport - mostly private cars - and transport is one of the biggest growth areas of New Zealand's greenhouse gas emissions. Agriculture is responsible for nearly 50 per cent of all greenhouse gas emissions, but is not growing so fast.

Central government is responsible for developing policies to reduce greenhouse gas emissions nationwide. Some of the ways it is planning to achieve this are to introduce a carbon tax, help energy-intensive businesses to become more energy efficient, and provide training for company directors to influence a conservation culture.

The clean clear air of Wellington – an asset for tourists and locals alike.

Where to from here?

The National Environmental Standards for air quality set emission standards and efficiency criteria for new wood burners. Over time, as old burners are replaced, the amount of pollution from home fires on cold winter nights should decrease.

With transport responsible for the national growth in greenhouse gas emissions and for most of the polluting chemicals discharged to air regionally, this is where a change is needed if we are to meet the objectives in the Regional Policy Statement.

More information

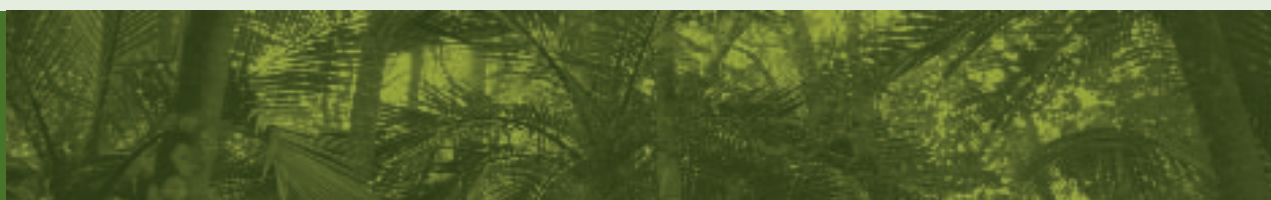
Davy, Perry. *Air quality monitoring technical report*, 2005. Greater Wellington.

Davy, Perry. *Air Quality – background report*, 2005. Greater Wellington.

Biodiversity and the state of our ecosystems

Objectives

1. The overall quality (health) of ecosystems is increased.
2. Healthy functioning ecosystems are distributed throughout the region, including the rural and urban environments.
3. The area and quality of indigenous ecosystems in the region is increased.
4. The region has a diversity of healthy ecosystems which represent the full range of regional flora, fauna and habitats.
5. Special ecosystems in the region are actively protected and appropriately managed.



Doing well

- The need to protect, and manage the threats to, our unique biodiversity is becoming more widely understood.
- The community is rolling up its sleeves and helping to restore important degraded ecosystems.
- More and more landowners are legally protecting biodiversity on their land.
- At specific sites, intensive management has produced spectacular improvements in biodiversity.

Must improve

- We don't really know if we are making a difference for biodiversity and we need to develop means of measuring change in ecosystems.
- The region's once rich biodiversity is now significantly diminished and we cannot afford further loss of some ecosystems.
- Ecological processes are impaired as a result of fragmentation and plant and animal pests in most ecosystems.

Webs of intrigue

What is biodiversity? The word, short for **biological diversity**, can be defined as "the diversity of life on earth", the sum total of nature and all its constituent facets.

Ecosystems are one such facet.

Scientists describe an ecosystem as a community of plants, animals and micro-organisms of many different species interacting with each other and their surrounding environment. In this chapter, the term biodiversity means nature, and "ecosystem" defines a specific type of biodiversity, such as a wetland ecosystem or a lowland forest ecosystem.

Healthy ecosystems provide us with life's essentials: plants and animals for food and shelter, fibre for clothing, timber for construction, and so on. Ecosystems also supply the "services" that power the cycle of life – processes that purify air and water, decompose and detoxify wastes, give us productive soils, and stabilise climate extremes. We also value their aesthetic qualities and the sense of national (and regional) identity they give us, use them for our recreation, and treasure them in our cultures.

Today, many ecosystems are a fusion of indigenous and introduced plants and animals. This isn't necessarily a bad thing. A carefully managed farm, for instance, with wetlands and forest remnants protected, streams fenced with riparian buffer zones, erosion prone soils protected and with stocking rates matching the land's carrying capacity, can be ecologically, economically and socially sustainable. In general, though, this chapter is about our indigenous biodiversity.

Impacts on our biodiversity

The story of New Zealand's biodiversity is a remarkable one. Our land was cut off from the rest of the world for 80 million years, so our cargo of plants and animals is unique. That means only we can protect these species.

The first Polynesians arrived here about 1000 years ago, and the extinctions began soon after. But the most dramatic impacts came 150 years ago with the arrival of European settlers, who felled forests and drained wetlands with astonishing zeal. The change they brought to the New Zealand landscape has been described as the most abrupt in the world, resulting in a number of extinctions. Today about 1000 of our known animal, plant and fungi species fall into the "threatened" category.

A rat attacking a fantail (piwakawaka) on its nest. Rats are a major predator of our wildlife. Photo: David Mudge.

The Wellington region reflects that national picture. We have inherited a severely depleted biodiversity. For example, before human arrival, around 98 per cent of our region was cloaked in forest. Today, just 28 per cent survives – mostly in the hills.

Damage to our biodiversity goes well beyond habitat loss and the condition (or quality) of many of our ecosystems types is poor. The introduction of pest plants, such as old man's beard, and animals such as possums, goats, rats, cats and stoats has put further stress on our ecosystems, and nowadays we accept that they cannot thrive without our help.

Biodiversity also faces less obvious pressures:

- drainage of wetlands and channelling of natural waterways
- air and water pollution
- fire
- grazing of forest remnants and riparian areas
- clearance of regenerating scrub and native trees
- water extraction, which drives up temperatures and nutrient concentrations
- structures, urban expansion, and land-use changes that modify or destroy habitats
- pollution and over-fishing in coastal waters
- the effects of climate change.

Where we are now

One challenge we face is to get a fix on the state of our biodiversity. Work by various organisations, such as the Department of Conservation (DoC), Greater Wellington and city and district councils, has given us a reasonable idea of the **quantity** of various ecosystems. For instance, we know approximately how many hectares of wetlands we have left, and the extent and location of our remaining lowland forest ecosystems and dunelands.

By examining this data against our knowledge of the threats they face, DoC identified the region's most at-risk ecosystems:

- lowland forests
- rivers, lakes and river margins
- wetlands
- dunes
- estuaries
- coastal escarpments.

While we can quantify and map our regional ecosystems, it's much more difficult for us to judge the **quality** of our biodiversity. Apart from a few important sites such as Kapiti Island, the Karori Wildlife Sanctuary and Greater Wellington's Key Native Ecosystems, no detailed biodiversity monitoring is being done.

Most of what we do know is limited to terrestrial ecosystems – we know very little about the health of our waterways (although the gap is closing) and almost nothing about our marine ecosystems.

So how do we take the pulse of our biodiversity?

Ecologists recently developed a theory that relates the size of a particular land area to the number of species that area (be it a paddock or mountain range) can support. The theory, called the species/area relationship, expresses that relationship not as a line, but a curve. Initially, species might be lost only slowly, but as habitat is reduced, the rate of local extinctions speeds up.

Some scientists suggest that biodiversity loss becomes critical when 70 to 90 per cent of habitat has been destroyed (see Table 6.1).

Table 6.1: Suggested criteria for assessing biodiversity loss.

Category	Criteria
Acutely threatened	< 10 per cent indigenous cover remaining
Chronically threatened	< 20 per cent indigenous cover remaining
At risk	< 30 per cent indigenous cover remaining
Critically unprotected	> 30 per cent indigenous cover remaining **but** < 10 per cent legally protected
Under-protected	> 30 per cent indigenous cover remaining **but** 10 – 20 per cent legally protected

The recently developed Land Environments of New Zealand (LENZ) system (see box) gives a valuable overview of our ecosystems by showing us the percentage of natural cover remaining in each type. By comparing this against the criteria in the table above, we can see which ecosystems most urgently need protection.

What is LENZ?

LENZ (Land Environments of New Zealand) classifies New Zealand landscapes using a set of climate, landform and soil variables chosen for their geographic and biological significance. These classes, called **environments**, identify areas of similar environmental conditions, regardless of where they occur in New Zealand.

Assuming that the composition of indigenous ecosystems is largely controlled by their "environmental drivers" (such as climate, slope and soils), the area covered by a particular type of land environment should contain a distinct ecosystem type.

This information is presented at four levels of detail containing 20, 100, 200 or 500 environments (levels one to four) nationally. In the Wellington region there are eight level one environments, 12 level two environments, 20 level three environments and 61 level four environments.

LENZ classifications are similar to the **ecological domains** approach promoted by Greater Wellington, with the added advantage of nationwide coverage. This means we can compare our region with the national picture.

Using the level three LENZ environments for our region, Figure 6.1 illustrates those that have less than the critical 20 per cent of their indigenous vegetation left.

LENZ shows us what's been lost;

- The C class land environments represent the fertile alluvial plains of Wairarapa, Kapiti Plains and Hutt Valley. Originally they would have nourished dense lowland podocarp forests of kahikatea, matai, tawa and pukatea. Today, less than 20 per cent of these forests remain. The C2 and C3 environments are acutely threatened, with less than 10 per cent of cover left.
- The hill country of the F environments shows patchy health. The F1 environments, representing moist hill country such as the Tararua foothills, are moderately intact, averaging 52 per cent indigenous cover. On the other hand, the F4.1 environment – the dry eastern Wairarapa hill country – is left with just 13.5 per cent of its original forest cover.

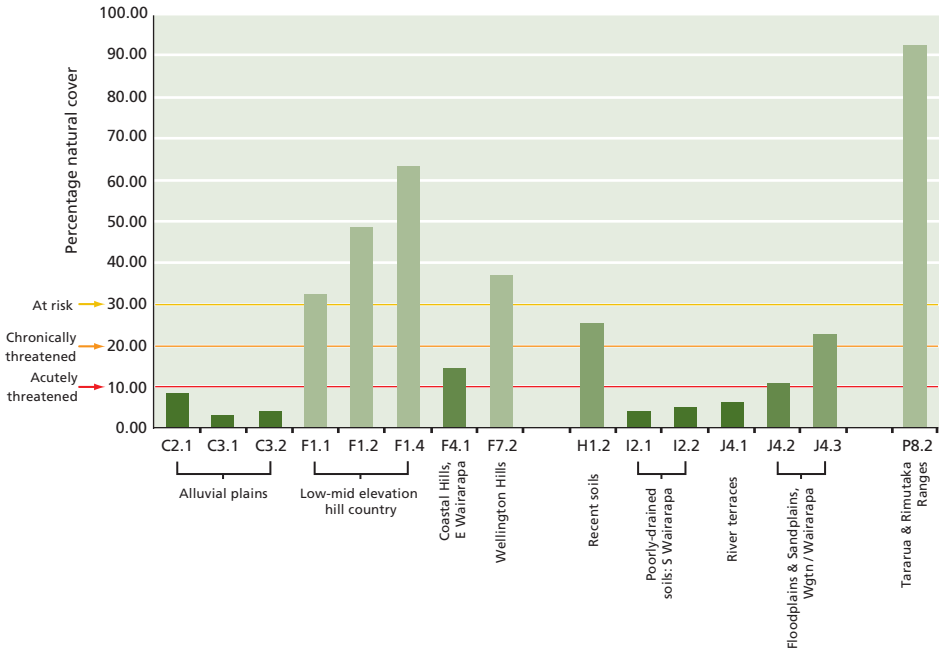


Figure 6.1:
Percentage of natural vegetation cover remaining in the region by LENZ Level three classes.

- The former saline wetlands of southern Wairarapa – the small but significant I2 environments – carry only about 4 per cent of original cover.
- The H and J environments – areas of recent soils, river terraces and dunelands, have all lost at least 75 per cent of their original cover.
- The montane P8.2 environment – 90 per cent intact – is the least degraded environment in the region.

LENZ analysis confirms that the region's once rich diversity is now seriously diminished in the major lowlands and the eastern Wairarapa hill country. Many of these areas qualify as Acutely Threatened or Chronically Threatened.

As an interpretative tool, the use of LENZ is still in its infancy, but Greater Wellington will investigate its potential for providing benchmarks of our region's biodiversity. A recent report prepared for the Department of Conservation used LENZ to identify those land environments around New Zealand most vulnerable to biodiversity loss. Adapted to our region, a similar exercise could offer valuable guidance to our biodiversity programmes and may also be a useful monitoring tool for future reports.

Much of our ecologically rich lowland forest exists only as scattered remnants.

The health of our indigenous forests

We have already noted the dramatic forest loss since the arrival of humans. In the Wairarapa, native forest is still falling to make way for pasture or plantation trees.

However, in some western areas of the region, retired farms are reverting to scrub and forest, and throughout the region more and more landowners are protecting their native forest remnants through Queen Elizabeth II National Trust covenants, up from 99 in 1999 (covering 3,650 hectares) to 182 in 2005 (4,782 hectares).

This area might seem insignificant, but it shows that some landowners are open to voluntary protection – a trend that others can be encouraged to follow, particularly if some financial assistance is available.

We know that without possum control, native forests steadily decline and eventually collapse, so possum numbers can serve as a proxy measure of forest health. Residual trap catch (RTC) is a standard way of monitoring those numbers so that ecologists can gauge their impact. For instance, a high RTC of 30 per cent tells us that the forest is suffering significant possum damage, so much so that its species composition will be changing. In contrast, a low RTC, say five per cent, means that possums are too scarce to cause serious damage.

Possums are now controlled over more than 65 per cent of the region, mainly to combat Bovine tuberculosis (Tb). But the Tb programme is a major boost for biodiversity, too. It's estimated that the Tb offensive keeps RTC levels down to around five per cent – good news for forest remnants and scrublands that are unlikely to get possum control solely for ecological reasons.

We need to remember though, that possums are just one of a suite of animal pests destroying our forest ecosystems, and the Tb programme does little to halt the ravages of cats, rats, stoats and ferrets.

Tackling a suite of pest animals – and plants – is called "integrated pest management". It's expensive, but it gets impressive results. Greater Wellington undertakes integrated pest management in specially selected areas of high ecological value on private and public land, called Key Native Ecosystems.

A red-crowned parakeet, or kakariki, one of a number of native forest birds reintroduced to Wellington in recent years. Some species became locally extinct in Wellington more than a century ago after the arrival of stoats, cats, rats and possums.

Today, kakariki, kaka, whitehead (popokatea), tomtit (miromiro), and bellbird (korimako) are all found in neighbouring suburbs and bush reserves after being released into the Karori Wildlife Sanctuary, and the Department of Conservation (DoC) now believes they have established independent populations, thanks to possum and rat control undertaken by Greater Wellington Regional Council and DoC.

Further kakariki releases on Matiu/Somes Island have bolstered forest bird numbers in East Harbour Regional Park.

Greater Wellington's own forests have also come in for more attention in the last few years with big biodiversity gains.

Case study: Greater Wellington's forest

Greater Wellington manages more than 37,000 hectares of forests in water collection areas and Kaitoke Regional Park. We have monitored their health for many years with techniques such as vegetation plots, rata digital photography, fruit-fall plots, bird transects and pest plant surveys. Integrated pest control focuses on possums, goats and pest plants, and the results, especially in the last three years, have been tangible. A five-yearly 1080 possum control regime (which covers inaccessible or difficult terrain) helps curb other pests like rats as well. Intensive goat control protects native seedlings and the invasion of pest plants has been stopped. Measured benefits to indigenous forest health include:

- increases in native bird abundance after 1080 operations, thanks to lower rat numbers for at least one bird breeding season
- an improvement in rata tree health as measured by rata digital photography
- more seedlings growing past the browse layer owing to a drop in goat and deer numbers
- healthy mistletoe plants in Kaitoke Regional Park
- removal of pest plant species from high value ecological sites.

The health of our wetlands

Wetlands are important because of the rich biodiversity – birds, fish, plants and insects – they support. But many wetland species have become increasingly rare as their habitat disappears. Wetlands also help protect against flooding, and store and purify water. Hungry for pasture, settlers started draining the region's wetlands in the mid 1800s, a practice that continued until the 1980s.

Results of recent surveys of the region have been recorded on a wetlands database, summarised in Table 6.2. The estimated historical wetland area is an approximation based on soil maps.

Number of wetlands	267
Total wetland area (hectares)	10,161 (Lake Wairarapa is 7,146 hectares)
Estimated historical wetland area (hectares)	83,658
Estimated wetland remaining	12 per cent (or 3.5 per cent if we exclude Lake Wairarapa)

Table 6.2:
Wetlands remaining in the Wellington region.

Many remaining wetlands are very small – half of them just two hectares or less. This compromises the way they function. Small wetlands are more susceptible to the detrimental effects of pest plants and animals, human induced changes to the catchment and local hydrology, and pollution. This means smaller wetlands need more intensive management to keep them healthy.

We have a way to go to ensure our remaining wetlands in the region are protected – only nine per cent of wetlands on private land are legally protected by covenant, and of the remainder a third still need fencing to keep stock out.

The end of government subsidies for flood control and drainage schemes in the mid-1980s finally stopped wholesale drainage and infilling, but wetlands continue to disappear. Parts of the lower Taupo Swamp near Plimmerton, for example, have been turned into sportsfields and industrial land.

Freshwater fish

The rivers, lakes and wetlands of the region are home to 22 species of native freshwater fish – one of New Zealand's most diverse assemblages. Seven exotic fish species are also present, mostly in lowland rivers and lakes. Brown trout, a highly prized introduced sport fish, is found in many of our rivers.

Fish known to live in the region's rivers are listed in Table 6.3. The information in the table is based on 80 years of records from the New Zealand Freshwater Fish database 1921-2001.

Table 6.3: Freshwater fish of the region. The species in **bold** are nationally threatened.

Native fish found at more than 50 sites	Native fish found at less than 50 sites	Exotic fish found at more than 50 sites	Exotic fish found at less than 50 sites
Longfin eel	Bluegill bully	Brown trout	Rainbow trout
Shortfin eel	Giant bully		Perch
Redfin bully	Crans bully		Rudd
Common bully	**Dwarf galaxids**		Tench
Upland bully	**Shortjaw kokopu**		Goldfish
Koaro	Lamprey		Koi carp
Inanga	Common smelt		
Banded kokopu	**Brown mudfish**		
Giant kokopu	Black flounder		
Torrentfish	Yellow flounder		
	Grey mullet		
	Unidentified triplefin		

Of the nationally threatened fish, the decline of the longfin eel is likely to be a result of commercial overfishing, while nationwide habitat loss is responsible for the decline of the others. Fortunately, our region has plenty of suitable habitat for shortjaw kokopu in the Tararua, Rimutaka, and Haurangi ranges, and the streams in these ranges are reasonably easy for the migratory fish to get to from the open sea – as long as they get past the whitebait nets! There are good populations of dwarf galaxias in the Pakuratahi River, the upper reaches of the Wainuiomata and the Waihora Rivers.

The giant kokopu and brown mudfish prefer lowland streams, where unfortunately much of their habitat has been degraded. We can improve their life chances by limiting disturbance to what is left of the streams they live in, cleaning up rivers and stepping up streamside planting projects.

Freshwater fish are not regularly monitored in this region, but surveys over the last four years have generally revealed the presence of the same species as were recorded in the 80 years up to 2001.

A specially developed **fish diversity index** from Massey University gives us a picture of the diversity of freshwater fish species living here now. The index shows us that the diversity of fish in this region is higher than in other regions in New Zealand.

Fish numbers and species diversity are declining in some streams though, with urban and lowland streams most at risk.

The banded kokopu is found in urban and rural streams throughout the region. The Owhiro Stream in Wellington city once had all five of the whitebait species living in it. Today, only the banded kokopu still lives there. Photo: Angus McIntosh.

The health of the marine environment

Greater Wellington's responsibilities for the coastal marine area (the region's boundaries extend 12 nautical miles out to sea) are set down in the Resource Management Act 1991. They cover environmental protection such as the control of discharges, reclamation works, noise, seabed disturbances and occupation. The control of the harvesting of plants or animals is the responsibility of the Ministry of Fisheries.

The last *Measuring up* in 1999 reported that our knowledge of marine biodiversity was piecemeal. Since this time, some work has been done. See **Coastal environment** for information about coastal ecosystems.

However, we do know that some populations of fur seals are increasing. The Wellington region supports a breeding colony at Cape Palliser and they regularly come ashore elsewhere around the region.

Twenty-three whale species (the term also includes dolphins, porpoises, orca and beaked whales) have been recorded around our coasts. Deep canyons and food-bearing currents in Cook Strait provide a rich food store and Wellington harbour offers a chance for rest and relaxation in warmer waters.

What's being done

Many businesses, schools, community groups, landowners and individuals have joined with Greater Wellington in rising to the biodiversity challenges in our region. The growth of the community environmental programme, *Take Care*, is proof positive, with a total of 33 groups now working to restore streams, dunes and wetlands. Many more projects exist outside the programme.

The Department of Conservation, local authorities and groups like The Royal Forest and Bird Protection Society all do valuable work, managing their own lands or assisting others with advice and expertise.

Table 6.4: Some of Greater Wellington's biodiversity initiatives

Programme	Targets	Delivers
Top 100	Native forest owners	Identifies the highest value native forest in the region (assistance is available for landowners wishing to protect and manage these).
Key Native Ecosystem (KNE)	High value ecosystems	Integrated pest plant and animal control in the region's highest value ecosystems on private land or in city or district council ownership. Monitoring is carried out to measure ecosystem health improvements.
Covenant protection assistance	Private landowners	Financial assistance for landowners entering into perpetual QEII National Trust covenants to protect any high value ecosystem (bush, wetlands, dunes).
Covenant pest control assistance	Landowners entering into QEII National Trust covenant	Expert advice and assistance with pest control.
Wetland incentive programme	Private landowners	Expert advice and targeted financial assistance for wetland protection.
Streams Alive	Landowners with streams in 12 high value catchments	Advice about streamside plants and financial assistance for plants and weed control in the 12 catchments.
Freshwater ecosystems	Knowledge gaps	Builds understanding of the region's native fish populations and their habitat requirements.
Take Care	Communities	Expert advice and financial assistance for community groups wishing to restore certain degraded ecosystems.
Take Action	Students and schools	Education to help students care for their local ecosystems and biodiversity.
Greater Wellington Parks and Forests Asset Management	Greater Wellington's land	Integrated pest plant and animal management supported by monitoring designed to improve ecosystem health.
Biodiversity booklets	Private landowners, community groups	Practical information on managing wetlands, native bush, stream margins, restoration planting and managing weeds.

More and more, Greater Wellington is taking an ecosystems approach to its work. Flood protection engineering, for instance, now accommodates environmental values.

Where to from here?

We know that many of the region's ecosystems are in trouble. Apart from our protected uplands – the Rimutaka, Tararua and Haurangi Forest Parks – our ecosystems are now small, isolated fragments, and pests have replaced many of their original native plants and animals. Greater Wellington's biodiversity programmes are a response to community concern about that decline.

But are we doing enough? The truth is we don't really know. Biodiversity health is difficult to measure beyond a very local level. We can measure broad changes in the quantity of say, native forest, using satellite imagery, but these trends tell us little about quality. It's now widely accepted that our ecosystems are under such stress that without our intervention they will continue to deteriorate rapidly.

Are we achieving the ecosystem objectives of the Regional Policy Statement? As noted in the last *Measuring up*, the objectives are so ambitious that we may never meet them, even though biodiversity protection, management and restoration efforts have increased significantly in the region.

There are many success stories – streamsides restored, estuaries cared for and the return of native birds after long absences – but whether this is enough to reverse the decline, we cannot tell.

Monitoring changes in the quality of biodiversity at a regional scale is difficult. The techniques used for monitoring specific sites such as bird counts and vegetation plots do not lend themselves to region-wide use. This is an issue faced by every city, district or regional council and, at a national level, by the Department of Conservation. However, techniques for broad-scale monitoring are starting to emerge (see *Where we are now* above) and these may enable us to report against the objectives of the Regional Policy Statement with some certainty in the future.

More information

Porteous, Tim. 2005. *Ecosystems background report*. Greater Wellington.

Landscape and heritage

Objectives

1. Nationally and regionally outstanding geological features, landforms, soil sites and other natural features of the region are protected from inappropriate subdivision, use and development.

2. Adverse effects from human activities on the region's natural and physical resources are avoided, remedied or mitigated, so that the quality of any regionally outstanding landscapes which those resources contribute to is maintained.

3. The cultural heritage of the region which is of regional significance is:
   - Recognised as being of importance to the region;
   - Managed in an integrated manner with other resources; and
   - Conserved and sustained for present and future generations.

4. The attributes of natural and physical resources which provide for regional recreational opportunity, and for the appreciation and enjoyment of those resources by the regional community, are maintained or enhanced.

Doing well

- There is an emerging consensus that landscape management is important if the region is to keep its distinctive identity.
- The number of registered heritage places has increased over the last decade, and for many registered residential and public buildings, the structural integrity is good.
- All local authorities now require resource consent before buildings and heritage items listed in their district plans can be demolished, removed or substantially altered.

Must improve

- Significant landscapes have yet to be identified, and there is no strategic guidance for landscape management in the region. In this policy vacuum, decisions about landscape change are ad hoc and happen by accident rather than design.
- Communities have strong views about the importance of local landscape for themselves and for future generations, but management solutions must also recognise the rights of landowners.
- The quality of information on many archaeological sites and numerous heritage items is poor, their condition is mixed and the distribution of registered items and places is uneven across the region.
- Some heritage places of national or regional significance are at risk and may need active attention and management. More financial assistance and encouragement for all owners of heritage would be very helpful, but few public authorities offer such support.

A sense of place

When people describe a place, they often talk about how it looks, the things that make it a bit different, and what they specially remember about it. They may like or dislike the place, but in either case their comments help us understand what they think and feel about it.

The landscapes and heritage of the Wellington region define a special place. Long stretches of rocky coastline, rugged mountain ranges and river systems dominate the landscape we live in. And everywhere is evidence of our history – of how our region evolved under human occupation.

Landscape and heritage are the children of change – a mix of accident and design. We can't preserve them forever just how they are right now, so we need to manage inevitable change in ways that reflect the values that make places special to us.

What do we know about the current state of our landscapes and heritage and the pressures on them? How do we manage these pressures in future?

In this chapter, we recognise that landscapes do change through time. In one sense, landscapes are the product of past choices; they reflect – and are part of – our history. The land has shaped the human experience over generations, and that relationship is reflected in the heritage that remains.

Landscapes change through time; Pauatahanui Inlet, 2005.

What is landscape?

Technically, "landscape" might be described as a combination of land form, land cover and land use, but mostly, landscape reflects the emotional response of the individual. The value we put on places is the sum of our different priorities, backgrounds and associations, as well as our sense of beauty and history.

For Maori, the land defines their rohe, or tribal area, and takes on a powerful cultural significance. Features like mountains or islands, for instance, are earthly links with ancestors or legend.

From an ecological perspective, the climate and physical character of a particular place make it a home for plants and animals, specifically adapted to live there. For them, this landscape is a living environment, their special place. We need to consider these non-human associations when we pursue landscape management.

Landscape, then, is more than a visual snapshot, and managing landscape is more than simply recognising the most attractive parts. While the Wellington region has its share of iconic features, we need to remember that we all have places which are special to us, no matter how small or remote.

Kapiti Island, a special place to Maori for its history but also important to many people for its visual and ecological values.

Landscape management needs to think beyond "protecting the best and forgetting the rest". With landscape (and heritage management too) we should acknowledge the contribution that local identity – that unique mix of places, spaces, buildings and views – makes to our quality of life.

The Regional Policy Statement and landscape

In 1995, the Regional Policy Statement identified several landscape-related issues which are still relevant.

- There continues to be concern about potential damage to the region's significant natural features and soil sites.
- Similarly, there is concern about the impact of development on landscape quality. Examples of current pressures include large-scale earthworks associated with subdivision, development in the coastal environment (e.g. in some parts of the Wairarapa and along the Porirua and Kapiti coast), and infrastructure associated with wind energy generation on ridgelines and hilltops (e.g. the West Wind proposal on the Wellington peninsula).
- The loss of natural character, particularly where associated with remnant native vegetation, has continued at a localised scale.
- The rights of private landowners to use and manage their land sometimes conflicts with the expectations of the community for such land to provide public enjoyment through landscape protection – both for present and future generations.

Hill tops provide viewpoints, but are also parts of views from elsewhere. We need to think about their management and use from both perspectives, and a third one too - that of the landowner.

Some places have resilience and a ruggedness that helps ensure maintenance of their character. Turakirae Head is a significant geological site, with nationally important raised beaches brought about by uplift during earthquakes. A mix of dynamic natural forces - crashing seas, seals, dramatic skies and active geology - create a very special sense of place. Photo: Dave Hansford.

The Regional Policy Statement anticipated that a Regional Landscape Plan would provide the specific guidance necessary to resolve some of these issues. Such a plan was developed and then withdrawn after public submissions and hearings persuaded the Council that these matters could be addressed by district and city councils with guidance from non-statutory landscape guidelines. Later, the Council decided that guidelines were not necessary and the upcoming review of the Regional Policy Statement was seen to be a more appropriate opportunity for revisiting the question of landscape management for the region.

Where we are now

The decisions to withdraw the Regional Landscape Plan and stop work on the guidelines mean that significant landscapes in the region have yet to be identified. Because of this, there is no strategic guidance for landscape management. At best, development proposals have been subject to landscape management provisions in district plans, but these are patchy in coverage, and their wording provides rather generalised guidance that does not necessarily achieve the desired outcomes.

This strategic policy vacuum means that landscape decisions are being made *ad hoc*, and that landscape change is still happening by accident rather than design.

What's being done

There is a growing awareness of the importance of place and of the need to take a more consistent and coordinated approach to landscape management. A number of such initiatives are now under way in the region, for example:

- Porirua City Council's District Plan is under review, and landscape, heritage and ecology are being considered in an integrated way.
- In Wellington City, recent changes to the District Plan point to the potential benefits of a landscape inventory - the identification, description and listing of different types of landscape, as well as their unique characteristics.
- The Wairarapa district councils and Greater Wellington have put together the Wairarapa Coastal Strategy, of which landscape description and assessment are a significant part.

As part of the background to this report, territorial authorities and landscape professionals were asked to comment on how landscape was managed. They said they wanted a more coherent and consistent policy context, that regional leadership was needed, and that Greater Wellington was best placed to provide such leadership.

Where to from here?

How do we manage the mosaic of landscape types in a more consistent way? And how will it reflect the importance we might attach to each of them? Do some places deserve

more care than others? If they do, how do we decide which ones?

Is it realistic to seek input from many different interests - landowners, iwi, individuals, local communities and the wider regional community – and try for some sort of consensus?

A first step might be to describe the region's different landscapes – an objective, fact-based way of characterising and classifying the landscape. However, this would not be sufficient in itself.

Increasingly, people are concerned about how the region's landscapes can sustain their character in the face of human pressures. Whether this groundswell translates into broader agreement about landscape management and/or effective action will be partly determined by our responses to the questions above. In the upcoming review of the Regional Policy Statement, people will get a chance to speak about their feelings for landscapes.

Wellington's landscapes are a mix of natural and human influences – houses and bush on the hills, and the city centre with its modern towers and the bustle of shoppers, the harbour as the backdrop. For Wellington and the region, we may need to better appreciate what specific characteristics and qualities make landscapes work if we are to effectively manage the opportunities and the risks that change presents.

What is heritage?

The Regional Policy Statement defined cultural heritage as *"buildings, structures, sites, areas, wahi tapu and wahi tapu areas associated with human activity which are inherited from the past or are of value to future generations, and which are considered to be of special value."*

In 2003, the Resource Management Act 1991 (RMA) definition of "historic heritage" was amended to mean: *"those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, deriving from any of the following qualities: archaeological, architectural, cultural, historic, scientific, technological, and includes historic sites, structures, places, and areas, archaeological sites, sites of significance to Maori, including wahi tapu, and surroundings associated with natural and physical resources."*

The Regional Policy Statement interpreted "regionally significant" cultural heritage as those places classified as Category I on the Historic Places Trust Register. This was a rather limited interpretation, and meant that Regional Policy Statement provisions applied to only about 100 places.

Taylor Stace cottage, Pauatahanui - classified as Category 1 on the Historic Places Trust Register and therefore a 'regionally significant' heritage item in the Regional Policy Statement. Photo: R. McClean, NZHPT, 2004.

Where we are now

The Government reviewed heritage management in the late 1990s, and the amended definition of "historic heritage" in the RMA mentioned above was one result of that review. Other changes made protection of historic heritage a matter of national importance under section 6(f) of the Act, and an addition to section 12(g) gave protection to historic heritage in the coastal marine area.

Such changes notwithstanding, the Historic Places Trust and city and district councils retain the chief responsibility for heritage management. Nowadays they are backed up by a growing number of organisations and societies – often working at a local level.

What's being done

After discussions in 2004, Greater Wellington and the Historic Places Trust sent questionnaires to agencies and interest groups about the state of heritage in the region, the pressures on it, and how different authorities were dealing with those pressures. The Trust then assessed the condition of selected registered buildings. The box below highlights their main findings.

Main findings of the heritage surveys

- The number of Historic Places Trust registered places increased from 555 in 1995 to 648 in 2005 – but the increase was slow compared with earlier years – and the increase is largely concentrated in Wellington and Porirua.
- While only two items have been removed from the Historic Places Trust Register between 1995 and 2005, these figures understate the true extent of damage.
- The integrity of buildings on the Register varies between residential and public buildings (where repair and use are generally compatible with the heritage values) and commercial buildings (where the heritage fabric is often restricted to the facade following major internal modifications), especially in the main towns and cities.
- Information about Category I items on the Register is generally good, but data for Category II is only poor to fair.
- Category I generally excludes historic areas, registered archaeological sites and sites of significance to Maori.
- Although the number of archaeological sites increased from 881 in 1995 to 1030 in 2005, information about their condition is mixed and not geographically representative. The New Zealand Archaeological Association is currently upgrading its information, supported by Greater Wellington and territorial authorities in the region.
- All city and district councils now demand resource consent to demolish, relocate or carry out substantial alterations and additions to heritage items listed in the district plans. However, the effectiveness of plan rules varies greatly between districts.
- The Historic Places Trust considers a reasonably large number of places of regional or national significance to be at risk and needing intervention.
- Support for heritage owners is critical but available funding is limited. Central government provides some money through the Historic Places Trust's heritage incentive scheme (but only for Category I items), and only four councils (Wellington City Council, Kapiti Coast District Council, Masterton District Council, Hutt City Council) offer any financial support for property owners.

The Historic Places Trust and Greater Wellington also drew up a set of "heritage indicators" to bring all the collected information together and to be able to assess heritage and its management. One indicator of heritage recognition is the number of Category I and II items on the Trust's register. Table 7.1 shows these figures for the Wellington region while Table 7.2 provides more detailed information broken down for each of the city and district councils.

Wellington region	1995	2005
Number of registered category I historic places	114	126
Number of registered category II historic places	422	496
Number of registered historic areas	18	24
Number of registered wahi tapu and wahi tapu areas	1	2

Table 7.1:
Category I and II items on the Historic Places Trust Register, 1995 and 2005.

Table 7.2:
Category I and II items, 1995 and 2005, by local authority area.

Local Authority	1995						2005					
	Historic Places			Historic Areas	Wahi Tapu	Wahi Tapu Areas	Historic Places			Historic Areas	Wahi Tapu	Wahi Tapu Areas
	Cat I	Cat II	Total				Cat I	Cat II	Total			
Carterton DC	0	18	18	0	0	0	1	18	19	0	0	0
Masterton DC	11	41	52	0	0	0	11	44	55	1	0	1
South Wairarapa DC	4	66	70	1	0	0	4	71	75	2	0	0
Hutt CC	7	35	42	1	0	0	9	37	46	3	0	0
Upper Hutt CC	5	7	12	1	0	0	5	7	12	2	0	0
Kapiti Coast DC	5	18	23	2	0	1	5	22	27	2	0	1
Porirua CC	4	7	11	1	0	0	5	50	55	1	0	0
Wellington CC	78	230	308	12	0	0	86	247	333	13	0	0
Regional total	114	422	536	18	0	1	126	496	622	24	0	2

Where to from here?

Wellington has a rich and varied historic heritage, which represents a valuable record of our past and economic potential for the future (e.g. tourism). For these reasons – and others – it should be managed well.

Lower Hutt Post Office, a more recent heritage item but an important landmark building, nonetheless, contributing to the city centre's character. Photo: R. McClean, NZHPT, 2004.

Heritage, like landscape, helps define our sense of place, and continuing damage and destruction may have sparked a greater appreciation of its value. What's left, and how we manage it, are key issues for the Regional Policy Statement review. It may be that we adopt a more comprehensive interpretation of the range of historic heritage in our region, in line with the definition in the RMA and the feedback from our questionnaire.

The heritage monitoring indicators developed for this State of the Environment work are a positive way to compare our achievements of the coming decade with those of the last. Perhaps we have seen a turning of the tide, and historic heritage may now be better appreciated for the contribution that it makes to our quality of life.

More information

Holmes, John, 2005. *Landscape and heritage background report.* Greater Wellington.

McClean, Robert, 2004. *Wellington Region State of the Environment Cultural Heritage Technical Report*. New Zealand Historic Places Trust.

Natural hazards

Objective

1. Any adverse effects of natural hazards on the environment of the Wellington region are reduced to an acceptable level.

Doing well

- Regional hazard investigations have been completed for earthquake, tsunami, wildfire and meteorological hazards.
- Floodplain management plans or river schemes are in place for all major rivers.
- Hazard information is now accessible on Greater Wellington's website.
- All district plans have rules for mitigating flooding and fault rupture hazards.
- The Wellington Region Civil Defence Emergency Management Group has been formed and the Civil Defence Emergency Management Group Plan launched.
- 69 per cent of Wellington region's residents have stored water for emergencies.

Must improve

- There is inadequate information available on who and what is at risk.
- Land use decisions do not always fully consider risk from natural hazards.
- 31 per cent of Wellington region's residents still don't have stored water for emergencies.

Reducing our risk

The Wellington region is vulnerable to natural hazards such as earthquakes, tsunami, flooding, landslides, coastal erosion, wind, wildfire, drought and even volcanic activity. The effects of such disasters will depend on just where and when they strike.

Greater Wellington aims to reduce their impacts to an acceptable level. Destructive natural events will occur – we can't completely avoid them – but we can lessen their effects.

Where we are now

Earthquakes

Our region rests on a geologically active zone near the junction of the Australian and Pacific tectonic plates. Wellington, Porirua and the Hutt Valley have the highest potential in the country for social and economic losses from earthquakes.

Figure 8.1:
Earthquakes larger than magnitude 2 recorded in central New Zealand between 1995 and 2005. There is a general pattern of shallow earthquakes (less than 40 km deep) through Hawke's Bay, Wairarapa, Wellington and Marlborough, and deeper earthquakes – linked to the subducting, or sinking, Pacific Plate – from Taranaki to Nelson.

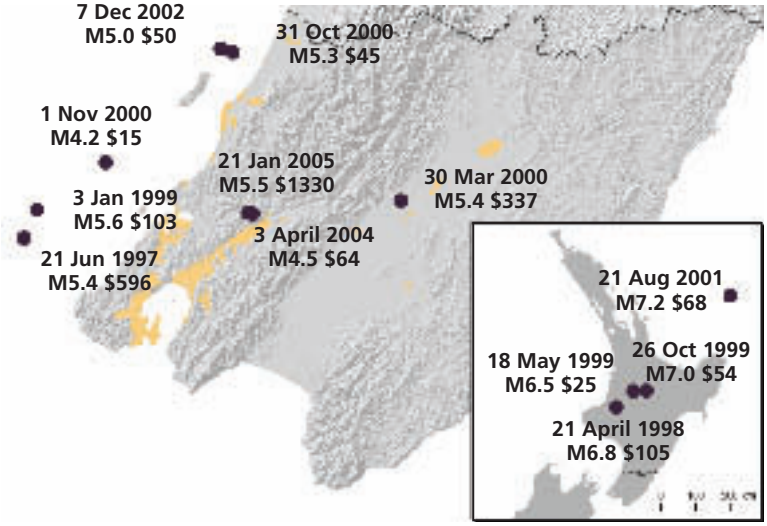


Figure 8.2:
Since 1997, 12 earthquakes have caused significant damage in the region. The date, earthquake magnitude and cost to EQC (in $1,000s) for the region are shown here. The most expensive happened on 21 January, 2005 – a magnitude 5.5 earthquake near Upper Hutt which cost EQC $1.33 million on some 1000 damage claims.

While there have been no reported injuries in the region from earthquakes over the last decade, earthquake damage to property came to more than $3 million. Ten years of data, however, don't reflect the real hazard we face. A number of active faults in and around the region could produce large, destructive quakes, resulting in hundreds of deaths, thousands of injuries and billions of dollars worth of damage.

Table 8.1: Characteristics of major active faults in and near the Wellington region.

Fault	Recurrence interval (yrs)	Time since last event (yrs)	Estimated magnitude *
Awatere (South Island)	<1000 – 1300	157	7.5 – 7.8
Wairau (South Island)	1000 – 2300	>800	7.2 – 7.7
Ohariu	1500 – >5000	1060 – 1140	7.6
North Ohariu	1000 – 4000	<4000	7.3 – 7.7
Gibbs	unknown	<10,000	~ 7.0
Shepherds Gully	2500 – 5000	>1000	7.6
Otaki Forks	4000 – 9000	unknown	7.3 – 7.6
Wellington	500 – 770	335 – 485	7.6
Wairarapa	1160 – 1880	150	8.0 – 8.3
Carterton	~1000	unknown	7.0
Masterton	~1000	unknown	6.7
Boo Boo (offshore)	500 – 2000?	unknown	7.2 – 7.6
Subduction interface	500 – 5000?	unknown	7.8 – 8.2

* Estimated earthquake magnitude able to be generated by that fault.

Earthquakes can be described in different ways. "Magnitude" measures the energy released in the earthquake or its "size". This is the number often reported on the news after an earthquake. "Intensity" is the amount of ground shaking and damage, and is usually measured with the Modified Mercalli (MM) Scale (see Table 8.2). Intensity at a given point depends on the magnitude of the earthquake, how far away and how deep it was, and the local ground conditions – such as whether the ground is sand or rock.

Even distant earthquakes can cause damage here. One of the quakes shown in Figure 8.2 was centred 180 km north of East Cape. The expected average return periods for ground shaking intensities on a bedrock site in downtown Wellington are given in Table 8.2. Return periods are likely to be shorter for areas of soft sediment, where ground shaking is often amplified.

Such areas include reclaimed land around central Wellington, Kilbirnie, Rongotai and Miramar, Petone, Lower Hutt, Wainuiomata, Mangaroa Valley, low lying areas around Porirua Harbour and Pauatahanui Inlet, and areas of the Wairarapa Basin around Masterton, Carterton and Lake Wairarapa. If ground shaking intensity exceeds MM VII, many of these areas could also suffer liquefaction. This is when some soils lose strength and behave more like a liquid than a solid.

Table 8.2:
Average ground shaking intensity return periods for a bedrock site in downtown Wellington according to the Modified Mercalli (MM) scale.

Ground shaking intensity (MM scale)		Return period (years)
V	Felt outside, sleepers wake, small objects and hanging pictures move.	2
VI	Felt by all, furniture moves, plaster cracks, some minor chimney damage.	9
VII	General alarm, difficult to stand, windows crack, some plaster/ bricks/tiles fall, small landslides and rockfalls, minor liquefaction.	42
VIII	General alarm approaching panic, unreinforced chimneys fall, stone and brick walls damaged/collapse, moderate landslides, ground cracks, liquefaction.	170
IX	Panic, masonry buildings and foundations damaged, some destroyed, some houses shift off their foundations, widespread landslides and liquefaction.	450

The impacts of earthquake hazards, such as ground shaking, fault rupture, liquefaction and landslides, will continue to increase with more development in the region, especially when development happens on or near active faults, on areas of soft soil or on steep or excavated slopes.

Ground shaking itself can't be avoided, but good engineering and planning can prevent or minimise building damage, liquefaction and landslides. Preparedness, response and recovery plans are also key to earthquake mitigation.

Tsunamis

No damaging tsunamis have struck the region's coastline over the last decade. The 2001 Peru and 2004 Asian tsunamis both reached Wellington, but measured less than 30 cm by the time they got here. However, the region has suffered damage in the last 200 years, and many coastal communities and assets remain at risk from both local and distant tsunamis.

Several undersea faults lie beyond our coast, including the major Hikurangi subduction margin to the east, the Boo Boo, Wairarapa, Wellington and Ohariu faults to the south and some smaller faults off Kapiti. Movement of these faults could trigger a tsunami, as could a submarine landslide. Recent research by NIWA shows many landslide scars in the canyon walls of Cook Strait.

The region's coast, especially in the east, is also exposed to tsunamis generated off the coast of South America.

Research shows that on average, a damaging tsunami is likely to strike some part of the region's coast every 85 years or so. Castlepoint, Riversdale and Palliser Bay communities – along with low lying communities in Wellington Harbour and the south coast – are most at risk.

The move to coastal living has put more people and property in areas where tsunamis are likely to hit, increasing the potential impact. Rising sea levels caused by climate change could worsen that impact because sea level will become closer to people's homes.

The best way to avoid tsunami damage is not to build in exposed coastal areas. At the very least we should be using building techniques to better withstand tsunamis in these areas. However, because tsunami strikes are so infrequent, we tend to rely on preparedness, rather than applying land use restrictions in tsunami prone areas.

Flooding

Flooding is the most commonly experienced natural hazard in the region. Steep river catchments tend to funnel rain directly onto floodplains and gravel fans, where much of our population works and lives.

The last decade saw a number of serious floods. The largest and most destructive came in October 1998, when two northwesterly storms in the same week flooded Kapiti, the Hutt Valley and Wairarapa. Homes were evacuated in Kapiti and two civil defence emergencies were declared. A number of roads were closed in the Wairarapa.

Sustained heavy rains returned to Kapiti, the Hutt Valley and Wairarapa in February 2004. In early January 2005, the Otaki, Waikanae, Akatarawa and Whakatikei rivers rose to over 60-year highs. The Waikanae River burst its banks and hundreds were evacuated from houses and a camping ground.

Later, in March 2005, a southeasterly storm hit the eastern Wairarapa and the Rimutaka Range, severely damaging the eastern Wairarapa hill country and Wainuiomata and sending huge debris flows down the Orongorongo Valley. Four hundred and forty four mm of rain fell in just 36 hours – the kind of deluge expected less than once in a hundred years.

Flooding at Hutt Park during February 2004. These floods prompted evacuations and closed roads, some for months, throughout Kapiti, the Hutt Valley and Wairarapa.

In the last ten years, floods in the region killed four people and wrought tens of millions of dollars in damage - more than $11 million to Greater Wellington's flood protection works alone. An average of five storms a year caused surface flooding with minor property and infrastructure damage.

Catchments on both sides of the Tararua Range, such as the Hutt, Otaki, Waikanae, and Ruamahanga, face the greatest danger from flooding. But areas away from major rivers can still suffer localised flooding if natural drainage and stormwater systems can't cope.

Meteorologists predict more La Niña events over the next 20-30 years, increasing the likelihood of ex-tropical cyclones striking from the east. Over the longer term, climate change is likely to bring more intense rain across the region.

We can't stop storms, but the effects of floods can be reduced by constructing stopbanks, maintaining river corridors and reforesting upper catchments. We can also build less in flood-prone areas, have minimum floor levels and have effective response and recovery plans.

Landslides

The region's steep, unstable hills – and the tectonic turmoil beneath – make it particularly prone to landslides. Earthquakes can unleash large slips of bedrock and soil; the 1855 Wairarapa earthquake triggered landslides over 20,000 square kilometres in the southern North Island. Most of our landslides, however, are small soil slides and flows set off by intense or prolonged rainfall.

The last decade saw at least 17 events that involved widespread slipping, property damage and/or evacuations. Most of these were set off by heavy rain and accompanied by major flooding. For example, in October 2003 an intense rainstorm dumped 100mm of rain in just 24 hours on Paekakariki and the hills behind it. The resulting debris flow enveloped a motel and covered road and rail lines with gravel. Houses and shops were inundated with muddy water.

A landslide triggered by heavy rain at Te Marua during the February 2004 floods. This landslide blocked the Hutt River, diverting it through Te Marua golf course. Photo: Graham Hancox.

Between 1997 and 2005, the Earthquake Commission received at least 1200 claims, totalling more than $5 million, for landslide damage to houses and contents in the Wellington region. Over half came from Wellington City.

The areas most susceptible to landslides are steep, unsupported cuts along the Hutt motorway, Ngauranga Gorge, and Haywards and Rimutaka Hill roads. Similar cuts in metropolitan hill suburbs are also sensitive, as are areas of steep coastal slopes, fault scarps, steep river terraces and quarry slopes.

Much of the eastern and coastal Wairarapa hill country is prone to slumps and shallow soil slips. Every four to 12 years the area suffers a storm severe enough to cause widespread landslides, with smaller slips every one to three years.

More landslides are likely in future as a result of the heavy rain expected to come with climate change. Development, modification and deforestation of hillsides – especially in steep areas – makes them more unstable. For example, more than two thirds of the 74 landslides reported during the February 2004 storms happened on slopes already weakened by earthworks.

Shallow soil slides at Castlepoint Station in the eastern Wairarapa hill country, triggered by intense rainfall in March 2005. Photo: Masterton District Council.

To reduce landslide risk, future development should avoid terrain that needs excessive modification to accommodate it.

Coastal erosion

Coastal erosion is part of a natural cycle of sediment movement, and only becomes a hazard when buildings, roads and other assets are built too close to erosion-prone sites.

Much of our coast is hard bedrock, but softer sediments, such as the dunes at Castlepoint, Riversdale and the Kapiti coast, soft mudstone on the Palliser Bay coast and small areas within Wellington and Porirua harbours, are prone to erosion.

Erosion may worsen with climate change, which will increase sea level and alter other erosion drivers such as wave action, storminess and sediment movement. The potential for erosion damage is also climbing with the demand for coastal living. Human activities can easily make things worse – building a seawall in one area might increase erosion further along the coast – so careful management is a must. The most sensible option is to avoid developing erosion-prone areas in the first place.

Te Kopi, Palliser Bay, 2002. Coastal erosion is a continuing problem for settlements and the road along this stretch of coast.

Severe wind

Climate and topography make the Wellington region especially windy. Westerly winds, turned south by the Tararua Range, race through the gap of Cook Strait to produce strong north or northwesterly winds. The Tararua Range creates turbulent downwind waves in such conditions, delivering very high winds to the Wairarapa.

Southerlies flow parallel to the main Wellington ranges, so they don't gust as strongly as northerlies, but overall, southerly wind speeds are higher.

Damaging winds blow on average about once a month, disrupting transport (particularly ferry crossings), felling trees, power and telecommunication lines, and even lifting roofs.

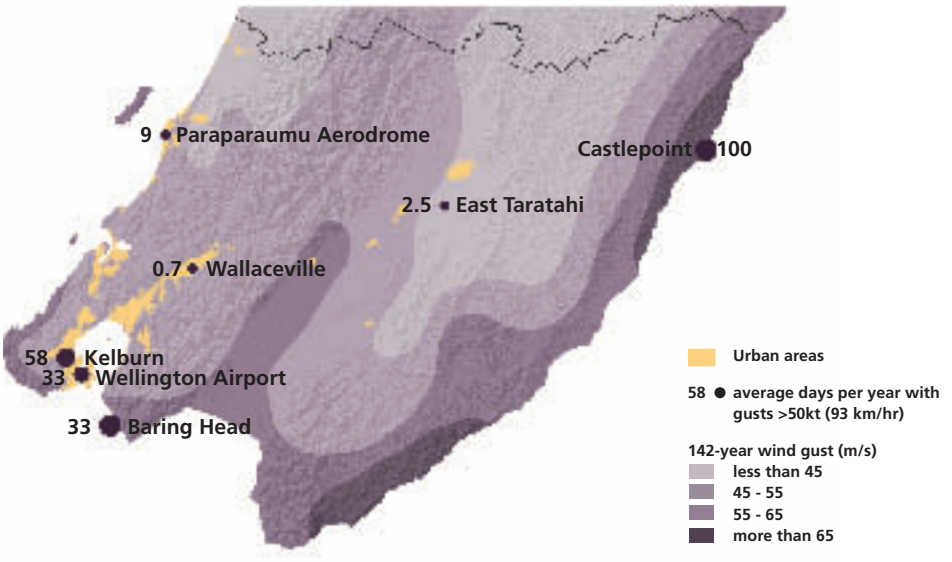


Figure 8.3:
Wind hazard varies widely across the region. The calculated 142-year return period wind gust is shown here, along with the average number of days per year with wind gusts over 50 knots (93 km/h) at selected locations. (The return interval values don't consider local topographic effects caused by features like hills, gorges and vegetation.)

The windiest areas are generally the eastern Wairarapa coast – particularly Castlepoint and the area around Tora – followed by the southern Wairarapa and Wellington coasts. Featherston, Mt Bruce and parts of the Rimutaka Road suffer localised wind effects.

Westerlies are expected to occur more often with climate change, but it's not yet known what that might mean for wind hazard in our region.

Wind-resistant building design and accurate weather forecasting remain the best defence against wind damage.

Wildfire

A wildfire is any unplanned blaze in an open space. They can ignite naturally – by lightning strike for instance – but are more commonly started by people. A wildfire's spread depends on the weather, slope angle, and how much fuel and oxygen are available to it. Wildfires are most common during the warmer, drier months between November and March.

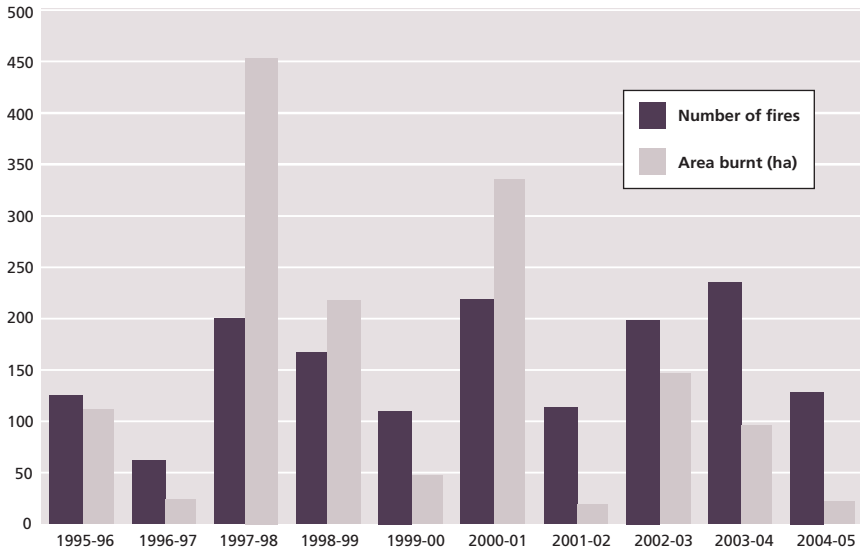


Figure 8.4:
Between July 1995 and June 2005, 1,544 wildfires burnt a total of 1,460 hectares in the Wellington region. There were many fires during the particularly hot and dry summers of 1997-98, 2000-01 and 2002-03.

Around 165,500 hectares, or 20 per cent, of land in the Wellington region is at high or extreme risk from wildfire, based on the prevalence of gorse and scrub, steep slopes, low rainfall and the proximity of people. The most at-risk areas are the southern and western edges of Wellington city, the eastern Hutt hills and areas around Eastbourne and Wainuiomata. In the Wairarapa, the eastern foothills of the Rimutaka and Tararua ranges, the Cape Palliser coast and parts of the coastal eastern hills are most vulnerable.

Increasingly, people have moved to the rural/urban fringe, and forests and open spaces have become their playgrounds, raising the likelihood – and potential impact - of wildfires. Climate change, predicted to bring a drier climate to eastern parts of the region, will further increase the threat of wildfire.

The number of wildfires has fallen nationally in the last ten years. This has been put down to more public education, more and better-equipped volunteer firefighters, and better cooperation between the National Rural Fire Authority and the New Zealand Fire Service.

Fire prevention is still our best defence, but rapid response and "safety zones" around homes and schools are important safeguards too.

Drought

Drought can lead to water shortages or restrictions, crop damage or failure, lack of stock feed and higher fire risk. Most summers, Kapiti and the Wairarapa can expect a water shortage to some degree, but it takes a major drought to affect the Wellington metropolitan area.

Nevertheless, the last decade saw three serious droughts in the region. El Niño conditions in the 1997-98 summer, with predominant westerlies, parched the Wairarapa, where just 30 per cent of normal summer rain fell on some of the eastern hills – the worst drought for almost 100 years. Water was rationed and farmers were forced to sell stock.

The summer/autumn drought of 2000-01 – this time linked to La Niña conditions – struck the Wellington, Hutt and Kapiti areas and to a lesser degree, southeast Wairarapa. The summer was the driest in Wellington city in nearly a century. In Kapiti, water supplies were restricted and swimming pools were closed. Farmers, faced with feed shortages, sold stock and fires were banned over the entire Wellington region.

In 2002-03, the Kapiti coast suffered again – as did the Tararua and Akatarawa ranges and the Wairarapa – when rainfall dipped well below normal. With between 20 and 40 per cent of average rainfall in Kapiti and Porirua, water restrictions returned.

Like flooding, droughts result from naturally- and human-induced climate variations. In general, La Niña periods bring easterly and northeasterly winds – with drier summers – to the Kapiti coast, western and southern Tararua Ranges and the Rimutaka Ranges.

In contrast, El Niño periods – with their prevailing westerlies – can bring drought to the Wairarapa.

Climatologists expect more La Niña events over the next 20 to 30 years, which could bring more droughts to Kapiti and central Wellington catchments. Longer term, climate change could mean more westerlies, driving up temperatures and reducing rainfall in the Wairarapa.

We can't control the weather, but we can ease the impact of drought by providing timely, accurate information so that water users can plan ahead.

Volcanic eruption

There are no active volcanoes in the Wellington area – the nearest are Mt Taranaki, Mt Ngauruhoe and Mt Ruapehu – but we could still feel their wrath. In 1995, and again the following year, westerly and southerly winds kept ash from the Mt Ruapehu eruptions from reaching us, falling instead over East Cape, Hawke's Bay and the Bay of Plenty. A northerly would have brought a different story, in which a millimetre of ash could have covered the region.

This doesn't sound like much, but even small amounts of ash can irritate lungs and eyes, contaminate water supplies, damage vehicles and houses, and close airports.

Ash layers preserved in the geological record tell us that falls have reached here in the past, but it's difficult to estimate when it could happen again – it would depend on the source and size of the eruption, and the direction of prevailing winds.

Return periods for the Wairarapa are estimated at 1300-1600 years for a 1-5 mm ash-fall from Mt Taranaki and more than 2000 years for a 0-2 mm ash fall from the central North Island volcanoes.

The likelihood of the Wellington region being directly affected by a volcanic eruption is low, but we should still be prepared, knowing what to do if ash comes our way.

What's being done

The nature of – hence our response to – each natural hazard is different. We might reduce risk by avoiding hazard prone areas, by adopting better building design or by constructing stopbanks. And we can reduce the impact of an event by being prepared. Greater Wellington plays a leading role in managing natural hazards in the Wellington region along with several other organisations.

Investigations and monitoring

Over the last 15 years, Greater Wellington has carried out many regional scale natural hazard investigations. In 1996, after a series of studies, we published earthquake hazard maps for the Wellington metropolitan area. Since then, earthquake hazard studies have mostly focused on mapping the region's many active faults.

A 2001 regional tsunami study led to an options report on managing tsunami risk, and a meteorological hazard study was completed in 2002. All major rivers – and some smaller streams – have had their own flood hazard assessments and in 1997, after a wildfire study, Greater Wellington produced wildfire hazard maps of the region.

Greater Wellington also keeps a watching brief on the effects of climate variations, both natural and human-made and has developed models to help predict drought likelihood.

City and district councils also investigate natural hazards, independently and in partnership with Greater Wellington. Wellington and Porirua cities, and Kapiti Coast, Masterton and South Wairarapa districts have all commissioned coastal erosion reports and Greater Wellington has helped several city and district councils with fault mapping projects.

A trench across the Ohariu Fault in the Ohariu Valley - the land on the right hand side has been pushed over the land on the left hand side. Scientists date organic material in buried soil layers to determine when and how often the fault has moved. The Ohariu Fault last moved about 1100 years ago in an estimated magnitude 7.6 earthquake. Photo: GNS.

Funding from the Earthquake Commission, the Foundation for Research, Science and Technology and others goes into natural hazard research by the Institute of Geological and Nuclear Sciences, the National Institute of Water and Atmospheric Research, Scion (formerly Forest Research) and private companies. Universities, particularly Victoria University, also make a valuable contribution to hazard research in the region.

Regional plans

The Regional Freshwater Plan, operative since 1999, sets out low flow levels for the region's main rivers. These direct people when to stop taking water from rivers so that fish and other stream life are not threatened. The Regional Soil Plan, operative since 2000, controls roading and tracking, land disturbances and vegetation removal on erosion prone land.

The Regional Coastal Plan, also made operative in 2000, promotes the use of soft engineering options – like beach nourishment – to manage coastal erosion. It encourages too, the consideration of natural hazards when assessing consent applications for coastal activities.

District plans

The Regional Policy Statement provides direction for land use planning in district plans. All city and district councils in the region recognise natural hazards as a resource management issue and their district plans reflect this with various levels of land use control.

For instance, they all carry provisions restricting or managing development around active faults and in flood-prone areas. Some (Upper Hutt, Kapiti Coast, Porirua, Wellington) have controls on earthworks and the removal of vegetation on erosion-prone land (Hutt City).

The Kapiti Coast District Council's upcoming coastal strategy will address coastal erosion management, and review their coastal setback limits – the distances people may build from the foreshore. The Wairarapa Coastal Strategy – a joint project between the three Wairarapa district councils and Greater Wellington – also sets out policies dealing with coastal hazards, particularly erosion. Provisions from the Strategy may be built into the combined Wairarapa District Plan. Currently in draft, the Plan contains controls on the construction of buildings within a foreshore protection area – generally 50 metres from mean high water springs.

No city or district council has land use restrictions in tsunami-prone areas. Instead, they rely on preparedness and proper response in such an event. Some planning provisions which are in place, such as setback limits, go some way to mitigating tsunami hazard.

Under the Building Act 2004, city and district councils must develop policies for dealing with earthquake-prone buildings to reduce the level of risk to the public over time. Measures to address ground shaking, liquefaction, landslides and strong winds are generally dealt with during the building consent process.

Providing information

In the last five years, Greater Wellington has improved access to natural hazard information through the internet and GIS technology. In 2003-04, we published 18 fact sheets on a range of hazards in the region and their mitigation. Greater Wellington's website hazard pages are updated regularly, and the Hazards Online database lists over 500 resources (reports, articles, etc) from a range of agencies. Greater Wellington staff also give presentations on natural hazards and emergency management to schools and other groups, and answer public enquires.

Greater Wellington shares hazard information with city and district councils, who pass it on to the public through district plans, Land Information Memorandums and Project Information Memorandums. Masterton and South Wairarapa district councils have also erected signs along their coastlines alerting people to the tsunami risk.

Civil defence emergency management

Greater Wellington and the region's eight city and district councils make up the Wellington Region Civil Defence Emergency Management (CDEM) Group. Released in May 2005, the CDEM Group Plan provides the context and direction for the region's civil defence emergency management. The Plan sets out a five-year work programme addressing areas such as public information and media management, communications systems, public education and debris disposal.

In an emergency, city and district councils are guided by their own standard operating procedures. Should a major disaster strike, the CDEM Group's job is to assess damage and needs, co-ordinate a response, and manage information through its Emergency Operations Centre.

Hazard warnings for severe weather, volcanic and distant-source tsunami arrive at the CDEM Group Office, where they are evaluated, then forwarded to other agencies, emergency services and the public.

Flood protection and warning

Greater Wellington has developed floodplain management plans or river schemes for the larger rivers in the region. These include hazard assessments, stopbank construction and annual programmes of groyne maintenance, planting, channel alignment and gravel extraction.

Floodplain management plans for the Hutt, Waikanae and Otaki rivers provide a 40-year programme to reduce flood risk. The Wainuiomata River and the Waitohu, Mangaone and Waiwhetu streams have all been assessed for their flood potential, and work on the Mangaroa River is underway.

In the Wairarapa river schemes are in place on the Waiohine, Waingawa, Waipoua and Ruamahanga rivers.

Construction of a rockline to form a new river channel edge on the Hutt River opposite Strand Park in 2004. The gravel bund in the river helps reduce sediment input into the river during construction.

Newsletters and consultation keep local communities informed, and care groups in Otaki and Waikanae monitor flood protection activities and help with care of the riverbank environment.

Greater Wellington gathers data electronically from a network of telemetered rainfall and river-level monitoring stations. City and district councils are alerted when water levels reach preset trigger points.

Erosion control

Greater Wellington works with landowners to control soil erosion – particularly in the eastern Wairarapa – by developing individual farm management plans with them.

We also monitor erosion, offer advice on soil management and stock rotation and subsidise the revegetation of eroded land. Further information is given in the Soil chapter.

Coast care groups – usually local residents – operate throughout the region, particularly on the Kapiti coast. They get funding from Greater Wellington, and sometimes their city or district council, to restore the coastal environment, often planting dunes with native sand binding plants to help curb coastal erosion.

Rural fire authorities

The Department of Conservation, and all city and district councils, act as rural fire authorities and are responsible for fire control within their areas. They train rural fire brigades, run education campaigns, maintain fire breaks, declare fire seasons and issue fire permits.

Lifelines groups

The Wellington Lifelines Group (WeLG) and the Wairarapa Engineering Lifelines Association (WELA) are voluntary associations of utility owners including power and telecommunications companies, water and sewerage providers, and transport infrastructure owners.

These two lifelines groups carry out hazard analyses and mitigation work to reduce vulnerability to natural hazards and to boost resilience during and after a disaster. WELA published the results of a major study of natural hazards, and the risk to lifelines in the Wairarapa, in 2003.

Where to from here?

In the years ahead, Greater Wellington will work closely with city and district councils on local hazard investigations, and continue to advocate for appropriate land use through district plans.

We need to investigate further not only the when and where of natural hazards, but also their consequences. We need to monitor just where, who and what is at risk – particularly from earthquake, flooding, tsunami, and coastal erosion. Without this information, it's difficult to know how well we are achieving our objective - reducing the adverse effects of natural hazards.

A July 2005 survey showed that 80 per cent of residents in the Wellington region consider themselves very or quite well informed about hazards – up from 69 per cent the previous year. However, only 69 per cent have emergency water stored, 65 per cent have emergency food supplies, and just 26 per cent have a household emergency plan.

Greater Wellington and the new CDEM Group need to continue their hazard awareness and preparedness education.

More information

Grant, Helen, 2005. *Natural hazards – background report.* Greater Wellington.

Energy

Objectives

1. Energy demand is moderated and energy that is needed is produced, distributed and used efficiently so as to reduce impacts on the environment and to make effective use of limited energy resources.

2. An increasing proportion of energy is provided by sources that are renewable.

3. Adverse local and global environmental effects of energy production, transportation, transmission, conversion and end use are avoided, remedied or mitigated.

Doing well

- Five councils in the region are members of the Energy Efficiency and Conservation Authority's EnergyWise Councils Programme.
- Renewable energy production from wind looks set to increase within the region.

Must improve

- Finite fossil fuels continue to be the largest, and growing, source of energy, with an increasing proportion coming from imported oil.
- Transport is the sector showing the most growth in energy use, and the main source of energy-related carbon dioxide emissions.
- Energy data for the region is very poor but the objectives of greater energy efficiency and more renewable energy production appear to have not been achieved during the last ten years.

Introduction

Dry winters and low hydro lakes have loomed large in the national headlines in the last few years, but today's energy stories are global; "Oil prices highest so far", "Is climate change already with us?"

In New Zealand, energy – where it's coming from next and the costs of our appetite for it – has assumed a high press and public profile. We have enjoyed cheap, abundant energy for so long that we rarely stopped to think about where it came from or how much we used. As long as we had enough to power the burgeoning array of "essential" home appliances, keep the machinery, lighting and air conditioning going at work, and fill the tank of the car, we were fine.

Until now.

We've been used to cheap, readily available petrol… but for how much longer, and what are the real costs?

But even today, we still tend to think less about energy itself and more about the things we want to use it for. The demand for "more power" diverts our thinking about what sort of energy we need, and where it comes from. Most current energy sources for transport, for example, are from finite fossil fuels imported from overseas, and burning these fuels creates all sorts of local pollution problems, besides contributing to climate change.

Constant, reliable energy is crucial to our economy and way of life.

So what route do we want to take through this hazy, uncertain situation? How best to plan ahead? To answer questions about our energy future, we need to know more about our energy present.

Where we are now

Energy is a global issue. Oil continues to drive world politics, even as nations argue about measures to reverse the impacts of its use on the Earth's climate.

In New Zealand, energy is one of four government priorities under the Sustainable Development Programme of Action. A National Energy Efficiency and Conservation Strategy (National Strategy) sets targets for improved energy efficiency and renewable energy production, and the Resource Management Act 1991 (RMA), was amended in 2004 to give formal recognition to the benefits of renewable energy and the effects of climate change.

Other central government initiatives include the New Zealand Transport Strategy, which promotes energy efficiency and greater use of renewable transport fuels, and a national environmental standard requiring greenhouse gases from large landfills to be "collected and destroyed or utilised."

A raft of other proposals aim at cutting greenhouse gas emissions - through a carbon tax, for instance - and positive financial incentives for renewable energy projects, such as offering carbon credits for suitable schemes.

One of the functions of the Electricity Commission, established in 2003, is to ensure that electricity is produced and delivered in a fair, reliable and environmentally sustainable manner.

In the Wellington region, the Regional Policy Statement offers objectives and policies for sustainable energy management that closely mirror the National Strategy, seeking to:

- moderate energy demand
- be efficient in the production, transmission and use of energy
- increase the proportion of energy from renewable resources
- manage the adverse effects of energy production, transmission and use, both locally and globally.

The Regional Policy Statement sets no specific targets, but the National Strategy calls for a 20 per cent gain in energy efficiency by 2012, and an increase in renewable energy generation of 22 per cent – or 30 petajoules – by the same date.

In light of rising demand for energy, it's increasingly important to know how well – or how badly – we are responding to the obligations, goals and targets in these various measures.

How well are we doing?

Reliable energy data for the Wellington region is very difficult to get, so this chapter draws mainly on national figures with an assumption that most of the conclusions hold true for the region as well.

The chapter examines:

- Total energy supply, or **primary energy**. Primary energy is the raw material – coal, gas, oil, geothermal, hydro, wind – that is then processed, transformed or refined to a form of energy we can use.
- Energy actually available to consumers - **consumer**, or **delivered energy**. Consumer energy is less than primary energy because during the processing, transformation and transmission of the primary energy supply, some of the value of energy is "lost".
- How energy is used **(end use)**, including some information about vehicle fuel use in the Wellington region.
- Energy produced and used from **renewable sources**.
- The production of **greenhouse gas emissions** from energy production, conversion and use.
- How efficient we are in our production and use of energy **(energy efficiency)**.

All quantities used in the chapter are given as petajoules unless otherwise specified. As a rough guide, one petajoule (PJ) is about equivalent to the electricity used in a city the size of Porirua – around 40,000 people - in a year.

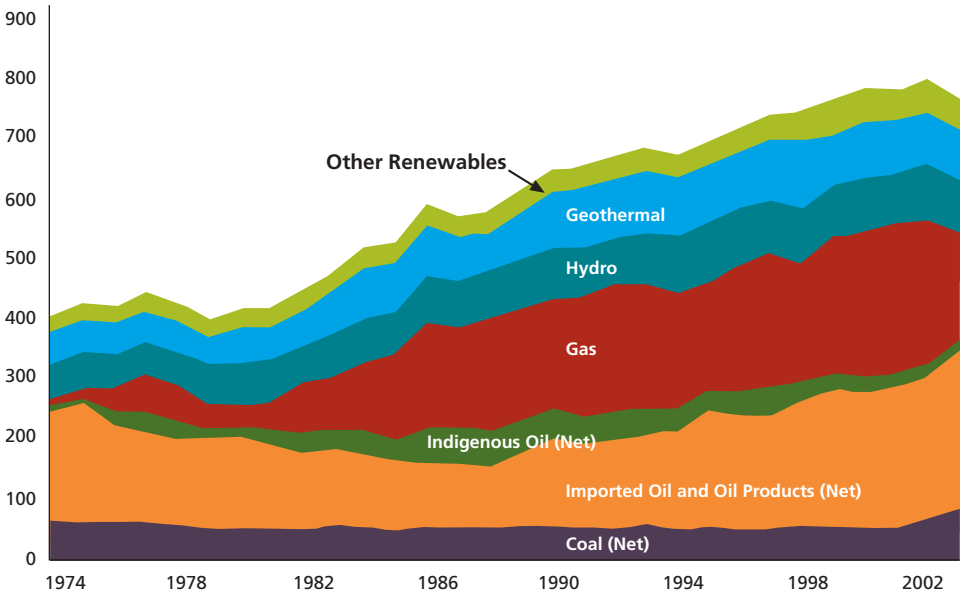
Primary energy supply

Energy is an essential input for our economy but energy demand has outpaced economic growth. New Zealand's total primary energy supply (see Figure 9.1) has gone from under 400 PJ in 1974 to 750 PJ in 2003, an increase of 87.5 per cent. Over the same period, the economy (as measured by GDP) grew by only 75 per cent.

Our use of fossil fuels (oil, coal, gas) jumped from around 150 PJ a year in the mid-1980s to 270 PJ in 2003, with an increasing proportion coming from imported oil.

Gas has been a significant primary energy source in recent years – 247 PJ in 2001 – but the Maui field is nearly exhausted and its contribution will fade. Hydro and geothermal have generally been steady sources of supply since the late 1980s (with the occasional hiccup with the hydro lakes). In recent years, renewables (hydro, biogas, industrial waste and wood) have actually been decreasing as a component of primary energy, both in actual numbers (slightly) and as a proportion of the total (more substantially).

Figure 9.1:
Total Primary Energy Supply, New Zealand, 1974-2003.



Consumer or delivered energy

Thirty three per cent of primary energy is "lost" in processing (e.g. refining crude oil), conversion (e.g. using coal to generate electricity) and transmission (e.g. carrying electricity through power lines) to the "consumer". For New Zealand in 2003, this meant about 750PJ of primary energy supply became 500PJ of useful energy actually delivered to the consumer.

Of the energy delivered to the various sectors of the economy, all showed some growth but the domestic transport sector swallowed up the greatest increase between 1995 and 2003 – an extra 45 PJ, or 28 per cent. Proportionally too, the sector grew from 38 per cent to 42 per cent of the consumer/delivered energy total (see Figure 9.2).

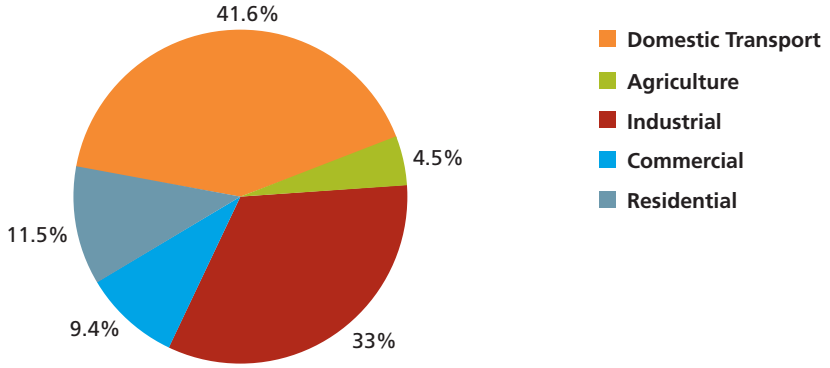


Figure 9.2:
Total Consumer Energy by Sector, New Zealand, 2003.

Source: Energy Data File, January 2005; Ministry of Economic Development.

End use energy

"End use" refers to how much effective energy, or "work", we get from our machines, appliances and so on. How much "work" we get from equipment, cars or cooling systems depends partly on what type of energy they use and partly on how efficient the piece of equipment, or vehicle, is in using the energy it gets.

The result of this second loss of useful energy means that of the 500 PJ of energy delivered to the "consumer", only about 200 PJ of it gets to do the job we want it to do – propelling the vacuum cleaner, heating the workplace or propelling our car from A to B. Vehicles are especially inefficient in this regard, using only a fraction (about 15%) of the energy we pour into them to meet the desired end use – getting around. Household appliances and office equipment tend to be better at using the electrical energy put into them.

In the Wellington region for the year ending March 2002, there was a 60 per cent loss between delivered and end use energy – from about 43 PJ to about 18PJ (see Table 9.1 for a comparison of Wellington with some other urban regions of the country).

	Wellington		Auckland		Canterbury		Waikato	
Fuel Type	Delivered	End Use	Delivered	End Use	Delivered	End Use	Delivered	End Use
Biomass	4.82	2.05	13.46	5.72	7.15	2.82	4.42	1.7
Electricity	10.81	8.39	29.41	22.41	14.57	11.86	10.67	8.48
Fossil fuel (non-transport)	8.78	5.09	45.35	18.85	9.8	4.19	13.01	6.49
Fossil fuel (transport)	18.92	2.65	61.22	9.27	26.34	3.9	19.23	2.79
Geothermal	0	0	0.02	0.01	0.01	0	0.15	0.11
Totals	**43.33**	**18.18**	**149.46**	**56.26**	**57.87**	**22.77**	**47.48**	**19.57**

Table 9.1:
Delivered consumer and end use energy, by fuel/ energy type, for Wellington and selected regions, March 2001-02

Source: Energy Efficiency and Conservation Authority End Use Database.

Congestion is costly, in both time and fuel wasted. We like our freedom to go where we like when we want to. But can we just look in the rear-view mirror and project more of the same sort of picture in the future? More cars, more roads, more trips, more emissions. With future oil supply uncertain and climate change approaching, are we at a cross roads for how we meet our energy needs for transport?

A major "end use" of energy, and the only one showing significant growth in demand for energy, is transport. Our "drive" for improved accessibility relies almost totally on finite oil derivatives, the burning of which contribute significantly to greenhouse gas emissions. As noted above, the internal combustion engine is not a very efficient user of energy and for New Zealand as a whole, 196 PJ of delivered energy goes into the transport sector but translates to less than 30 PJ of end use energy.

For the Wellington region, vehicle fuel sales are the highest they have been after rising by 8 per cent between 1998 and 2004 (see Table 9.2). A slight overall decline in the region between 2002 and 2003 was bucked by the Wairarapa, where sales have steadily increased every year. Furthermore, car ownership keeps climbing, as do the number and length of our car journeys.

Table 9.2:
Vehicle Fuel Data (in litres) for Wellington region: 1998-2004.

Source: Data collected by Wellington City Council (for the western part of the region) and by Masterton District Council (for the Wairarapa districts) for the purposes of the local body fuel tax.

Year	Totals	Petrol	Diesel
1998	425,429,290	301,497,615	123,931,675
1999	437,999,158	307,764,741	130,234,417
2000	444,787,603	305,064,407	139,723,196
2001	442,445,892	300,570,072	141,875,820
2002	458,333,632	310,440,684	147,892,948
2003	451,598,272	312,516,040	139,082,237
2004	458,984,817	313,001,234	145,983,583

Renewable sources

Nationally, renewable energy production dipped slightly between 1995 and 2003 – from 134.6 PJ to 128.4 PJ – mainly due to a small drop in hydro output between those two years. Only a small decline, maybe, but any decrease in renewable electricity supply makes it harder for us to meet the targets set for renewable energy production in the National Strategy or the policies in the Regional Policy Statement.

Wellington has a lot of wind. Indeed, from a wind energy perspective, it's one of the best places in the world to generate electricity. But for those people living nearby, landscape and noise are important issues, so careful siting of wind farms is essential. Photo: Dave Hansford.

Better news may be on the horizon, depending on your viewpoint, with the development of wind farms. Nationally, wind energy production capacity has increased by more than 200 per cent since 2000. There are several proposals for wind farms in the Wellington region. Other forms of renewable generation which offer some promise, such as wave power and solar, are considered uneconomic for large-scale production at present. However, solar offers potential for greater use at a domestic scale in the near future.

Greenhouse gas emissions

Carbon dioxide is a gas that contributes to climate change (a "greenhouse" gas) and is released into the atmosphere when we burn fossil fuels, such as oil and coal.

The Kyoto Protocol is an international agreement that aims to limit greenhouse gas emissions. Carbon dioxide emissions from energy use jumped by 40 .7 per cent between 1990 and 2003. This translates to an annual increase of about 2.4 per cent. However, between 2002 and 2003, the increase was 4.1 per cent. As greenhouse gas emissions rise, and we move further away from the Kyoto Protocol targets, the likelihood of controls being introduced to meet our Kyoto reduction targets becomes greater.

A contented cow might make good milk, but also methane. Methane is produced by ruminating animals and is a greenhouse gas that we also need to manage.

Domestic transport was responsible for 46.1 per cent of New Zealand's carbon dioxide energy emissions in 2003, while industry accounted for 18.6 per cent and electricity generation (from gas, coal and geothermal conversion) a further 21 per cent.

New Zealand is exceptional in that the equivalent of 49 per cent of our greenhouse emissions comes from agriculture, mostly in the form of methane from stock.

Energy efficiency

There is ample scope for more efficiency in all stages of energy production, conversion, transmission and end use. In a sense, energy saved through efficiency is an additional energy "source". The financial and other environmental benefits from improved efficiency can come to us as individuals from simply changing our behaviour, or from modest capital expenditure on energy efficient technology.

While improved efficiency is a good thing, it is almost impossible to accurately measure gains that are being made. The National Strategy seeks a 20 per cent improvement in efficiency across the economy by 2012. However, because of the assumptions that need to be made about the economy and uncertainties about energy use, the assessment that there has been a one per cent improvement in efficiency over the first two years of the National Strategy is a rather fuzzy finding.

What's being done

We all use energy, so we can all ease demand by using it more efficiently. We can insulate our homes and water systems, and install double glazing. We can use public transport more often. We can make greater use of renewable energy, such as domestic solar water heaters or by designing our homes for passive solar gain.

But as individuals we can only do so much; initiatives have to come from all sectors of the economy.

The National Energy Efficiency and Conservation Strategy

The National Strategy recognises that different activities and sectors each have parts to play, and has action plans that set out roles and initiatives specifically for:

- central and local government
- energy supply
- industry (including agriculture)
- buildings and appliances
- transport.

Other measures

The Energy Efficiency and Conservation Authority (EECA) is responsible for getting results from the National Strategy, and EECA also runs other programmes to boost energy efficiency and promote renewable energy production:

- **Emprove** – a programme to encourage commerce and industry to adopt energy efficient technology and practices, mostly through energy audits and management systems
- **Energy Intensive Businesses** – a programme to help energy-intensive businesses invest in energy efficient plant and technology
- **EnergyWise Home Grants** – funding for retro-fitting home insulation and other energy efficiency measures to pre-1977 rental and low-income housing
- **Travel Behaviour Change** – programmes that encourage people to change their commuting habits.

EECA sponsors the EnergyWise Rally to promote eco-efficient vehicles and good driving practice. The rally runs from Auckland to Wellington, and features celebrity drivers and surprisingly good performances by the vehicles, both in terms of fuel economy and general driveability. Photo: Dave Hansford.

In and around the Wellington region

Greater Wellington is helping fund bus and train upgrades in the region, and promoting public transport – alongside alternatives such as walking and cycling. *Be the Difference* is a Greater Wellington social marketing campaign which encourages people to take personal responsibility for a sustainable environment, and has recently focused on public transport use.

Greater Wellington, Wellington City, Kapiti Coast, Masterton and Carterton district councils are all members of EECA's EnergyWise Councils programme. All have adopted a range of initiatives to manage their energy consumption. Greater Wellington calculates its "carbon footprint" – a measure of how much carbon dioxide it produces as an organisation as a result of its energy use.

The Wellington region boasts the country's first wind turbine at Brooklyn, in Wellington and its first wind farm at Hau Nui, in the Wairarapa. There are now proposals for at least three more wind farms that, if built, would add approximately 270 megawatts of renewable capacity to the region's electricity supply.

Where to from here?

A growing wind energy industry, hybrid cars, improved insulation standards and some capture of greenhouse gas emissions at landfills, are all signs of progress on sustainable energy management. However, the contribution of renewable energy sources to our total supply is flatlining, and energy efficiency is not improving as it should. Above all, our fossil fuel use keeps climbing.

Overall, we're moving away from, rather than towards, the objectives and targets set out in the Regional Policy Statement and the National Strategy. Economic growth and the lifestyles we pursue continue to put great demands on energy.

So what's to be done? By being more energy efficient and easing energy demand, we can make our current supplies last a little longer and reduce our reliance on external – and vulnerable – international sources. We can save some money at a time of ever-rising energy costs, postpone the need for new energy developments, and curb the environmental impacts of extra energy production, transmission and use.

If we must satisfy rising energy demand, we could get a major contribution from renewable sources. Wellington offers one of the best wind resources in the world – appropriately sited wind farms could meet some of that demand.

Wellington enjoys over 2040 hours of sunshine per year, and solar energy – which gets more cost-effective every year – could provide domestic and commercial water and space heating. Photovoltaic cells could drive small-scale domestic electricity generation.

Waste and woody biomass, and "energy crops" may be further options in the next decade, while waves, tides and ocean currents are longer term possibilities.

Solar power is free and probably going to be around for a while... Take-up of this resource is more likely to occur at a domestic level, where house owners can individually choose to add solar technology that will help with their water heating and electricity needs. Photo: Dave Hansford.

What's stopping us?

As noted in the last *Measuring up*, market mechanisms and personal commitment can only do so much to foster sustainable energy management. For a long time, artificially low prices have given fossil fuels an advantage over renewable sources. As long as environmental and other costs are left off the price of fossil fuels, renewable sources will continue to be branded "uneconomic", hampering their acceptance and practical development.

Recent surveys show growing support for renewable energy as the wider costs of traditional energy sources become obvious. Incentives – and disincentives – such as carbon credits (a system developed under the Kyoto Protocol) and the carbon tax respectively - could help drive a groundswell of change.

In the end, achieving a sustainable energy regime will depend on what each of us does; as individuals, as a part of households, as a part of society. Technology offers a practical way forward, but we also need government- and industry-led initiatives to help us make the switch.

To truly sustain our quality of life, and that of our children, we need to think now about the type and amount of energy we consume to support that way of life. Are we prepared to make some changes?

More importantly, what will happen if we don't?

More information

Holmes, John 2005. *Energy – background report.* Greater Wellington.

Waste management and hazardous substances

Objectives

1. The quantity of waste generated is reduced.

2. The quantity of residual wastes for disposal is minimised through reuse, recycling and resource recovery.

3. Adverse effects on the environment and human health from the inappropriate disposal of residual liquid and solid wastes are avoided or, where this is not possible, remedied or mitigated.

4. The potential for any accidental or unanticipated effects to arise as a result of the use,storage, transportation and disposal of hazardous substances is minimised and any adverse effects that do occur are remedied or mitigated.

Doing well

- The amount of waste put in landfills has been falling since 2000.
- Landfill gas is collected at two landfills and used for fuel. At another landfill, it is collected and flared.
- Full compliance with resource consents for landfills and sewage treatment plants has improved from 15 per cent in 1999 to 62 per cent in 2004.
- Estimated volumes of dairy shed effluent recycled onto land more than doubled from 1,353 cubic metres in 1995 to 3,153 cubic metres in 2004. During the same period, the amount discharged to rivers dropped from 636 cubic metres to 42 cubic metres.
- Over 12 tonnes of hazardous material has been collected and sent overseas for destruction.

Must improve

- Only around 20 percent of materials that can be recycled – glass, plastic and paper – are actually sent for recycling.

The rubbish put in the region's landfills in 2004 would nearly half fill the stadium. Up to 20 percent of this could have been diverted for composting or recycling.

What a waste

Waste, as defined by the Ministry for the Environment (MfE) in its 2002 *New Zealand Waste Strategy*, is any material – solid, liquid or gas – that is unwanted and/or unvalued, and discarded or discharged by its owner.

Waste used to be mostly a disposal issue. Solid waste was put in a rubbish dump and liquid waste – like sewage – was discharged into rivers and the sea. Waste disposal sometimes harmed the environment and wasted potentially valuable resources as well. Throwing waste away is evidence that we're not using resources efficiently.

The Regional Policy Statement promotes a waste management framework that sees waste as a resource, rather than a problem. In other words, if we're to deal with the impacts of waste, we have to start by reducing the amount we create. We can then follow the rest of the "waste management hierarchy" – reusing unwanted materials, recycling materials from waste, recovering resources (such as energy) from waste, and disposing of residual waste safely. MfE's Waste Strategy also favours this approach.

Reducing the amount we throw away would:

- lower the social costs and health risks of waste
- reduce damage to the environment from waste disposal
- increase economic benefit to the community by using materials more efficiently.

Waste management is an important part of living sustainably.

We can't measure the quantity of waste generated. This is because it's impossible to monitor the quantities of unwanted materials that are sold or given away, such as at garage sales, second hand shops or over the internet. For this report, Objectives 1 and 2 have been measured in terms of quantities of unwanted material disposed of at landfills and at recycling centres; and quantities of liquid waste collected and disposed of from sewage treatment plants and the agricultural industry.

Objective 3 has been measured by the level of compliance with resource consents for landfills and sewage treatment plants, and the number of waste pollution incidents reported on our Pollution Hotline.

Where we are now

The responsibility for waste management rests chiefly with city and district councils. Under the Local Government Act 2002, they must prepare a waste management plan setting out how waste is managed in their district. Such plans cover all kinds of waste and must state who will collect it, and how waste will be reduced, reused, recycled, recovered, treated and disposed of.

Landfills

The Waikanae landfill in Kapiti closed in 2003, leaving nine municipal landfills in the region – Paraparaumu, Porirua, Wellington (northern and southern), Wainuiomata, Silverstream, Martinborough, Carterton and Masterton. There are two privately owned landfills in Wellington, but Greater Wellington has no data on the volumes and kinds of waste they receive.

All city and district councils in the region monitor the waste arriving at their landfills and recycling centres. Their information has gone into this report, summarised in Table 10.1 (Note, the most recent Kapiti data is 2002).

District	Tonnes landfilled 1999	Tonnes landfilled 2004	Tonnes composted 2004	Kilograms landfilled per person 2004	Kilograms recycled per person 2004
Kapiti	45,514	43,299	12,785	1,020	28
Porirua	107,809	69,453	None	1,123	47
Hutt cities	134,120	147,058	None	1,064	37
Wellington	118,173	107,533	26,194	628	57
Wairarapa	11,700	15,534	9,086	395	89
Region	417,316	382,877	48,065	837	49

Table 10.1:
Volumes of solid waste landfilled, composted and recycled annually.

In 2004, the region's landfills took 382,877 tonnes of material – about 837 kg per person, down by 20 per cent on the 1,019 kg per capita figure of 2001. Records for 1999, when the last *Measuring Up* was published, were not based on weight. An estimated 417,316 tonnes of waste went to landfills then, or about one tonne per person. Data for 1995, when the Regional Policy Statement was made operative, are insufficient to make any useful comparisons.

Porirua more than halved the per capita volume of waste sent to its landfills between 2001 and 2004, but regionally, Porirua residents still landfilled the most waste in 2004 (1,123 kg/year per person). They were closely followed by Hutt Valley residents (1,064 kg/year per person). Wairarapa residents had the lowest rate of landfilled waste in the region in 2004 (395 kg/year per person), less than half of Porirua and Hutt city residents.

Since 1996, the number of cans sent for recycling in Wellington City has doubled from about 350 tonnes to just over 700 tonnes.

Overall, the total amount of waste sent to landfills has been falling each year, except at Wainuiomata and Silverstream landfills.

The rising amount of waste sent to these landfills could be because their landfill fees are less expensive than the nearest alternatives at Porirua and Wellington, and because they don't divert green waste from the landfill.

Recycling centres

All districts in the region run recycling stations where paper, cans, and glass can be disposed of at no charge. Porirua, Upper Hutt, Lower Hutt, Wellington, Masterton, Carterton and South Wairarapa also have kerbside recycling collections in residential areas.

In 2004, 22,519 tonnes of material were diverted from landfills for recycling, equating to about 49 kg per person. Recycling figures prior to 2000 are inadequate, so this figure cannot be compared with the amounts diverted in 1999 or 1995.

Wairarapa sent the most waste for recycling in 2004 at 89 kg per person. Kapiti Coast – where there is no kerbside recycling service – sent the least, at 28 kg per person. During the last five years, each council has examined the composition of waste in its landfills. The results show that the bulk of recyclable material – mostly paper and cardboard – still gets dumped. More than 30,000 tonnes of paper and cardboard is being landfilled annually, as against the 6,000 tonnes that is being recycled.

Composting at landfills

All landfills except Porirua, Silverstream and Wainuiomata divert green waste for composting. Overall, some 48,000 tonnes of green waste is composted each year, reducing the demand on landfills by 22 per cent. If a similar proportion of green waste was diverted from Porirua and the Hutt landfills, another 48,000 tonnes of green waste would be composted.

Landfill gas

Three landfills in the region collect the gas that decomposing waste produces. This gas is mainly made up of the greenhouse gas methane. Gas collected from Porirua and Silverstream landfills is used for fuel, while at Wellington's southern landfill it is collected and flared. Flaring gas reduces the amount of methane discharged into the environment. The remaining six landfills do not collect gas, allowing it to vent naturally instead. Greater Wellington does not have information about the amount of gas collected each year.

Liquid waste

The region's liquid waste is discharged to the sea, fresh water and land.

There are 12 municipal sewage treatment plants in the region; two – Wainuiomata and

Waikanae – having closed down in the last five years. Seaview and Paraparaumu plants now service those communities. Today, about 413,440 people – or 90 per cent of the region's population – live in areas served by reticulated sewerage.

The sewage treatment plants treat 183,135 cubic metres of sewage and industrial wastewater every day. There are also three small privately-owned plants in the region, belonging to a motel, a rural business and a school.

The rest of the population – around 43,000 people – relies on systems like septic tanks. These discharge some 8,700 cubic metres of sewage every day.

Wellington City Council's sewage treatment plant at Moa Point near Wellington serves a population of about 130,000. The sewage is treated by screens, aerated tanks, bioreactors, clarifiers and finally ultra violet light for disinfection. The treated effluent is discharged from a 1.8 km outfall into Cook Strait.

In 2004, there were eight piggeries in the region, the same as in 1995. Greater Wellington has no information about the number of pigs in each, so it's difficult to gauge the total effluent they produce. The largest piggery in the region – with around 11,000 pigs – might produce up to 30 cubic metres of raw effluent daily.

The number of dairy farms in the region rose from 197 to 229 in the ten years up to 2005. Herd sizes also increased. This meant that the number of cows in the region went from 70,550 in 1999 to a peak of 74,224 in 2003. By 2004, dairy cow numbers had decreased slightly to 74,010.

Sewage effluent is by far the biggest proportion of liquid waste in the region. Almost all of it – 94 per cent – is discharged to coastal or fresh water. The nitrogen load on the Ruamahanga River from sewage adds up to around 74 tonnes per year, most of it (58 tonnes) coming from the Masterton plant. Each summer since 2003-04, the Carterton plant has discharged to land, reducing the nitrogen load on the river by nearly four tonnes a year.

	To land 1995	To fresh water 1995	To land 2004	To fresh water 2004	To coastal water 2004
Sewage effluent discharged (m^3/ day)	Not reported	Not reported	10,816	29,108	151,903
Estimated dairy effluent discharged (m^3/ day)	1,353	636	3,153	42	0

Table 10.2: Volumes of liquid waste produced daily, and the receiving environments.

In 1995, 68 per cent of all dairy farms discharged their dairy shed effluent to land, with the rest discharging to water. By 2004, this had changed to 99 per cent of all dairy farms discharging to land.

This practice has significantly cut the amount of dairy shed effluent pumped into rivers, despite a 60 per cent increase in the number of dairy cows in the region. It translates to a 70-tonne reduction in nitrogen discharged into the rivers – down to just 5 tonnes in 2004. However, these figures don't include effluent from stock access and stock crossings – the volumes of effluent reaching streams this way is not monitored.

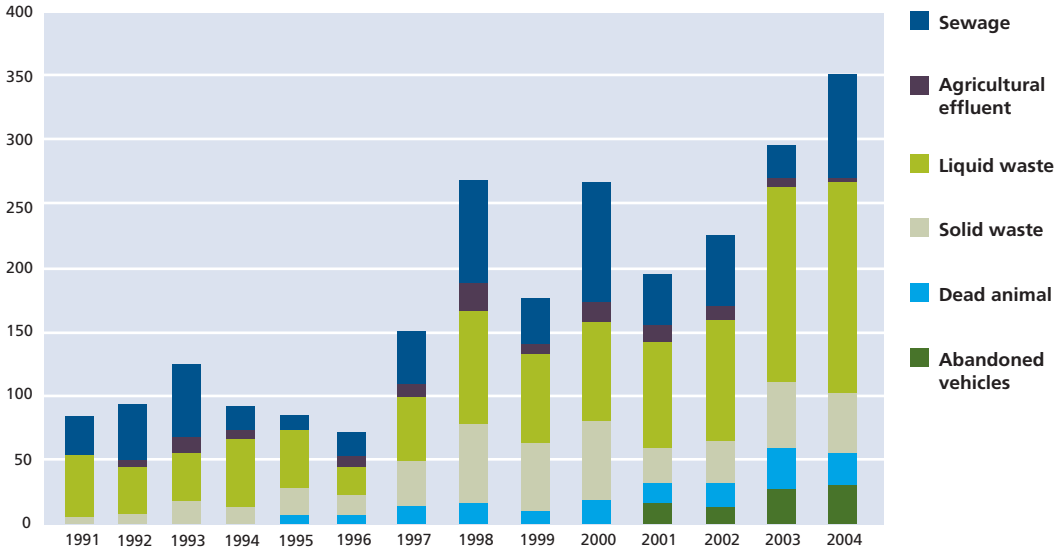
Managing the effects

Greater Wellington controls the environmental impacts of landfill waste and sewage discharges. We do this by imposing conditions on resource consents issued under the Resource Management Act 1991 (RMA), and by checking to see that those conditions are met. We also respond to all reported pollution incidents and unconsented activities around the clock. Any person who disposes of waste without a resource consent faces enforcement action.

Compliance with resource consents for landfills and sewage treatment plants has improved steadily over the last five years. In 1999, only one in 12 landfills and three out of 14 sewage treatment plants met all consent conditions – a compliance rate of 15 per cent. By 2004, this rate had increased to 62 per cent. Greater Wellington requires all condition breaches to be rectified as soon as they are discovered.

Liquid waste, including sewage and agricultural, accounted for twice as many pollution incidents as solid waste during the surveyed period (see figure 10.1). The overall increase in reported incidents may stem from a growing awareness in the community of Greater Wellington's role in environmental management, rather than any increase in actual incidents.

Figure 10.1:
Reported pollution incidents about waste increased from fewer than 100 per year prior to 1997 (except for 1993, with 127) to 348 in 2004. The trend is for reported incidents to increase.



Hazardous substances and hazardous waste

Objective 4 of the Regional Policy Statement has been measured against the number of hazardous substance pollution incidents reported since 1991, the amount of hazardous material Greater Wellington and city and district councils have collected and disposed of, and the number of known contaminated sites cleaned up since 1995.

Pollution incidents

Our records show that reported incidents involving hazardous material or hydrocarbons (such as petrol and oil) varied between 27 and 38 each year during 1991-1995, but have been increasing steadily ever since, totalling 127 in 2004. Hydrocarbons are typically responsible for at least twice the incidents of other hazardous materials.

Calls to the pollution hotline show a rising trend over the last 14 years, with around three times more calls in 2004 than in 1991. Incidents are affecting land, fresh water and sea at much the same rate.

As far as possible, the pollution control team ensures that any adverse effects from pollution incidents are dealt with by those responsible.

Hazardous waste collections

Greater Wellington collected 22.3 tonnes of unwanted agrichemicals from rural properties during 2001-03. They ranged from the banned insecticide DDT to herbicides such as Round Up or Tordon, which can still be used. Of the chemicals collected, 11.6 tonnes (52 per cent) were sent overseas for safe treatment and disposal. A further 6.8 tonnes (31 per cent) were treated and disposed of in New Zealand. The remaining 3.8 tonnes (17 per cent) were cleared for reuse.

Some landfills in the region accept hazardous waste, then send it for treatment or disposal elsewhere. Wellington City Council's southern landfill accepts around 7,650 litres of hazardous wastes every year. In addition, they collect over 10,000 litres of waste oil annually and send it for recycling. Kapiti Coast District Council's Otaihanga landfill accepts about 1,068 tonnes of hazardous waste, including waste oil, annually. Masterton District Council's landfill accepts about 2,250 tonnes of hazardous waste annually, including waste oil and special waste. We don't have data from Upper Hutt City about the amount of hazardous waste collected at the Silverstream landfill, and the Wainuiomata and Porirua landfills do not accept hazardous waste.

Upper Hutt and Hutt city councils run household hazardous waste collections annually, collecting an average of 7.4 tonnes a year since 2002. In three years of collecting, they have sent 19.1 tonnes (mostly paint) for recycling, 2.5 tonnes for treatment and safe disposal in New Zealand, and half a tonne overseas for destruction.

Contaminated land

Contaminated land is a legacy of poor waste management. In the late 1990s, Greater Wellington began compiling information about sites with a history of using, storing or manufacturing hazardous substances, including closed landfills. By 2004, there were more than 1,600 sites on the database.

Under the RMA, city and district councils govern the subdivision, use and development of contaminated land. Their staff have direct access to Greater Wellington's database, and use information on it when assessing subdivision and land use applications. Our records show that they look at the database between 300 and 400 times a week.

Greater Wellington has investigated some of the sites on the database for soil contamination. So far, 136 have been managed or cleaned up, 102 have been confirmed as contaminated but await remediation, and 36 have been judged clean. Because some have yet to be tested, the full number of contaminated sites is unknown.

Leachate leaking from a closed landfill in Wellington City. A toxic brew produced when water drains through decomposing rubbish, this leachate was reported to Greater Wellington's pollution control team. It was traced to a broken pipe, which was duly repaired so the leachate could be sent to sewer.

What's being done

Dealing with waste

Before we can follow the waste hierarchy – to reduce, reuse, recycle, and recover resources – waste has to be checked for its recycling or reuse potential. Someone then has to make that happen. This means the behaviour of the people discarding recyclable waste must be changed, and uses or markets found for the recycled material.

MfE's Waste Strategy sets targets for waste minimisation, hazardous waste management, and waste disposal. In line with the Strategy's principle of full cost pricing, some landfill operators in the region run charging policies that reflect disposal costs and encourage waste reduction and recycling. All city and district councils charge according to the type of waste and whether it comes from householders or commercial operators.

Charges for clean fill and green waste are generally cheapest, if not free. Specialised waste, like fridges, cars and tyres are more expensive. No one charges for the paper, glass and cans taken to recycling centres.

In 2004, MfE introduced a national environmental standard requiring greenhouse gases from landfills of over one million tonnes capacity to be collected and destroyed (or utilised). The Ministry is also developing 'product stewardship' schemes, which encourage producers, brand owners, importers and consumers to help manage the environmental effects of their products throughout their life cycle. Wastes that are particularly hard to manage, such as computer parts, cars and used oil, get the highest priority.

In 2004, Greater Wellington looked at attitudes to waste and waste reduction for our social marketing campaign, *Be the Difference*. This campaign aims to raise environmental awareness and promote personal action among the region's residents. We wanted to find out:

- people's level of awareness about waste and waste issues
- what sort of information would inspire them to change their attitudes and behaviour towards waste.

We found that, of all sustainability issues, people responded most readily to rubbish and recycling, but that enthusiasm was compromised in those districts without kerbside recycling. Conversely, regular collections (weekly) sustained recycling habits. We also found widespread scepticism about what happens to recycled materials, so there was an opportunity to educate about what happens to recycled and 'binned' material. People do not see composting organic waste as waste management and think it's only useful for fertilising their gardens.

As a result of the survey, Greater Wellington focused its campaign for waste on educating people about what can be recycled, why it's important, and what happens to recycled materials.

Hazardous substances management

Greater Wellington has produced two fact sheets: *Hazardous Substances*, which outlines how people can lessen risks from hazardous substances, and *Petroleum Hazards*, dealing with the risks of transporting and storing petroleum products. Both are available on Greater Wellington's web site.

Two reports have also been produced on the nature and distribution of hazards associated with petroleum transportation, where petroleum products are stored, and their vulnerability to natural hazards. These reports are *Petroleum Transportation Hazards in the Wellington Region,* and *Natural Hazards Risk Associated With Petroleum Storage, Wellington Region.*

Where to from here?

Population trends and the local economy typically drive waste volumes. From 2000 to 2004, the region's Gross Domestic Product (GDP) growth rate of 3.9 per cent was third nationally behind Manawatu-Wanganui and Canterbury. Our nominal GDP per capita of $36,732 was the highest in New Zealand (New Zealand Institute of Economic Research, 2004). Despite this growth, the amount of waste sent to landfills since 1999 has fallen. It seems then, that we can expect total waste volumes to keep dropping, so long as city and district councils continue to compost green waste and divert paper, plastic and glass for recycling.

The Carterton landfill closed in September 2004, and three more are expected to close in the next two years – Wellington's northern landfill (December 2005), Masterton's landfill (December 2006), and Kapiti's Otaihanga landfill (2007). With the exception of Wainuiomata, the five remaining municipal landfills all have a good compliance history. Wainuiomata is expected to fill up and close by 2013. If compliance continues to improve, the environmental impacts of landfills in the region should decrease.

Masterton's landfill, on the banks of the Ruamahanga River, will close down by December 2006. After this, waste will be collected here and transported elsewhere for disposal, probably out of the region.

The amount of liquid waste produced and disposed in the region depends largely on the number of people and animals in the region, and the kinds of industry it supports. It's possible that per capita sewage volumes may fall if we use more water efficient appliances (washing machines, dishwashers, showers, and dual flush toilets), though any such drop is likely to be offset by an increase in the region's population. If the overall number of dairy cows in the region keeps falling, as it has since 2003, then dairy farm effluent volumes will follow suit.

No sewage treatment plants are expected to close in the next decade. Those serving Martinborough and Carterton operate under new consents, granted in the last five years, that oblige them to improve effluent quality by 2010.

Consents for the plants serving Featherston and Masterton are under review and should be finalised within the next five years.

A 2005 amendment to the Resource Management Act 1991 placed new functions on regional councils and city and district councils for contaminated land. Regional councils now hold the responsibility of "investigation of land to identify and monitor contaminated land" , while controlling the subdivision, use and development of contaminated land rests with city and district councils. This will give them more power to decline subdivision consents or applications to change land use if it is contaminated. It could also give landowners an incentive to clean up contaminated land before subdividing.

Investigating the soils near the Waiwhetu Stream, Hutt City, 2005. The stream bed was contaminated by waste from nearby heavy industry from the 1940s until the installation of a trade waste sewer in 1978. With financial assistance from the Ministry for the Environment's contaminated site remediation fund, Greater Wellington and Hutt City Council are investigating options for cleaning up the stream bed in its lower reaches.

More information

Croucher, Bruce, 2005. *Soil quality monitoring technical report.* Greater Wellington.

Forsyth, Kirsten, 2005. *Waste management and hazardous substances – background report.* Greater Wellington.

Ministry for the Environment, 2002. *New Zealand Waste Strategy.*

Built environment and transportation

Objectives

1. Urban areas, the built environment and transportation systems are developed so that they, and their associated activities, use resources efficiently and demand for the use of finite resources is moderated.

2. The adverse environmental effects that result from the use of urban areas, transportation systems and infrastructure are avoided, remedied or mitigated and in particular, any adverse effects that result from the concentration and scale of activities in urban areas are recognised and provided for.

3. The environmental quality of urban areas is maintained and enhanced.

Doing well

- The Wellington region is the highest user of passenger transport in New Zealand.
- Greater Wellington, the city and district councils, Positively Wellington Business and iwi (through an advisory committee, Ara Tahi), are working together, looking at how the region can grow and sustain our quality of life.
- City and district councils in the region are producing documents that provide guidance on the location and types of infrastructure, urban design, and/or the management of effects in urban growth areas.

Must improve

- Nearly two thirds of commuters in the region still drive their own vehicles to work – traffic congestion is getting worse.
- The region's total energy use continues to increase. Petrol and diesel increased by 8 per cent between 1998 and 2004.
- Air quality in sheltered places, such as Masterton and Wainuiomata, can exceed national air quality standards during calm winter conditions.
- Twelve percent of monitored urban beaches (used for recreation) have poor or very poor water quality. Many of these sites border on Porirua's urban areas.
- Urban streams have some of the poorest water quality in the region.

Setting city limits

In 2002, *The New Zealand Official Yearbook* described New Zealand as one of the most highly urbanised countries in the world. In the 1880s, just under 60 percent of the population lived rurally. Since then, urban areas have grown rapidly and city suburbs have swelled with an influx of people from the rural areas. At first urban areas were concentrated around public transport routes, but the advent of the motor car triggered a sprawl that continues today. Our hunger for energy and raw materials has skyrocketed with it. More and more, we depend on infrastructure such as rail, roads, pipes and power lines for our quality of life. These changes affected the health of the environment, both rural and urban, but good design in the built environment can still give us great places to live, work and play.

This chapter looks at the pressures that change the built environment and transportation, the current state of urban development, transport, infrastructure, and the environmental quality of our urban areas.

The pressures

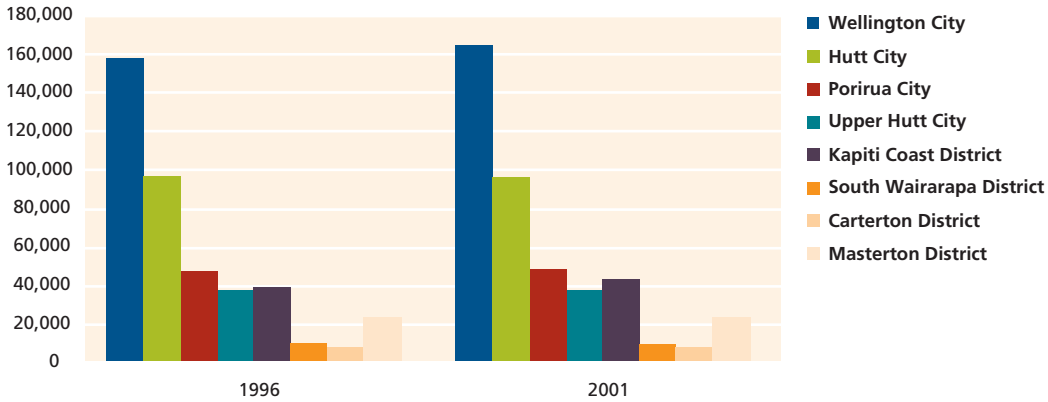
As population, economic activity and transport networks grow, we put more stress on resources, infrastructure and waste management, amplifying our impact on the environment. Monitoring our growth helps us understand the level of demands, effects and management required to achieve the built environment and transportation objectives in the Regional Policy Statement.

Population and economic growth

In 1995, 400,000 people lived in the Wellington region. When the last *Measuring Up* was published in 1999, that figure had risen to 415,000. By last year, according to Statistics New Zealand, there were 456,900 people in the region. This rate of increase – 2.3 per cent – still trailed behind the national average of 3.3 per cent over the last census period – 1996 to 2001.

Population change has been uneven across the region – numbers have dropped in the Hutt Valley and Wairarapa while increasing in Kapiti Coast.

Figure 11.1:
Resident population by city and district councils 1996 and 2001.



Percentage Population Change (1996 to 2001)	
Wellington City	3.9
Hutt City	-0.4
Porirua City	1.6
Upper Hutt City	-0.1
Kapiti Coast District	10
South Wairarapa District	-2.2
Carterton District	0.5
Masterton District	-0.6

Table 11.1: Population Change 1996 to 2001.

The Wellington region produced 12.8 per cent of New Zealand's Gross Domestic Product (GDP) in 2004. While growth has been steady over the last 10 years, the region experienced slower overall growth than Canterbury and Auckland. The trend has changed in the past year, Wellington's growth rate (at 5.5 per cent) has been above the national average (of 3.4 per cent), Canterbury (five per cent) and Auckland (1.8 per cent). Wellington city, as an economic hub, has a strong influence on regional figures, as does the manufacturing stronghold of the Hutt Valley, and the retail centre of Porirua.

Transport growth

Between 1996 and 2001 vehicle ownership per household rose twice as fast as the population did. People in the least-populated areas own the most cars – Wairarapa has the highest car ownership figures, Wellington city the lowest.

State highway traffic volumes in the region climbed by between one and two per cent a year between 2001 and 2004. Last year saw a decrease of one per cent, mostly because there was less traffic between Hutt Valley and Wellington city.

Between 2002 and 2005, "rush hour" (7am to 9am and 4pm to 6pm) passenger trips by bus, train and ferry rose by 664,000. Most trips – nearly 60 per cent – were made on the bus, with rush hour bus passenger trips increasing by 7.5 percent between 2002 and 2005, while rail patronage remained steady. Ferry passengers increased too, though they still account for less than one per cent of rush hour passenger trips. Off-peak volumes rose steadily between 2002 and 2004, with a marked jump in 2005 of 5% or 800,000 total passenger trips.

Where we are now

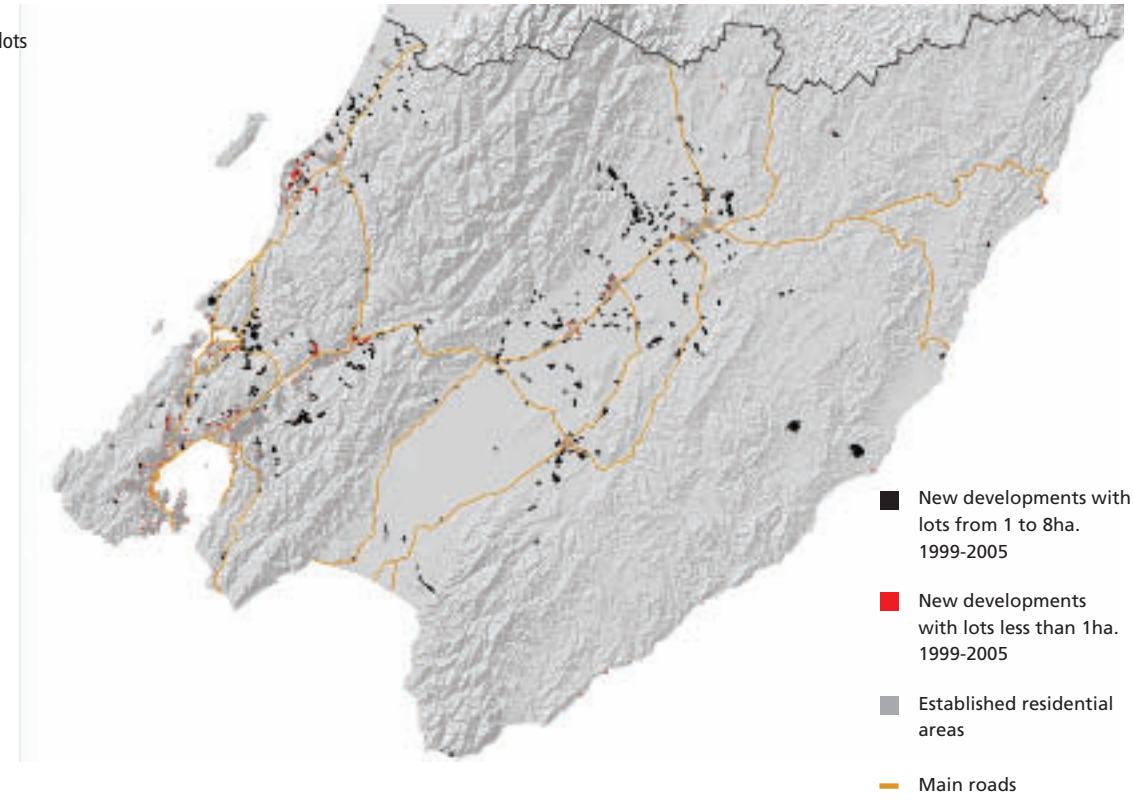
Objective One of the built environment and transportation chapter looks to stem the demand for finite resources through smart, efficient development of urban areas, transport and infrastructure. To see if we're achieving this objective, we measured the volume of waste generated, energy used and water supplied. We also gauge the size of the environmental "footprint" the region leaves as it consumes resources and discharges waste.

Urban expansion

The last *Measuring Up* noted that urban expansion was not so much the result of major developments as the cumulative effect of many small developments. This is still true today.

Wellington city has seen the most residential intensification through redevelopment and refurbishment of central city buildings. "Filling in" of urban gaps is also happening apace on the Kapiti coast. Expansion along the urban fringe is a common feature of regional development, mostly in north Wellington, Whitby and the Aotea Block in Porirua, the western hills in Hutt, and around Martinborough and Greytown. A growing number of greenfield projects – subdivisions on former farmland – have also occurred in Upper Hutt, Wairarapa and on the Kapiti Coast. Coastal development is a pressing planning issue for Kapiti and parts of the Wairarapa.

Figure 11.2: Distribution of new lots (less then 1 hectare and 1 to 8 hectares) 1999 to 2005.



Transport

Nearly two thirds of commuters in the region still drive their own vehicle to work. A small drop (of 2.7 per cent) in the number of car journeys between 1996 and 2001 could be put down to the appetite for central city living, and road congestion encouraging people to switch to public transport. Teleworking has relieved some pressure by allowing people to work from home, but increasing demand for travel means rush hour journey times continue to lengthen.

Surveys in 2004 showed that 62 per cent of Wellington residents thought congestion had worsened over the past two years, compared with 55 per cent of Aucklanders. Transit New Zealand figures (minutes delayed per kilometre travelled) however, show that congestion in Wellington is around 13 seconds per kilometre less than in Auckland during morning rush hour.

Residents of the Wellington region use more passenger transport – 70 trips per person per year – than those in the Auckland region (40 trips) and the greater Christchurch area (41 trips). They also think passenger transport is easy to use, and that walking and cycling is easy. Despite this, the private car remains our predominant mode of transport, especially in lower density areas.

Infrastructure

Over the last ten years, incremental urban expansion has resulted in extensions to existing stormwater, wastewater, local water, and road infrastructure. Two new sewage treatment plants have been built, one at Moa Point serving most of Wellington city, the other at Seaview, serving the entire Hutt Valley and Wainuiomata. Other treatment plants have been upgraded to improve wastewater management and sewage effluent quality discharges to the environment. A number of new water reservoirs, a smaller number of new pump stations and a new borefield in Waikanae have also been commissioned. Wellington City Council's programme to eliminate sewage from its stormwater system is improving the quality of stormwater discharged to the beaches.

Five commuter rail services – the Johnsonville line, Hutt Valley line, Melling line, Paraparaumu line and Wairarapa line – service the region, and a long distance passenger service, the Capital Connection, links Palmerston North and Wellington. The Wairarapa-Hutt Valley line and the Paraparaumu-Capital Connection line also carry freight. The last ten years have seen little change in the region's rail, except for more commuter services on the Wairarapa and Paraparaumu lines.

The regional bus fleet now totals 465, including 60 electric trolley buses. There are more services and better facilities than in 1995. Recent improvements include the new Lambton interchange, Petone station, dedicated bus only lanes in Wellington city, and more frequent services on several routes.

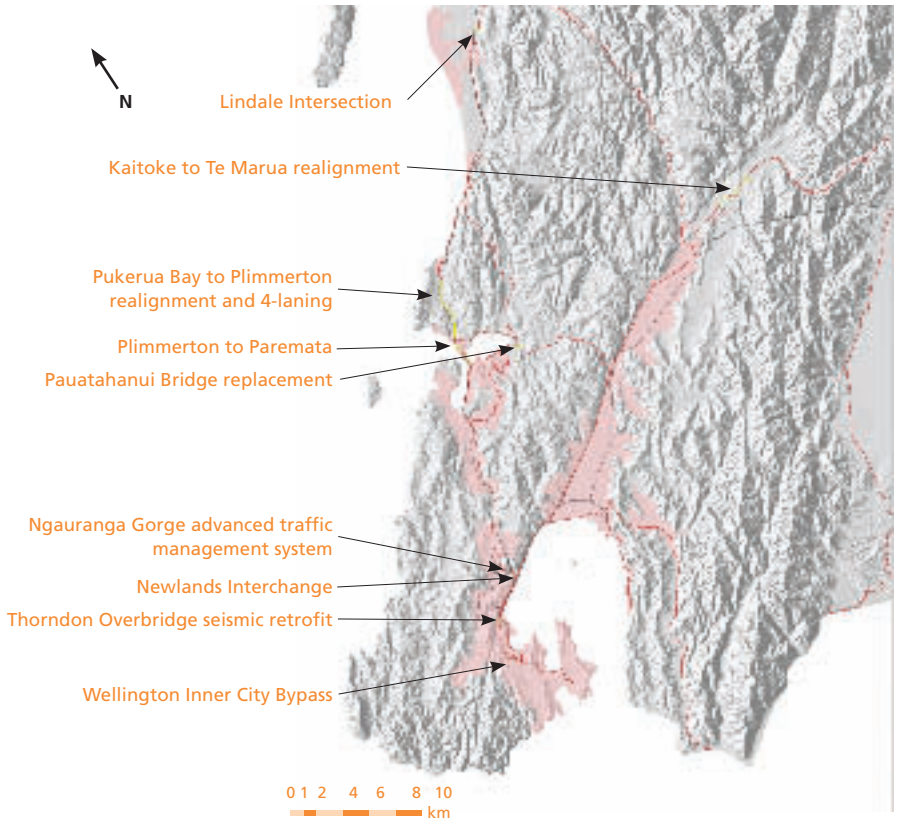


Figure 11.3:
Location of major State Highway projects over the last ten years.

Within the region there are four state highways – One, Two, 53 and 58. Over the last ten years there have been a number of major (defined by Transit NZ as a project costing over $3m) upgrades and improvements, shown in Figure 11.3.

Waste generation

Overall, the amount of waste sent to the region's landfills dropped over the last five years. 2003-2004 figures equate to around 837 kg per person per year - down from about one tonne per person in 1999. For more information, see **Waste management and hazardous substances.**

Every day, 183,135 cubic metres of sewage effluent and industrial wastewater is discharged from sewage treatment plants, almost all to coastal water and rivers. Daily per person volumes of sewage vary throughout the region – the lowest in Otaki and the highest in Masterton – but it's not known why. Changes in the way we gather information prevent a comparison between current volumes and those cited in the last *Measuring up.*

Energy

There is no data available to compare total energy use in the region over time. However, national figures indicate that total energy consumption is increasing at around two per cent a year.

We know that transportation in the region burned 459 million litres of petrol and diesel between 2003 and 2004, compared to 425 million litres between 1997 and 1998. This 8 per cent increase was much less than Canterbury's at 21 per cent, and Auckland's 18 per cent. For more information, see **Energy**.

Water supply

We have been unable to get figures for water demand across the whole region over the last decade. However, we do know the amounts supplied to the four southern local authorities – Upper Hutt, Hutt City, Porirua and Wellington.

Overall there was a gradual increase, though it lagged behind population growth. The water supplied dropped by an average of 0.3 per cent each year, with summer reductions of 0.5 per cent annually. We can't trace these downturns to any single cause, but they do follow publicity about water conservation and efficient garden watering.

Ecological footprint of the region

An ecological footprint is an accounting tool – it calculates the land needed to provide the resources we consume and absorb the waste we discharge. Expressed in hectares, ecological footprints allow us to measure the load each of us places on the environment.

The Ministry for the Environment's (MfE) 2003 report, *Ecological Footprint of New Zealand and its Regions*, found a deficit in the Wellington region of 305,820 hectares, revealing that we place a greater load on the environment than our land area and resources can sustain. Our region's footprint is the fourth largest in New Zealand, making up ten per cent of the combined national total.

The quality of our natural environment

The second objective for built environment and transportation chapter requires that we avoid, remedy or mitigate the environmental impacts of urbanisation, transport and infrastructure. As indicators of those impacts and how we are managing them, we look at the quality of our air, coastal recreational sites and urban streams.

Urban air quality in the region over summer is usually good. However, contaminants (mostly from domestic solid fuel fires) tend to linger in calm winter conditions, polluting air quality in sheltered places like Masterton and Wainuiomata. Occasionally, such pollution exceeds national environmental standards, posing a health risk. Vehicle emissions are another culprit, and air quality around busy roads is often poor. For more information see **Air**.

Two thirds of coastal recreational sites where water quality is monitored enjoy good or very good quality. However, 12 per cent of sites rate as poor or very poor. Water quality at these mostly urban beaches is monitored because they are popular with swimmers, surfers and boaties. Unsurprisingly, water quality is poor near stormwater outlets and small streams. Stormwater and streams can be contaminated by sewage overflows and overland rural runoff. All but one, of the poor or very poor sites, border on Porirua's urban areas.

Urban streams suffer some of the poorest water quality in the region. Runoff from sealed surfaces like roads, car parks and roofs delivers a host of contaminants to streams and the coast. Some - like heavy metals – are very harmful to stream life and our preliminary studies show they are building up to lethal levels in the beds of urban streams. For more information see **Fresh water.**

The environmental quality of our urban areas

Objective Three of the built environment and transportation chapter looks to preserve or improve urban environmental quality. This can be done through good design, high public amenity and the presence and health of natural resources in urban zones.
To measure urban design, we looked at four aspects; character, connectivity, density, the calibre of the public realm.

Everything that goes down the drain ends up in a stream or at the beach. It's not the place to wash out paint brushes or tip soapy water after washing the car.

A place's **character** is a unique combination of built form, landscape, history, people and their culture. A number of regional centres have a strong and distinctive flavour – the vibrant CBD in Wellington, the historic settlement of Aro Valley, the coastal suburbs of Plimmerton, Titahi Bay, and Eastbourne, the pioneer character of Petone, the church centres of Pacific Island communities in eastern Porirua, Naenae and state housing areas, to the thriving wine settlement of Martinborough and historic rural service towns in the Wairarapa. Although we have no measures of change in regional character over time; there are locations, such as central Wellington city, where character has noticeably improved.

Wellington in the early 1990s was a city where people hurried home from work in early evening as shops and cafes closed their doors. Many were unaware or unmoved by a harbour hidden behind drab, empty waterfront buildings. Visitors and tourists didn't linger.

In 2005, Wellington is a compact, vibrant city of cosmopolitan shops and restaurants with a hectic events schedule and easy access to a stunning harbour and waterfront walks. It's the home of Te Papa – the Museum of New Zealand – the "Cake Tin" and the Hurricanes. The native birds are back thanks to the eco-pioneering Karori Wildlife Sanctuary and tourists are staying longer to enjoy our many other natural attractions.

Connectivity is a measure of how effectively networks, streets, railways, walking and cycling routes, services and infrastructure knit together. The way our urban areas link up gives a snapshot of how the region connects as a whole. The region's strong north-south ridgelines and valleys have confined urban *centres* to three corridors; southern (Wellington City), north-western (Ngauranga to Kapiti) and north-eastern (Hutt to Wairarapa). This linear, relatively compact form makes for efficient transport, but it also means snarl-ups if a corridor is blocked. It also puts a premium on flat land, and developers are quick to build on any that presents. This is apparent on the Kapiti Coast, in the Wairarapa and, to a lesser extent, in Upper Hutt. A number of developments in the region have compromised connectivity with a surfeit of cul-de-sacs and difficult pedestrian access. Such poor planning creates a dependency on private vehicles.

Kapiti Coast District Council held sessions with sectors of the community on good design for Paraparaumu Beach town centre. Together they worked out open space areas, footpath upgrades, parking, where different types of development would occur and design concepts for the main street.

Often, the most **densely populated** urban areas have the greatest vitality, offering facilities, opportunities and choices that would not exist without a critical mass of people. Central Wellington city has the second highest resident population density (behind Auckland) in the country at 1,381 people per square kilometre. Less populous centres in the region still have a similar sense of energy, such as Jackson Street in Petone, Greytown and Martinborough.

The "**public realm**" describes public space and buildings, and those parts of private development that impinge on public space – the setting for community life. No information exists on the quality of the region's public realm, but the 2004 report *Quality of Life in New Zealand's Largest Cities*, by Gravitas Research and Strategy Limited, surveyed residents in Wellington, Porirua and the Hutt to gauge the sense of pride they took in their cities' look and feel. Wellington residents came out on top, while Porirua's and Hutt city residents were less enthusiastic.

The report also gave us a measure of public amenity. It found that fewer Wellington, Porirua and Hutt city residents considered air quality and rubbish to be a problem than respondents from elsewhere in the country. However, many felt that noise was an issue. Compared with the rest of New Zealand, Porirua and Hutt cities had slightly fewer residents who considered access to local parks or open space was easy. Wellington city residents were among those least likely to describe access as easy.

Figures 11.4 and 11.5 give us an indication of the public's perception of the state of the natural environment in our urban areas and how this compares to five years ago.

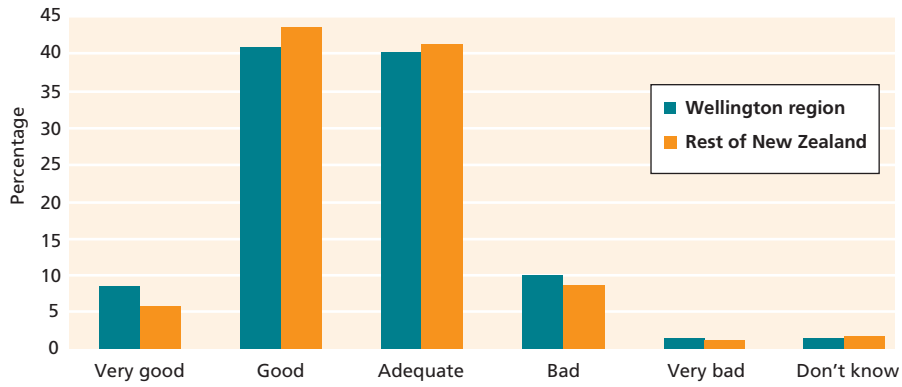


Figure 11.4: Perceived state of the natural environment in towns and cities, 2004.

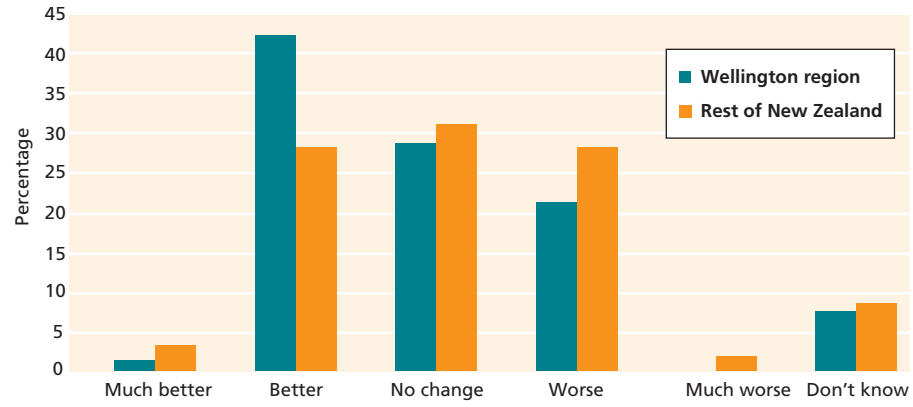


Figure 11.5: Perceived state of the natural environment in towns and cities compared to five years ago.

What's being done

Nationally

The last ten years have seen a proliferation of national guidelines on urban design and sustainable development. MfE has published *People + Places + Spaces: An Urban Design Guide for New Zealand (2002)*, *Creating Great Places to Live + Work + Play: Livable Urban Environments (2002)*, *The New Zealand Urban Design Protocol* (2005), and most recently, *The Value of Urban Design* (2005).

In 2003, the Government's Sustainable Development for New Zealand Programme of Action targeted "Sustainable Cities" as one of four key focus areas for central government.

Standards New Zealand introduced guidelines and standards for land development and subdivision, aiming to boost urban environmental quality. *SNZ HB 44:2001 Subdivision for People and the Environment* encourages creative design, while *NZS 4404:2004 Land Development and Subdivision Engineering* specifies engineering design requirements for land and subdivisions and encourages the use of new techniques.

Aspects of transport policy have changed over the past few years. A government review late in 2004 set out to encourage more integrated decision making in the transport sector. It also made changes to help deliver the stated aim of the New Zealand Transport Strategy – "An affordable, integrated, safe, responsive and sustainable transport system for New Zealand by 2010".

A number of other documents fit under the mantle of the Transport Strategy, looking to curb the use of private vehicles – thereby easing demand for fossil fuels – and to tackle the environmental impacts of transport, particularly air pollution. These include the National Rail Strategy 2005, *Getting there – on foot, by cycle* (2005), a Vehicle Fleet Emissions Control Strategy which introduced a 10-second visual check for smoky vehicles, and an emission standard for new and used vehicles entering New Zealand. In 2004, the Ministry of Transport also proposed a Vehicle Emissions Screening Programme. This proposal was withdrawn the following year, citing screening problems. Two other measures will replace it – a visual smoke test, conducted as part of the warrant/certificate of fitness check, and a ban on tampering with emissions control equipment on vehicles. These will arrive in late 2006 and 2007 respectively.

The Energy Efficiency and Conservation Authority is another player, producing travel planning workshops, a tool for auditing commercial vehicle fleets, energy-wise programmes and an energy-wise rally to promote biofuels and energy efficiency.

In 2004, MfE introduced a National Environmental Standard for air quality, the first under the Resource Management Act, 1991 (RMA). It set limits on airborne contaminants – carbon monoxide, fine particulates, nitrogen dioxide, sulphur dioxide and ozone – emitted by transport and the built environment.

Regionally

Greater Wellington has a number of plans and programmes aimed at maintaining and improving urban quality and protecting natural environments. They include regional plans and the regional Pest Management and Land Transport strategies. Non-statutory programmes like *Be the Difference* raise awareness and encourage personal action.

Take Charge helps businesses with pollution problems and offers options for dealing with business waste, recycling, energy efficiency and air emissions. A number of strategies (such as the Riparian Strategy), booklets (*Mind the Stream, Restoration Planting, Managing your Bush Block*), and programmes like the community environmental programme *Take Care* and pest control initiative *Key Native Ecosystems* all aim to bolster ecosystem health in urban areas.

Almost two thirds of people say if it were easier to get information on public transport they would use it more.

Greater Wellington's guiding transport document is the Regional Land Transport Strategy. The current Strategy, adopted in 1999 and updated by the Western Corridor Implementation Plan the following year, states the vision of "a balanced and sustainable land transport system that meets the needs of the community". It addresses transport's impact on the environment by promoting the reduction of emissions. It also encourages efficient transport choices to wean us off single occupant vehicles, and supports passenger transport, walking and cycling. It also advocates co-ordination between land and transport planning to reduce the need to travel. A review of the strategy spawned several subsidiary documents, such as the Regional Travel Demand Management, Pedestrian and Cycling Strategies.

Greater Wellington, the city and district councils, Positively Wellington Business and iwi (through an advisory committee, *Ara Tahi*), are collaborating on a growth framework – the Wellington Regional Strategy. A discussion document, released in August 2005, looks at growing the regional economy but also aims to improve "regional form and systems".

Locally

District plans contain aims and policies providing for the sustainable use of resources. They also advocate sensitive land use to minimise environmental damage. Strategies and programmes are also used, including:

- Walking, cycling and/or bridle path strategies
- Water use strategies
- Waste minimisation/management plans
- Energy-wise programmes.

District plans also focus on the environmental quality of urban areas through provisions that manage built character and amenity. Design guides and character guides are now commonplace, and their success is evident in Jackson Street in Petone, and Thorndon, Cuba Street and Mt Victoria in Wellington.

All city and district councils use guides or codes of practice as part of the subdivision approval process. The engineering standards they specify are typically strict, leaving little room for innovation. This stifles the use of new techniques like low-impact designs to manage stormwater discharge. It's now generally accepted that subdivision and development design needs to be more sensitive to the environment, using novel ways to ease impacts and demands on infrastructure. Kapiti Coast District Council is the first territorial authority to review their code of practice – a revamped framework that adopts new national subdivision and development standards, at the same time retaining rules specific to Kapiti.

Community groups and residents, with the help of city or district councils and Greater Wellington, are restoring areas of bush, parks and streamside areas around the region. Their work is not only improving the local amenity of their neighbourhoods, it is extending habitat to increase the abundance and variety of native birdlife.

It's become increasingly clear that case-by-case assessment of resource consents can't deliver good urban design and environmental safeguards alone, so some city and district councils have come up with non-regulatory documents giving guidance on infrastructure, urban design, and/or management of effects. These documents allow for alternative development and strategic planning, exemplified by Wellington City's Northern Growth Management Framework, Porirua City's Aotea Block Development Plan and Kapiti Coast's Paraparaumu Town and Beach Town Centres.

The degree of environmental protection afforded by district plans varies across the region, and not all recognise outstanding landscapes, significant ecological sites or areas of the coast with high natural character. Kapiti Coast District Council is the only territorial authority to have scheduled and mapped significant ecological sites on private land.

Where to from here?

As the region's population grows, we consume more and more resources, all the while expecting the natural environment to deal with the waste from our urban lifestyle. By 2016, the region is forecast to have 26,000 more people and 44,000 more vehicles than in 2001, and we will make 37,000 extra private vehicle trips.

It's assumed that the recently announced $885 million central government transport funding package will speed progress on transport issues over the next decade. Greater Wellington has suggested improvements to the passenger transport system, including rolling stock replacements, station upgrades, bus replacements, integrated ticketing and real-time information. Road capacity and safety upgrade proposals include a Petone to Grenada link road, western corridor improvements, a western link road in Kapiti, and roading improvements through the Wellington City Central Business Corridor. Transport system efficiency is expected to improve with more travel planning, awareness campaigns, and network information and management advances.

The region's local authorities are now looking together at regional form and systems through the Wellington Regional Strategy. The Regional Land Transport Strategy review was delayed so that it could progress alongside the Regional Strategy – a realignment to better integrate land use and transport management. However, before it assumes statutory weight under the RMA, it will need to be melded still further with the Regional Policy Statement and district plans.

Over the next decade it will be increasingly important to develop the built environment, transport and associated infrastructure with greater sympathy for the environment, creative solutions and good urban design. Only then will we maintain and improve on the quality of our built environment and transport.

More Information

Woods, Tami; Guscott, Susannah, 2005. *Built environment and transportation – background report.* Greater Wellington.

Conclusion

The aim of *Measuring up 2005,* is to find out if we are achieving the objectives set in the Regional Policy Statement. This will help us assess progress towards achieving sustainable management of the natural and physical resources of our region.

But have we got the right objectives? Might we be achieving the wrong things? It's important to realise in this context that the process of achieving sustainable environmental management remains an evolutionary one. As we continue to monitor our environment and report back on its state, we may have to adjust the objectives themselves to ensure that we keep on the right track. *Measuring up 2005* is the beginning of a review of our Regional Policy Statement — the review process will give us the chance to make any changes we might need.

With reference to our Regional Policy Statement, we can conclude the following:

- Candid discussion with iwi representatives and Greater Wellington staff and councillors shows an encouraging foundation of trust and respect, with all people interviewed commenting on the strength of the relationship. Commitment to Treaty principles is an area where the most improvement could be made.
- For now, we have enough water in our lakes and rivers – and in most of our aquifers – to meet our needs, and the needs of the freshwater ecosystems. But demands on our water stocks are escalating, mostly in the Wairarapa, with farmers needing water for irrigation during the dry summers.
- Most rivers in the region begin in the indigenous forests of the Tararua, Rimutaka and Aorangi ranges, so they get off to a clean start. With the exception of some sewage discharges and stormwater, there are now very few discharges to rivers. Sewage is no longer discharged to the Ngarara Stream, near Waikanae, or the Wainuiomata River and the water quality of both waterways has improved as a result. Only three dairy farmers were discharging their dairy shed effluent to water in June 2005, compared with 63 ten years ago.
- Stormwater is having the biggest effect on water quality and the biological health of urban streams, while rural streams are affected by runoff carrying bacteria, nutrients and sediment.
- We now have information on soil quality at 117 sites in the region. This is a small step towards understanding the soils of the region, but we are starting to build a picture.

- Coastal water quality at Paekakariki Beach, Days Bay, Scorching Bay, Worser Bay, Princess Bay and Riversdale Beach (south end) passed health guidelines for swimming on all but one or two occasions over the last four summers, but water in both arms of Porirua Harbour, and Plimmerton, Paremata, Hataitai, Petone and Titahi Bay regularly failed them with bacteria levels occasionally more than a hundred times over the limit.
- Since 2000, Greater Wellington has established five air quality monitoring stations - one in inner city Wellington to check the effects of vehicle emissions, the others in suburban areas to check the air quality around people's homes.
- Soot and other tiny particles from domestic fires hang around in the air on cold, calm winter nights. Peak pollution levels have been high enough to breach the National Environmental Standard in Wainuiomata, Upper Hutt and Masterton each winter since monitoring began. Air in inner city Wellington had the highest concentrations of carbon monoxide and fine particles, on average, in the region, but levels have stayed within the standards.
- Less than 20 per cent of the lowland podocarp forests of the Kapiti plains and Wairarapa and Hutt valleys remain. More dramatically, only about 12 per cent of our wetlands are left, and the former saline wetlands of southern Wairarapa now only have about four per cent of the original vegetation cover.
- Thanks to targeted pest control, forests now feed pigeons and bellbirds instead of possums and magpies. Projects like the Karori Wildlife Sanctuary and the efforts of small armies of volunteers have seen forest birds return to areas of the region after an absence of more than a century.
- More places are being recognised and registered by the Historic Places Trust, but registration does not guarantee protection and some places are at risk.
- Local government and the private sector have called for more leadership from Greater Wellington on landscape and heritage, and to work collaboratively on ways to manage them.
- Our understanding of the region's hazards is improving. We've published earthquake hazard maps, reported on tsunami risk, done flood hazard assessments for all major rivers, and keep a watching brief on climate variations to understand drought and flood risk.
- The community's level of preparedness is improving but could be better. A recent survey found that 65 per cent of households have emergency food supplies and only a few more have stored water. But barely a quarter have an emergency plan.
- The transport sector continues to devour the most energy – almost all of it from finite fossil fuels – and consumption continues to climb. Between 1998 and 2004, fuel sales rose by eight per cent in the region.
- The volume of solid waste arriving at landfills has been dropping, mostly because a lot of green waste is now kept back for composting. If we can divert more glass, plastic and paper away from the tip and into recycling bins, solid waste volumes should come down even further.

- Greater Wellington has a database of sites where hazardous substances have been used, stored or manufactured. City and district council staff check the database between 300 and 400 times a week to help them in their land use planning decisions.
- Wellingtonians are the nation's most enthusiastic patrons of public transport. But, vehicle numbers are **still** soaring – three times faster than population – making it vital to keep those lines open with planning that discourages isolated developments, cul-de-sacs, and difficult pedestrian access.
- The region's local authorities are now working together and are looking at regional urban form through the Wellington Regional Strategy. The Regional Land Transport Strategy review was delayed so that it could progress alongside the Regional Strategy – a realignment to better integrate land use and transport management.

The successes offer some promise that we are on course for sustainably managing our natural and physical treasures. The areas for improvement provide direction for the work ahead. All the information gathered for this report, and the extensive background reports that back it up, will be used to review the effectiveness of the provisions in our Regional Policy Statement and help us make decisions about what if anything, needs to be changed.


CRUISES