

# Chapter Ten

# Natural environment

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**This chapter looks at the physical aspects of the natural environment that have a substantial impact on life in cities, such as air, soil, water, drinking water and waste disposal.**

### Why this is important

The quality of the natural environment is directly related to people's quality of life. Population growth and economic development put pressure on the sustainability of the natural environment. Pressure for expansion of the urban area into peripheral areas will have effects on the natural ecosystems of both the land and sea. Issues such as environmental pollution, waste generation and management, heritage protection and preservation of indigenous wildlife in built-up areas are all important issues to be considered as urban areas grow and develop.

### Key points

Almost all (97.0%) of the New Zealand population living in metropolitan areas has access to kerbside recycling, offering opportunities to divert waste materials from landfills.<sup>1</sup>

All of the 12 cities are addressing biodiversity through their Long Term Council Community Plans (LTCCP) and District Plans, with many adopting policies and programmes to prevent loss of biodiversity.

Many of the city councils are changing their energy usage behaviour through sustainable energy use projects, such as trialling solar-powered lighting on bus shelters and generating electricity for the national grid through landfill gas extraction.

Air pollution is an issue in Christchurch, which had the highest rates of PM<sub>10</sub> (suspended particle) exceedances between 2001 and 2005. Auckland had higher levels of nitrogen dioxide and ozone concentration compared with other cities.

Residents of Christchurch and Auckland were more likely to state that air pollution was a problem in their city than residents of the other cities.

The public health risk at coastal beaches is relatively low in all five regions in which our cities are located. In comparison, the rate of public health risk at inland

freshwater beaches is relatively high. Of those regions with a comparatively high number of monitored sites, Canterbury has the highest number of samples exceeding guidelines.

North Shore, Auckland, Waitakere, Manukau, Hamilton and Tauranga have excellent grades for drinking water quality. In all our cities at least 99.8% of the population received water from suppliers that complied with *E. coli* standards.

### Links to other indicators

A healthy natural environment contributes to public health. Air pollutants, for example, can reduce the capacity to resist infection, which can increase the number of hospital admissions and emergency department visits, school absences, lost work days and restricted activity days.<sup>2</sup>

Emissions from motor vehicles and other sources of air pollution, such as industry and fires for home heating, have been linked to almost 1,100 premature deaths per year in New Zealand.<sup>3</sup> Polluted recreational water is also strongly related to human health problems, such as stomach and intestinal illness, colds and flu and skin, eye and ear infections.<sup>4</sup>

Ineffective waste disposal can create air, water and soil pollution and loss of biodiversity. Increasing water usage, resulting in depletion of water supplies, is a key factor in loss of biodiversity and water pollution and also impacts on recreational opportunities. Stress is placed on waterways through point and non-point pollution sources. These factors can compromise the source of a city's drinking water supply. The quality of drinking water supplied to residents has a direct impact on people's health and wellbeing.<sup>5</sup>

Biodiversity provides the critical ecosystem processes necessary to maintain life, such as the quality of the atmosphere, the climate, water and soil quality and waste disposal. Apart from the ethical, aesthetic and cultural reasons behind the need to preserve biological diversity, there are also economic motives to do so. The range of biodiversity impacts on control of plant and animal pests and diseases, provision of food, clothing, building materials and medicines and is a key component of tourism.

<sup>1</sup> It is difficult to assess accurately the level of waste generated by domestic, commercial and industrial sources, as waste management activities for most cities are carried out by commercial contractors. The data is considered to be commercially sensitive information, rather than data that could be used by councils to address the growing issue of waste disposal.

<sup>2</sup> Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/particles](http://www.mfe.govt.nz/issues/air/breathe/particles) Retrieved 16 July 2007.

<sup>3</sup> Fisher, G., Kjellstrom, T., Kingham, S., Hales, S. & Shrestha, R. (2007). *Health and Air Pollution in New Zealand*. A research project funded by Health Research Council of New Zealand, Ministry for the Environment and Ministry of Transport.

<sup>4</sup> Ministry for the Environment. (2003). *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas* (ME number 474).

<sup>5</sup> Ministry for the Environment. (2004). *Freshwater for a sustainable future: issues and options*. Prepared for the Minister for the Environment by the Water Programme of Action inter-departmental working group.

## Local natural environmental issues

- Key environmental issues facing the 12 cities are the effects of growth and development, protecting biodiversity, transportation, air quality and water supply/quality.

### What this is about

New Zealand's natural environment supports its people, economy and culture. As the population grows and economic activity increases, more demands are placed on the natural environment. Environmental issues impact on economic and public health issues.

This indicator considers the key environmental issues that the 12 cities have identified. While the Ministry for the Environment has a mandate to provide national level guidance on environmental issues, local government has ongoing responsibility for day to day environmental management.

### What did we find?

Key environmental issues vary across the 12 cities due to natural geography and level of urban growth. Issues mentioned frequently were the effects of city development/growth, protecting and restoring biodiversity, transport, air quality and water issues (e.g. continuity of supply and contamination of water sources).

Some issues, such as climate change, depletion of the ozone layer and disposal of waste and hazardous substances, are relevant to New Zealand as a whole.

### Local natural environmental issues, by city (2007)

Key local natural environmental issues	
Rodney	<ul style="list-style-type: none"> <li>• Accommodating growth and development whilst maintaining beautiful coastlines and rural landscapes.</li> <li>• Developing the economic viability of rural and aquatic industries and protecting native biodiversity, biosecurity and pest management.</li> </ul>
North Shore	<ul style="list-style-type: none"> <li>• Management of the volume and quality of stormwater.</li> <li>• Maintenance of a rural character edge to the city.</li> </ul>
Auckland	<ul style="list-style-type: none"> <li>• Contamination of storm water by heavy metals.</li> <li>• Air quality (with transportation as the primary contributor).</li> </ul>
Waitakere	<ul style="list-style-type: none"> <li>• Town centre revitalisation incorporating biodiversity.</li> <li>• Management of environmental pests to protect native bush areas.</li> </ul>
Manukau	<ul style="list-style-type: none"> <li>• Accommodating sustainable growth within the metropolitan urban limits.</li> <li>• Providing sufficient land for business and commercial development.</li> </ul>
Hamilton	<ul style="list-style-type: none"> <li>• Allocation of water in a sustainable and equitable way.</li> <li>• Degradation of the Waikato river bed.</li> </ul>
Tauranga	<ul style="list-style-type: none"> <li>• Management of urban growth in a sustainable way.</li> <li>• Maintenance of close linkages between land development and transportation.</li> </ul>
Hutt	<ul style="list-style-type: none"> <li>• Flooding concerns from Hutt River and Awamutu and Waiwhetu Streams (the latter heavily contaminated by pollutants and requiring remediation).</li> <li>• Growing population putting pressure on the water supply.</li> </ul>
Porirua	<ul style="list-style-type: none"> <li>• Restoration of Porirua harbour inlet and waterways.</li> <li>• Support for Transmission Gully Motorway to ease traffic congestion and increase road safety.</li> </ul>
Wellington	<ul style="list-style-type: none"> <li>• Conservation of biodiversity by protection from negative effects of land use, particularly development in urban areas.</li> <li>• Management of pests and weeds to enhance biodiversity.</li> </ul>
Christchurch	<ul style="list-style-type: none"> <li>• Winter air quality (with open fires as the main contributor).</li> <li>• Ensuring a safe, secure potable water supply for future generations.</li> </ul>
Dunedin	<ul style="list-style-type: none"> <li>• Protection of the diversity of landscapes particularly those of outstanding quality.</li> <li>• Pressure for rural residential development particularly at coastal locations.</li> </ul>

Data source: Participating councils, 2007



## Waste management and recycling

### 10. Natural environment

- Almost all of New Zealanders living in the major metropolitan areas have access to kerbside recycling.
- The volume of solid waste sent to landfill has slightly increased in the years 2002 to 2006.

#### What this is about

Waste is material that is perceived to have no further use and which is released into the environment as a means of disposal. If it is not effectively managed it can create a range of adverse environmental and human health effects, undermining our ability to live more sustainably.

Waste includes solid, liquid or gaseous materials. While this indicator focuses on solid waste, it should be noted that other major categories of waste produced in cities include liquid trade wastes, sewage, contaminated stormwater, greenhouse gas emissions and various health-damaging air emissions from vehicles and industrial sources.

This indicator includes three measures:

- Position of the 12 cities in recycling and the amount of waste generated
- Volume per resident of recyclable waste (kgs)
- Volume per resident of solid waste disposal to landfill (kgs).

#### What did we find?

There are considerable gaps in the data available for volume of waste generated in cities, particularly for commercial and industrial waste. As waste is usually managed by the private sector (e.g. waste management contractors), the volume handled in each city is often measured and reported on using different methodologies. Due to this, there were difficulties ascertaining an accurate assessment of the level of waste generated by people and businesses in New Zealand.

It is often difficult for territorial authorities to accurately record household waste as volume of waste often includes both domestic and commercial waste. Although most cities were

able to report on the volume of rubbish bags/wheelie bins and recycling collected, waste that is taken to landfills or drop-off stations was not always recorded. Also, user-pays waste disposal, which is operated by commercial companies and deposited at council-run landfills and drop-off stations, was often included in the commercial, rather than domestic, tally. In these situations, the household volume can be estimated by the contractor (e.g. commercial waste management contractors in Christchurch estimate domestic waste to be approximately 45.0% of the total waste they collect per year).

It is hard to measure the progress of individual cities in their efforts to provide more sustainable waste management practices. However the 2006 Review of Progress of the Targets in the New Zealand Waste Strategy<sup>6</sup> does give a national picture of the process toward more sustainable waste management activities.

#### Position of each city in recycling

All of the 12 cities provided a service to collect recyclable materials (paper and card, plastic one and two, glass, steel and aluminium cans) from households at the kerbside, as well as providing facilities for residents to dispose of these same types of recyclable materials at drop-off stations.

The Ministry for the Environment reported in 2006 that 97.0% of all New Zealanders had access to domestic recycling facilities (either kerbside or drop-off), with 73.0% at the kerbside. In general, the major metropolitan cities (classified as Auckland, Hamilton, Wellington, Christchurch and Dunedin in the Ministry for the Environment's report) were performing better on waste recycling services than other urban and rural areas. The exception to this is in the provision of green waste facilities, where the other urban areas were often better serviced for this type of recycling.<sup>7</sup>

## Waste management and recycling continued

### Recycling in metropolitan, urban and rural areas (2006)

	% of New Zealand population in area	% of area population with access to kerbside recycling	% of area population with access to recycling facilities	% of territorial authorities providing green waste facilities
Metropolitan	52.0	97.0	99.7	70.0
Urban	24.0	53.0	97.0	84.0
Rural	24.0	45.0	92.0	64.0

Data source: Ministry for the Environment - Targets in the New Zealand Waste Strategy, 2006 Review of Progress

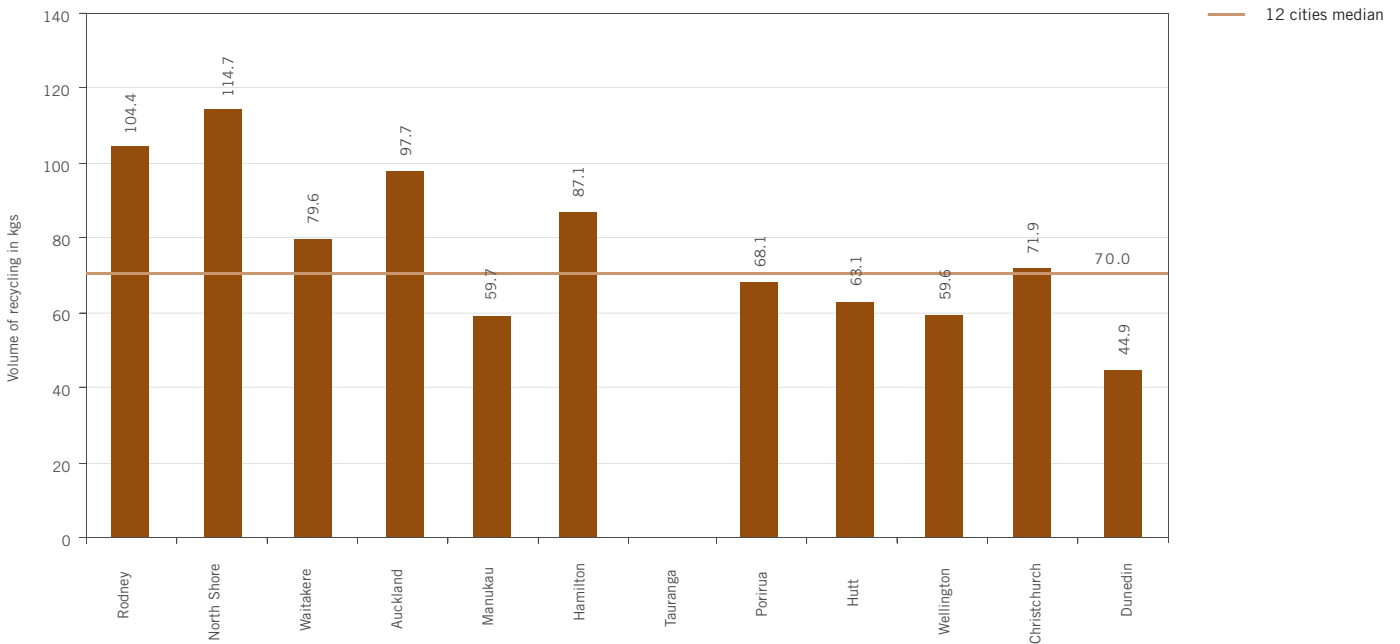
### Volume per resident of recyclable waste (kgs)<sup>8</sup>

There was variation across the cities, with the highest volume of total recycling collected<sup>9</sup> in North Shore (114.7 kgs per person per year). Dunedin (44.9kgs) and Wellington (59.6kgs) had the lowest volume of recycling per person per year.

The Ministry for the Environment noted in its 2006 progress review of Targets in the New Zealand Waste Strategy that space

allocation for recycling facilities in multi-unit residential and commercial buildings is not effectively achieved through councils' district plans. As a result, the Department of Building and Housing is examining options to make it mandatory for building designers to include space for recycling facilities in residential and commercial developments.<sup>10</sup>

### Volume of recyclable materials collected per resident per year, by city (2007)<sup>11</sup>



Data source: Participating councils, 2007

8 Recycling volumes may not be comparable across the 12 cities, as a mix of private contractors and councils manage recycling services in most areas and there is no agreed standard approach to assessing and reporting on recycling collected. The figures reported here are a per capita average and may not be an accurate reflection of total volumes collected.

9 This includes residential recycling collected at drop-off stations and kerbside. However, it excludes green waste recycled. It should be noted that some councils collect more types of plastic than just grade one and two. However, for the purposes of this report, they were requested to report on these grades only, to enable some degree of comparison.

10 Ministry for the Environment. (2006). *Targets in the New Zealand Waste Strategy, 2006 Review of Progress*. [www.mfe.govt.nz](http://www.mfe.govt.nz)

11 Data not available for Tauranga.

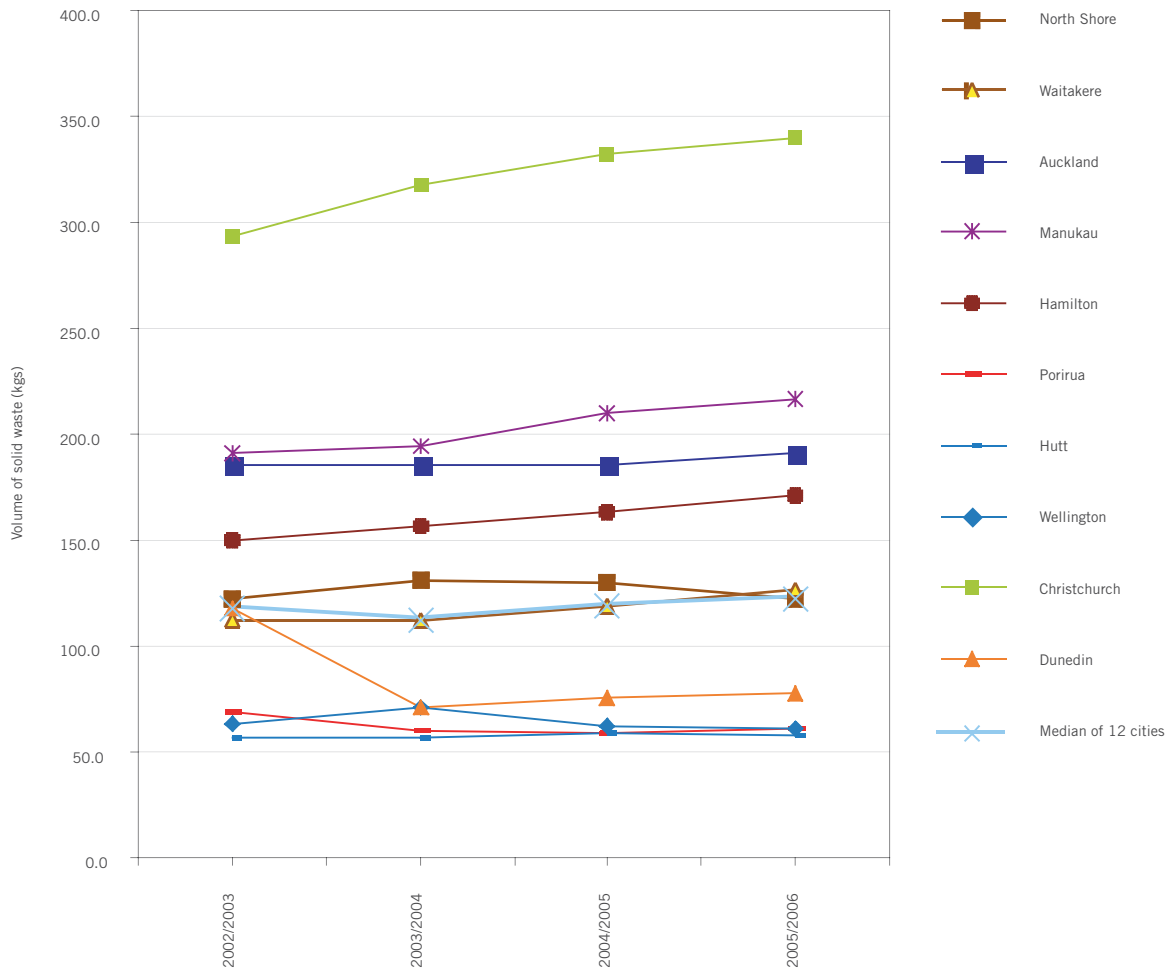


## 10. Natural environment

**Volume per resident of solid waste disposal to landfill (kgs)<sup>12</sup>**  
 Across the 12 cities, the amount of solid waste sent to landfill increased in the years 2002 to 2006. The amount generated by

each city varied widely, from Christchurch reporting 339.7kgs per person in 2005/2006, to Hutt with 57.7kgs. No data was available for Rodney and Tauranga.

**Volume of solid waste disposal to landfill per resident per year, by city (2002 to 2006)**



Data source: Participating councils, 2007

<sup>12</sup> Solid waste volumes may not be comparable across the 12 cities, as a mix of private contractors and councils provide waste management services in most areas and there is no agreed standard approach to assessing and reporting on waste volumes collected. The figures reported here are a per capita average and may not be an accurate reflection of total volumes collected.

## Biodiversity

- All the 12 cities are addressing biodiversity through their LTCCPs and District Plans.

### What this is about

Biodiversity is the number and variety of organisms found within a specified geographic region and the variability among living organisms on the earth (both within and between species and within and between ecosystems).

New Zealand's native biodiversity is unique, due to our geographic isolation. The high percentage of endemic species (those found nowhere else in the world) makes New Zealand's native biodiversity both special and highly vulnerable. This indicator focuses primarily on New Zealand's indigenous biodiversity.

Measures for this indicator include:

- Position of each city in conservation and sustainable management of biodiversity

- Hectares of privately owned open space covered by QEII Trust registered covenants
- Number of ecological heritage sites.

### What did we find?

#### Position of each city in conservation and sustainable management of biodiversity

In 2000, the Government released *The New Zealand Biodiversity Strategy*, which focused on the conservation, sustainable use and management of New Zealand's biodiversity. The first goal was to enhance community and individual understanding about biodiversity and to support community action to conserve biodiversity. The Local Government Act (2002) also requires that councils promote the environmental wellbeing of a community.

This measure explores how the 12 cities have addressed biodiversity through their LTCCPs and District Plans.

#### Council biodiversity issues

Rodney District Council	<ul style="list-style-type: none"> <li>• Natural and coastal environment is coming under increasing development and population pressure. District Plan zoning a key in conserving and enhancing the environment.</li> <li>• Key projects to protect biodiversity include establishing ecological corridors and reviewing incentives for protection of natural heritage on private land.</li> </ul>
North Shore City Council	<ul style="list-style-type: none"> <li>• Priorities include a study of protected natural areas and a review of development in greenfield areas.</li> <li>• Zoning controls include protection of native bush within the residential and rural zones and a tree protection bylaw for trees over certain sizes.</li> </ul>
Auckland City Council	<ul style="list-style-type: none"> <li>• Hauraki Gulf Islands District Plan identifies sites of ecological significance that contribute to the natural heritage and character of the islands. Development activity is controlled in these areas.</li> <li>• 'Greening the City', released in 2004, provides direction for the management of the natural environment.</li> </ul>
Waitakere City Council	<ul style="list-style-type: none"> <li>• Key priority is sustainable development including supporting ecosystem capacity and respecting environmental limits.</li> <li>• Biodiversity Strategy adopted in 2006 with one of the goals being the re-establishment of species lost from the city.</li> </ul>
Manukau City Council	<ul style="list-style-type: none"> <li>• Sustainable Environment and Heritage a theme in LTCCP. Actions include recognising and protecting natural and cultural sites and protecting and enhancing the natural qualities of lakes, streams and coastlines.</li> <li>• District Plan specifies protection of stream systems and native bush areas and zoning of residential areas to protect floral heritage.</li> </ul>
Hamilton City Council	<ul style="list-style-type: none"> <li>• Raising awareness about creating a sustainable urban environment is a priority through environmental education programmes such as Gully Restoration and the EnviroSchools schemes.</li> <li>• Zoning and environmental protection overlays to manage the natural values and significant natural features of the city under the District Plan.</li> </ul>
Tauranga City Council	<ul style="list-style-type: none"> <li>• District Plan allows for zoning areas as 'Conservation', 'Rural' or 'Greenbelt' to protect and enhance ecological sites and habitats.</li> <li>• Sub-regional growth strategy 'Smart Growth' released in 2003 to address protection of ecological corridors during the growth phase. Protection of the water quality, ecological and landscape values of Tauranga Harbour a priority.</li> </ul>
Hutt City Council	<ul style="list-style-type: none"> <li>• District Plan includes a list of significant natural resources. Provisions for protecting these areas appropriately are under review at time of writing.</li> <li>• All subdivisions are required to be designed in a way which considers the natural and physical characteristics of the land, with adverse effects avoided, remedied or mitigated. Subdivisions within the coastal environment and areas of ecological value are subject to ecological evaluation.</li> </ul>
Porirua City Council	<ul style="list-style-type: none"> <li>• Key project is Porirua Harbour and Catchment Management supported by a comprehensive monitoring, research and action programme.</li> <li>• District Plan includes inventory of ecological sites including areas of native vegetation.</li> </ul>
Wellington City Council	<ul style="list-style-type: none"> <li>• Range of projects to protect and enhance biodiversity, including natural habitats such as Otari-Wilton's Bush and Karori Wildlife Sanctuary, the Native Vegetation planting programme and restoration of areas to their original natural state.</li> <li>• District Plan has a schedule of Conservation sites requiring protection.</li> </ul>
Christchurch City Council	<ul style="list-style-type: none"> <li>• 'State of the environment' monitoring programme in place.</li> <li>• Under District Plan threatened land environments rating highest for criteria such as Biodiversity, Unusualness (or rarity) and Naturalness are given higher priority for protection.</li> </ul>
Dunedin City Council	<ul style="list-style-type: none"> <li>• Priority outcome of 'we value the natural environment, biodiversity and landscapes'.</li> <li>• District Plan notes that indigenous vegetation and habitats of indigenous fauna are under threat from land use practices such as vegetation clearing. Areas of natural character are recognised and protected from further modification.</li> </ul>

Data source: Participating councils, 2007



## 10. Natural environment

### Hectares of privately owned open space covered by QEII Trust registered covenants

The QEII Trust is a non-government organisation that enables landowners to protect special natural and cultural features on their land through open space covenants. A QEII covenant is a legally binding protection agreement registered on the title of the land. It is voluntary but once in place binds current and all subsequent landowners. Each covenant is unique and can apply to the whole property or part of the property.

Open space covenants are generally made in perpetuity, although there can be a case for a variable term covenant. These include:

- **Kawenata** on Maori land, which recognises tino rangatiratanga (independence)
- **Life of the trees** where individual trees occur in a situation where they may not be self-regenerating
- **Landscape protection agreements** where the land does not have a certificate of title (e.g. roadside areas).

As at 1 October 2006, there were 2,412 registered QEII open space covenants covering 78,266 hectares in New Zealand. A further 616 approved covenants (covering 19,951 hectares) were awaiting registration.

Within the 12 cities regions, the Waikato region had the largest area of land with registered and approved QEII covenants (15,524 hectares), while the Otago region had the largest average covenant size (75.8 hectares).

### QEII trust covenants by land area and number (October 2006)

Regional council	Total land in the region (hectares)	Number of registered covenants	Number of approved covenants	Total area registered and approved (hectares)	Largest registered covenant in region (hectares)	Average covenant size (hectares)
Auckland	500,000.0	176	33	3,561.0	841.0	17.0
Waikato	2,500,000.0	369	101	15,524.0	645.0	33.0
Bay of Plenty	1,223,100.0	130	21	10,398.0	6,564.0	68.9
Wellington	813,000.0	217	52	5,770.0	824.0	21.4
Canterbury	4,220,000.0	171	25	11,701.0	1,679.0	59.7
Otago	3,200,000.0	104	30	10,163.0	2,735.0	75.8
<b>Total NZ</b>	<b>26,303,400.0</b>	<b>2,412</b>	<b>616</b>	<b>98,217.0</b>	<b>6,564.0</b>	<b>36.1</b>

Data source: QEII Trust, 2006

## Biodiversity continued

### Number of ecological heritage sites

Ecological heritage sites are areas of remnant indigenous vegetation, which contribute to the ecological quality and diversity of the city. They are an important part of New Zealand's natural heritage and provide environmental functions such as reducing flooding, stabilising land (e.g. cliffs and riverbanks), filtering pollution and providing wildlife habitats for native birds, insects and plants.<sup>13</sup>

They are also valuable in providing educational and scientific resources of benefit to schools and tertiary institutions. Many sites are important to Maori. For example they may be places for

food gathering and storage and sources of weaving material. The protection of ecological heritage sites fulfils councils' obligations under the Resource Management Act (1991) (RMA) for the maintenance of indigenous biodiversity.

Threats to ecological heritage sites include agricultural or residential development and the subsequent displacement of native vegetation, balancing public access and recreational use with the need to protect the site, weed invasion and pests and predators causing damage to plants and animals.<sup>14</sup>

This measure identifies the number of ecological heritage sites that each Council has listed in their District Plan.<sup>15</sup>

### Ecological heritage sites (2007)

	Number of sites <sup>16</sup>	Comments
Rodney	296	97 as outstanding significance 199 as high significance
North Shore	326	153 as outstanding (over and above requirements of section 6c RMA) 108 as significant (meets requirements of section 6c RMA) 65 as linkage or wildlife corridors
Waitakere	219	29 outstanding and significant fauna habitats 180 outstanding vegetation sites 10 coastal protection areas  94 heritage trees and stands of trees In addition, the Waitakere Ranges Heritage Area covers two thirds of the city area
Auckland	85	85 sites of ecological significance
Manukau	1	1 wetland area  194 notable, exotic or native trees or stands of trees 21 conservation areas not in District Plan 2 wildlife refuge areas not in District Plan Auckland Regional Council Coastal Plan includes numerous coastal protection areas
Hamilton	7	7 areas of significant indigenous vegetation 82 significant trees or stands of trees
Tauranga	36	36 areas of significant vegetation value and significant flora and fauna
Porirua	171	13 large areas of mature forest 94 sites of small forest remnants in rural and built-up areas 22 inland or coastal wetlands 10 coastal scarps or dune 15 largely riparian sites 17 sites of reverting bush or diverse nature reserve
Hutt	63	63 significant natural resources areas
Wellington	28	28 conservation sites (for the protection of ecosystems and natural heritage)
Christchurch	48	8 dryland savannah sites 8 wetlands sites 5 forest sites 1 sand dunes site 26 short tussock grassland/shrubland sites
Dunedin	118	118 of significant vegetation value and/or areas of significant flora and fauna
<b>Total 12 cities</b>	<b>1398</b>	

Data source: Participating councils, 2007

13 Auckland City Council. (2007). [www.aucklandcity.govt.nz/council/services/heritage/ecological.asp](http://www.aucklandcity.govt.nz/council/services/heritage/ecological.asp) Retrieved 16 July 2007.

14 Christchurch City Council. (2007). *Ecological Heritage Sites Fact Sheet*. [www.ccc.govt.nz/Education/FactSheets/EcologicalHeritageSites/#1Weeds](http://www.ccc.govt.nz/Education/FactSheets/EcologicalHeritageSites/#1Weeds) Retrieved 16 July 2007.

15 Each city records ecological heritage sites in different ways, so the number of sites listed varied considerably across the cities. North Shore reported 326 sites listed in their city, while Manukau listed 21 designated sites.

16 Ecological heritage sites figure does not include heritage/notable trees. However, these have been listed in the comments column as a reference.



## Energy use

### 10. Natural environment

- Energy efficiency projects are underway in all of the 12 cities.
- Electricity demand has slightly increased in most areas, with the largest increase in demand in the greater Auckland region.

#### What this is about

The supply and use of energy has environmental consequences. In New Zealand effects from energy production include:

- Poor air quality and localised smog from wood and coal fires and motor vehicles
- Flooding land for hydro-electricity generation
- Geothermal power generation affecting nearby geysers
- Waste heat from thermal power generation plants.

Recently, the threat of climate change has raised questions around energy needed, the long term effects of energy use and ways to change to more sustainable forms of energy use. Sustainable development in energy terms means moving away from the fossil fuels currently used to lower carbon fuels, more efficient technologies and renewable energy.<sup>17</sup> Improving energy efficiency, that is, using less energy for the same amount of production, heating, light and transport, is a cost-effective way of achieving sustainable development.<sup>18</sup>

This indicator uses two measures:

- Electricity usage
- Sustainable energy use projects.

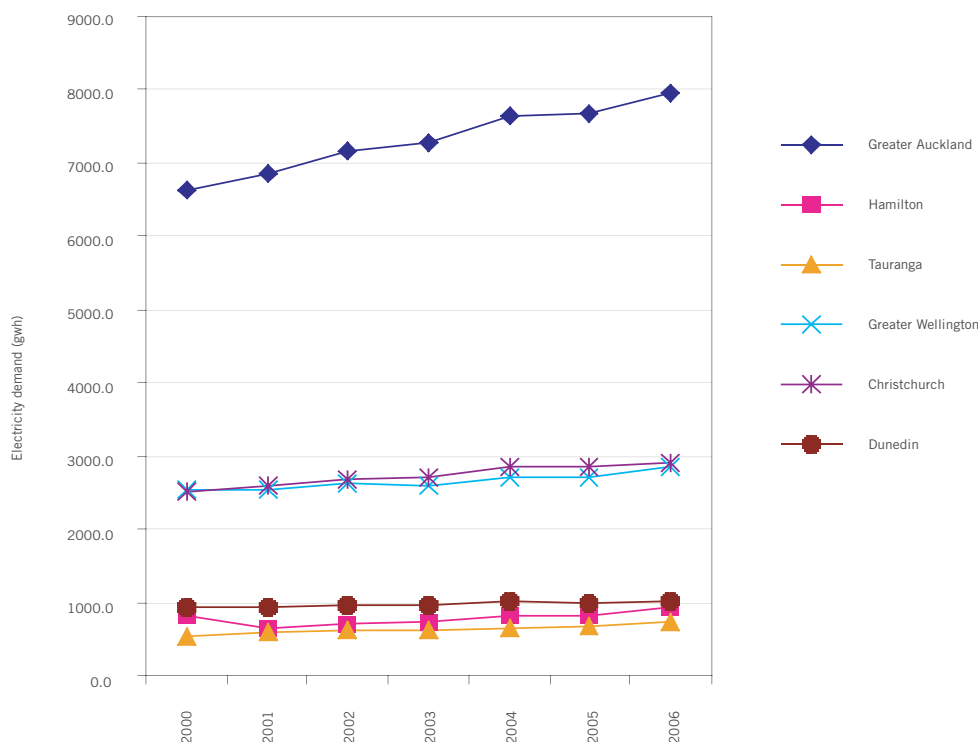
#### What did we find?

##### Electricity usage

Although electricity in New Zealand is increasingly generated from renewable sources, the level of electricity use increases every year. This results in a need to produce more energy to keep up with consumer demands and the subsequent impacts this may have on the environment.

This measure explores the demand for electricity in the 12 cities.<sup>19</sup> Demand for electricity has slightly increased in most areas, with the greater Auckland region showing a more marked increase in demand from 2000 to 2006.

**Electricity demand in gigawatts (gwh, at gxp net of embedded generation) per year, by city or region (2007)<sup>20</sup>**



Data source: Electricity Commission

17 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/energy](http://www.mfe.govt.nz/issues/energy) Retrieved 16 July 2007.

18 Department of Prime Minister and Cabinet. (2003). *Sustainable development for New Zealand - Programme of Action*.

19 Electricity arrangements in the Auckland and Wellington regions are not aligned to local territorial authorities, therefore the cities are reported as greater regions.

20 One gigawatt hour (GWh) is equal to one million kilowatt hours. New Zealand's annual demand is approximately 38,000 GWh. Grid exit point (GXP) is a point of connection where electricity flows out of the national grid to local networks or direct consumers. 'Net of embedded generation' means that the output of any power generators connected to a local lines network has been subtracted from the totals. Electricity Commission. (2007). [www.electricitycommission.govt.nz](http://www.electricitycommission.govt.nz) Retrieved 18 July 2007.

## Energy use continued

### Sustainable energy use projects

In the year ending March 2007, total energy generation in New Zealand increased 1.6% compared with the year to March 2006.<sup>21</sup> Increases in total electricity generation have occurred every year since 2000.

All councils across the 12 cities had a range of projects underway to increase their energy efficiency. Rodney, North Shore, Auckland, Waitakere and Manukau (alongside central government agencies) are part of a greater Auckland regional sustainable development framework project.

Common areas of investment mentioned by a number of councils included:

- Monitoring of energy use at council sites and facilities
- Establishing an energy management team, with functions such as energy auditing, creating energy strategies and policies and promoting energy efficiency
- Monitoring petrol/diesel use by council fleet vehicles
- Replacing lighting in council facilities with more energy efficient bulbs
- Installing co-generation engines at wastewater treatment plants
- Introducing a 'Walking and cycling for sustainable transport' plan
- Solar powered lighting on bus shelters
- Eco-design adviser service available to promote energy saving practices to builders, developers and residents
- Generating electricity for the national grid from landfill gas extraction.

Around a third of the total energy in New Zealand comes from renewable sources. About 70.0% of New Zealand's electricity is currently generated from renewable sources, such as hydro-electric stations, which have environmental impacts on river flows and lake levels. Compromises are often necessary to protect the ecological and recreational features of the rivers that remain.<sup>22</sup>



21 Statistics New Zealand. (2007). New Zealand Energy Statistics: March 2007 quarter. [www.stats.govt.nz](http://www.stats.govt.nz) Retrieved 10 July 2007.

22 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/energy/production.html](http://www.mfe.govt.nz/issues/energy/production.html) Retrieved 10 July 2007.



## Air quality

### 10. Natural environment

- Air pollution is perceived as a problem by residents in Christchurch and Auckland.
- Christchurch has the highest average annual levels of PM<sub>10</sub> and highest carbon monoxide levels in relation to the other cities.
- Auckland has the highest nitrogen dioxide levels in relation to the other cities that monitored such levels and the highest ozone concentrations (compared with the limited monitoring carried out in other cities).

### What this is about

Good air quality is essential for human health and the health of the natural environment. Factors that impact on air quality include domestic home heating, motor vehicle emissions, industrial emissions, outdoor burning (including agricultural burning and rubbish fires), plant pollens, dust and sea spray.

Air quality is directly impacted by increases in population, industry and motor vehicles in New Zealand's cities.

A report released in 2007 indicated that almost 1,100 premature deaths occur each year as result of exposure to air pollution from all sources in New Zealand.<sup>23</sup>

Six measures were used to assess air quality:<sup>24</sup>

- Levels of PM<sub>10</sub> (exceedances of 12 month maximums and annual average levels)
- Annual average levels of carbon monoxide (CO) (exceedances of maximums over 12 months)
- Annual average levels of nitrogen dioxide (NO<sub>2</sub>) (maximum one hour average over 12 months)
- Annual average levels of sulphur dioxide (SO<sub>2</sub>) (maximum one hour average over 12 months)
- Annual average levels of ozone (O<sub>3</sub>) (maximum one hour average over 12 months)
- Residents' perception of air pollution as a city problem.

### What did we find?

New Zealand has relatively good air quality due to a low population density, close proximity to the sea and remoteness from other sources of pollution. However, there are some urban areas where concentrations of air pollution were, at times, quite high, especially where there was high traffic density or where home heating was mainly by open fires or wood burners.

The Ministry for the Environment provides national guidance for regional councils and local authorities to manage the air in their region. This national guidance includes air quality guidelines, good practice guidance, research and reporting.<sup>25</sup>

Monitoring results released in a report by the Ministry for the Environment in 2004 indicated that the existing guideline value for fine particles in the air had been exceeded at 36 locations measured throughout New Zealand. The report estimated that implementation of air quality standards would save 625 lives over the analysis period (2004 to 2020) and would cost \$177,000 per life saved.

#### Levels of PM<sub>10</sub> (exceedances of 12 month maximums and annual average levels)

Suspended particles (PM<sub>10</sub>) refer to particles suspended in the air that have a diameter of less than 10 microns. Larger particles are not generally a problem for human health since they fall rapidly out of the atmosphere. High concentrations of smaller particles (less than 10 microns in size or PM<sub>10</sub>) can penetrate the lungs and damage the respiratory tissues.<sup>26</sup>

The main source of particulate matter in most areas of New Zealand is solid fuel burning for domestic home heating. Levels of particulate matter are generally higher in winter than in summer due to wood fires being used to heat homes and because wintertime weather conditions are more conducive to elevated pollution.

This measure looks at the number of days per year that the National Environmental Standard (NES) for PM<sub>10</sub> was exceeded. The NES allows for one exceedance of 50 µg<sub>m</sub><sup>-3</sup> per year.<sup>27</sup>

23 Fisher, G., Kjellstrom, T., Kingham, S., Hales, S. & Shrestha, R. (2007). *Health and Air Pollution in New Zealand*. A research project funded by Health Research Council of New Zealand, Ministry for the Environment and Ministry of Transport.

24 The maximums reported were based on the averaging period specified in the National Environmental Standards (NES), with hourly averages for NO<sub>2</sub>, SO<sub>2</sub> and Ozone and eight hour average for CO. It should be noted that where a city has more than one monitoring point, data from the worst-case monitored site in each city was used (North Shore, Rodney Waitakere, Tauranga, Hamilton and Dunedin each had one air monitoring site). In some areas this may be a 'residential neighbourhood' site or it may be a 'peak' site. Site classifications are described in Ministry for the Environment. (1999). *Good Practice Guide for Air Quality Monitoring and Data Management*.

25 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air](http://www.mfe.govt.nz/issues/air). Retrieved 29 August 2007.

26 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/particles.html](http://www.mfe.govt.nz/issues/air/breathe/particles.html) Retrieved 10 July 2007.

27 The amount of exposure to pollutants is often measured in units of micrograms of a substance per cubic metre of air (µg/m<sup>3</sup>). 50 µg<sub>m</sub><sup>-3</sup> refers to particles with a diameter of less than 50 microns (50 µm or 50 micrometres). Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/particles.html](http://www.mfe.govt.nz/issues/air/breathe/particles.html) Retrieved 10 July 2007.

## Air quality continued

### Number of exceedances of the national environmental standard for PM<sub>10</sub> (days per year) (2001 to 2005)

	NES exceedances (Days per year) <sup>28</sup>				
	2001	2002	2003	2004	2005
Rodney	n/a	n/a	n/a	n/a	n/a
North Shore – Takapuna site	2	0	0	0	1
Waitakere – Henderson site	0	0	0	0	0
Auckland <sup>29</sup>	1	3	0	0	1
Manukau	n/a	n/a	n/a	n/a	2
Hamilton	3	0	4	1	0
Tauranga	0	0	0	0	0
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt	0	0	0	0	0
Wellington	n/a	n/a	n/a	0	0
Christchurch – Coles Place site	52	28	41	36	32
Dunedin	2	0	0	1	1

Data source: Environet Ltd

Fires for home heating are a key factor in the high rates of air pollution. In Christchurch, geography and weather conditions trap air pollution near the ground in winter. Vehicle emissions played a key role in air pollution in Auckland.

When viewed over the period of a year, Christchurch's PM<sub>10</sub> levels were still higher than the other cities' readings. Concentrations in Auckland were also above the annual average guideline of 20 µg m<sup>-3</sup> each year. There was little variation in annual levels of PM<sub>10</sub> in Hamilton or Wellington.

### Annual levels of PM<sub>10</sub> per year (2001 to 2005)

	Annual average PM <sub>10</sub> (µg m <sup>-3</sup> ) <sup>30</sup>				
	2001	2002	2003	2004	2005
Rodney	n/a	n/a	n/a	n/a	n/a
North Shore – Takapuna site	14	17	17	19	17
Waitakere – Henderson site	19	16	15	16	15
Auckland	23	22	20	22	20
Manukau	n/a	n/a	n/a	n/a	18
Hamilton	15	15	15	17	15
Tauranga	12	13	12	13	12
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt	14	15	14	15	14
Wellington	n/a	n/a	n/a	17	16
Christchurch	29	24	25	24	20
Dunedin – Albany St site	24	21	22	20	21

Data source: Environet Ltd

<sup>28</sup> Data has been extrapolated for missing values and adjusted to high volume sample equivalent concentrations. This includes adjusting the number of guideline exceedances statistically based on the number of days that monitoring was carried out.

<sup>29</sup> Data for Auckland is from the worst site (Khyber Pass).

<sup>30</sup> µg m<sup>-3</sup> = micrograms per cubic metre of air.



## 10. Natural environment

### Annual average levels of carbon monoxide (CO) (exceedances of maximums over 12 months)

Carbon monoxide (CO) is a gas that is produced as a product of incomplete combustion. Sources of ambient air carbon monoxide concentrations typically include motor vehicle emissions, domestic home heating, outdoor burning and industry.<sup>31</sup> Health effects associated with exposure to CO include headaches, dizziness and nausea and can result in problems with visual

perception, dexterity, learning ability and the ability to perform sensorimotor tasks.<sup>32</sup>

The NES for CO has been set by the Ministry for the Environment at 10  $\mu\text{gm}^{-3}$  for an eight hour average.

The highest eight hour average CO concentrations were measured in Christchurch, with the peak concentration of 14  $\mu\text{gm}^{-3}$  occurring in 2002. A single high concentration in excess of the NES was measured in Dunedin during 2002.

### Maximum carbon monoxide (CO) level ( $\mu\text{gm}^{-3}$ ) per year, by city (2001 to 2005)

	Eight hour average CO ( $\mu\text{gm}^{-3}$ )				
	2001	2002	2003	2004	2005
Rodney	n/a	n/a	n/a	n/a	n/a
North Shore	4	7	7	6	6
Waitakere	5	3	3	4	4
Auckland	9	9	9	9	7
Manukau	9	7	7	6	5
Hamilton	7	5	7	7	4
Tauranga	2	1	2	2	1
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt	n/a	3	3	3	2
Wellington	n/a	n/a	n/a	4	3
Christchurch	12	14	10	10	8
Dunedin	n/a	12	n/a	n/a	n/a

Data source: Environet Ltd

### Annual average levels of nitrogen dioxide (NO<sub>2</sub>) (maximum one hour average over 12 months)

Nitrogen dioxide (NO<sub>2</sub>) is a respiratory irritant that affects lung function, can lower resistance to respiratory infections and may also increase reactivity to natural allergens. The main source of NO<sub>2</sub> in most urban environments is motor vehicle emissions, although burning of other fossil fuels (e.g. coal, gas and oil) will also produce NO<sub>2</sub>.<sup>33</sup>

The NES for NO<sub>2</sub> have been set at a maximum of 200  $\mu\text{gm}^{-3}$  for a one hour average concentration (nine allowable exceedances).

Of the 12 cities, Auckland, Wellington and Christchurch are the only cities that have consistently measured NO<sub>2</sub>, by monitoring the hourly average. The levels of NO<sub>2</sub> in Auckland far exceeded those measured in other cities. However it should be noted that the Auckland monitoring site is a roadside site and is likely to be affected by vehicle emissions more than other sites. In all other areas monitored, NO<sub>2</sub> concentrations were within the NES.

### Maximum nitrogen dioxide (NO<sub>2</sub>) level ( $\mu\text{gm}^{-3}$ ) per year (2001 to 2005)

	One hour average NO <sub>2</sub> ( $\mu\text{gm}^{-3}$ )				
	2001	2002	2003	2004	2005
Rodney	n/a	n/a	n/a	n/a	n/a
North Shore	101	128	97	124	122
Waitakere	n/a	n/a	93	83	98
Auckland Khyber Pass site	227	250	239	271	264
Manukau	76	72	97	70	66
Hamilton	n/a	n/a	102	n/a	n/a
Tauranga	n/a	n/a	n/a	n/a	n/a
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt <sup>34</sup>	n/a	69	83	89	55
Wellington <sup>35</sup>	n/a	n/a	n/a	n/a	138
Christchurch	110	118	120	154	77
Dunedin	n/a	n/a	n/a	n/a	n/a

Data source: Environet Ltd

31,32 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/carbon-monoxide.html](http://www.mfe.govt.nz/issues/air/breathe/carbon-monoxide.html) Retrieved 10 July 2007.

33 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/nitrogen-dioxide.html](http://www.mfe.govt.nz/issues/air/breathe/nitrogen-dioxide.html) Retrieved 10 July 2007.

34,35 Provisional data only as the method of data processing has changed.

## Air quality continued

### Annual average levels of SO<sub>2</sub> (maximum one hour average over 12 months)

Sulphur dioxide (SO<sub>2</sub>) has health impacts that include coughing and irritation of the nose, throat and lungs. Concentrations of SO<sub>2</sub> in ambient air typically occur as a result of combustion processes, in particular the burning of high sulphur fuels, although specific industries such as fertiliser manufacturing also discharge SO<sub>2</sub>. The main source of SO<sub>2</sub> is typically motor vehicles or industry, although domestic heating can be a main contributor in areas where domestic coal burning is prevalent.<sup>36</sup>

The NES for SO<sub>2</sub> has been set by the Ministry for the Environment at a maximum of 350 µgm<sup>-3</sup> for a one hour average concentration (nine allowable exceedances per year). With the exception of 2001 in Auckland, concentrations of SO<sub>2</sub> were similar in both Christchurch and Auckland at between 40 to 60 µgm<sup>-3</sup> with no exceedences of the NES at any of the locations monitored.

### Maximum sulphur dioxide (SO<sub>2</sub>) level (µgm<sup>-3</sup>) per year (2001 to 2005)

	One hour average SO <sub>2</sub> (µgm <sup>-3</sup> )				
	2001	2002	2003	2004	2005
Rodney	n/a	n/a	n/a	n/a	n/a
North Shore – Takapuna site	n/a	n/a	n/a	n/a	n/a
Waitakere – Henderson site	n/a	n/a	n/a	n/a	n/a
Auckland – Penrose site	165	48	48	40	54
Manukau	n/a	n/a	n/a	n/a	n/a
Hamilton	n/a	n/a	n/a	n/a	n/a
Tauranga	n/a	n/a	n/a	n/a	n/a
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt	n/a	n/a	n/a	n/a	n/a
Wellington	n/a	n/a	n/a	n/a	n/a
Christchurch	65	52	54	46	37
Dunedin	n/a	n/a	n/a	n/a	n/a

Data source: Environet Ltd



36 Ministry for the Environment. (2007). [www.mfe.govt.nz/issues/air/breathe/sulphur-dioxide.html](http://www.mfe.govt.nz/issues/air/breathe/sulphur-dioxide.html) Retrieved 10 July 2007.



## 10. Natural environment

### Annual average levels of ozone (O<sub>3</sub>) (maximum one hour average over 12 months)

Ozone is formed through atmospheric reactions between NO<sub>2</sub> and volatile organic compounds (VOCs). Ozone has a greater tendency to form in warmer areas. Health impacts from ozone include respiratory illness such as coughing, phlegm and wheezing. The main sources of ozone-forming contaminants are motor vehicles, domestic heating and industry.<sup>37</sup>

The NES for Ozone has been set by the Ministry for the Environment at a maximum of 150 µgm<sup>-3</sup> for a one hour average concentration (no allowable exceedances per year).

Monitoring of ozone has been carried out in the Auckland region from 2001 to 2006 and intermittently in Christchurch and Hamilton. Of these cities, concentrations of ozone are highest in Auckland at the Manukau site. However, there were no exceedances of the NES at any of the locations monitored.

### Maximum ozone (O<sub>3</sub>) level (µgm<sup>-3</sup>) per year (2001 to 2005)

	One hour average O <sub>3</sub> (µgm <sup>-3</sup> )				
	2001	2002	2003	2004	2005
Rodney	93	103	88	101	95
North Shore	n/a	n/a	n/a	n/a	n/a
Waitakere	n/a	n/a	n/a	n/a	n/a
Auckland – Sky Tower site	91	114	94	112	n/a
Manukau	90	135	134	111	100
Hamilton	n/a	n/a	n/a	80	n/a
Tauranga	n/a	n/a	n/a	n/a	n/a
Porirua	n/a	n/a	n/a	n/a	n/a
Hutt	n/a	n/a	n/a	n/a	n/a
Wellington	n/a	n/a	n/a	n/a	n/a
Christchurch – Lincoln site	n/a	n/a	97	n/a	n/a
Dunedin	n/a	n/a	n/a	n/a	n/a

Data source: Environet Ltd

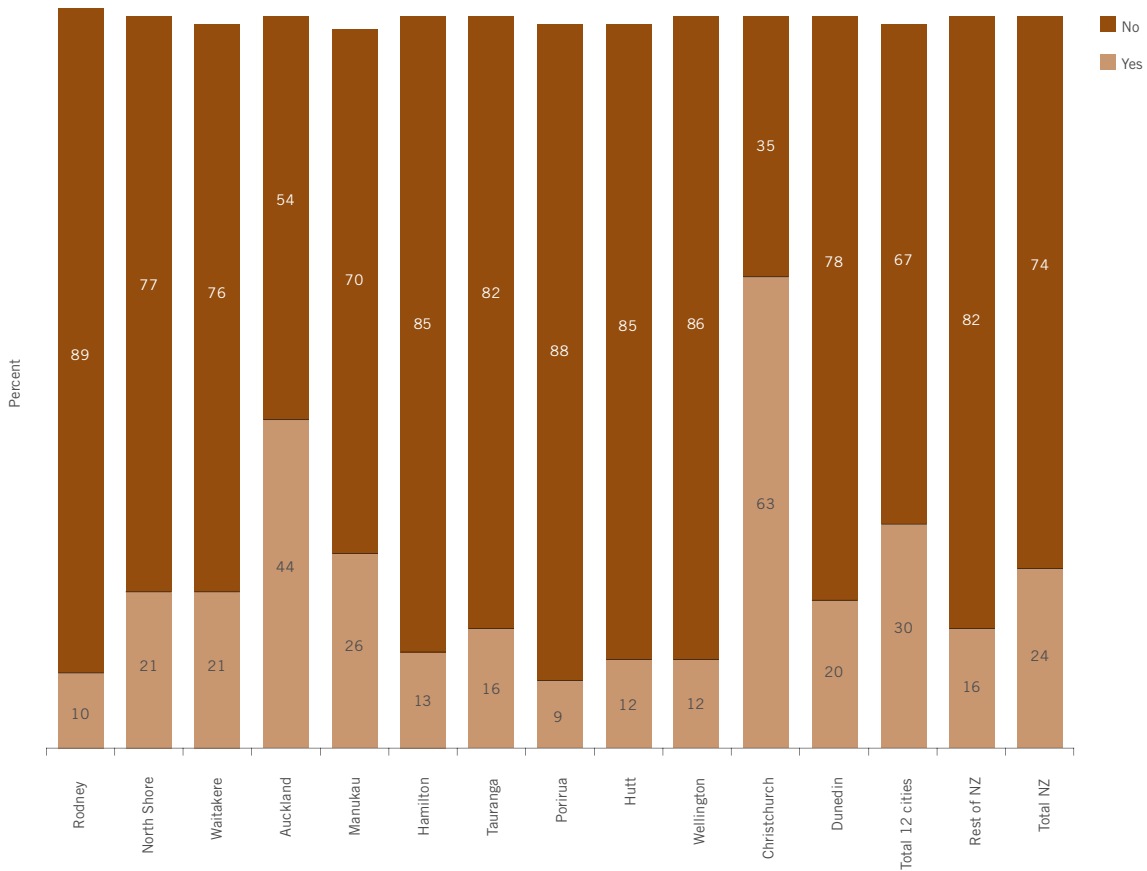
## Air quality continued

### Residents' perception of air pollution as a city problem

This measure looks at whether residents perceived air pollution as a problem in their city in the past 12 months, using 2006 Quality of Life Survey data. There was a degree of variation across the cities, with the highest rates of perception of air pollution as a problem in Christchurch (63.0%) and Auckland (44.0%).

Across the 12 cities, Maori were significantly more likely to have perceived air pollution as a problem (36.0%), compared with Pacific Islands residents (30.0%), New Zealand Europeans (24.0%) and Asian/Indian people (20.0%).

Residents' rating of air pollution as a city problem (2006)<sup>38</sup>



Data source: Quality of Life Survey 2006

38 Figures might not add to 100% as 'don't know' responses are not shown.



## Beach and stream/lake water quality

### 10. Natural environment

- In general, the rate of public health risk at coastal beaches is relatively low in all five regions. Risk is higher at freshwater bathing sites.
- North Shore, Auckland and Hutt residents are more likely to rate water pollution as a problem than residents of other cities.

### What this is about

Beach and stream/lake water quality is measured to ensure that the water is safe for human recreational use and to show the impact of human activity on beaches and natural waterways. High levels of bacteria can directly impact on the health and wellbeing of residents as they indicate the presence of pathogens (illness-causing bugs). A key factor in the quality of beach and stream/lake water is the quality of a city's stormwater and sewerage systems.

Two measures are used for this indicator:

- Beach and stream/lake water quality
- Residents' perception of water pollution as a city problem.

Water quality data is analysed using the national Microbiological Water Quality Guidelines for Marine and Freshwater recreational areas (Ministry for the Environment and Ministry of Health, 2003). These guidelines state that warning signs should be erected at a beach if indicator bacteria concentrations exceed 550 *E. coli*<sup>39</sup> per 100mls in a single sample for freshwaters and 280 enterococci per 100mls in two consecutive samples for coastal waters.

### What did we find?

#### Beach and stream/lake water quality

Monitoring of coastal and freshwater beaches happens in all five of our regions. The Auckland, Wellington and Canterbury regions have the most coastal monitoring sites, which reflects the relatively large populations and proximity of the cities in these regions to the coast. The Bay of Plenty and Canterbury regions have the most inland freshwater monitoring sites, probably due to the relatively high number of lakes and rivers that are accessible for recreation in these regions.

The table shows the average numbers of beaches monitored and samples taken that exceed guideline levels in the five regions of New Zealand occupied by the 12 cities (for the period 2003 to 2007).<sup>40</sup>

The bacterial quality of water for each region is also tested to determine percentage of samples taken that exceed national guideline thresholds.<sup>41</sup> It is important to note that not all single sample exceedences result in public health warning signs being erected.

The rate of public health risk at coastal beaches is relatively low in all five regions occupied by the 12 cities. The average percentage of samples exceeding guidelines at coastal sites over the period 2003 to 2007 ranged from 2.0% in the Bay of Plenty to 5.0% in the Auckland region. The higher indicated risk in the Auckland region probably reflects the fact that most monitored beaches are located on the margins of the city and are therefore subject to higher volumes of urban stormwater runoff. Many of the Auckland beaches are also in harbour settings where wave energy is low and contaminants may not be dispersed very quickly. By contrast, many of the monitored beaches in the Bay of Plenty are at small settlements on the open coast where there is likely to be less contaminated runoff and greater dispersal by waves and currents.

The rate of public health risk at inland freshwater beaches is relatively high compared with coastal sites. The highest rates of sample exceedance occurred in the Auckland (15.0%) and Otago (14.0%) regions. Only a small number of sites are monitored in these regions so results should not be considered representative of the region's freshwater quality. Of those regions with a relatively high number of monitored sites, Canterbury had the highest number of samples exceeding guidelines (12.0%). This may be related to the amount of intensive farming in the Canterbury region and faecal pollution from stock runoff from pasture.

Bathing water quality is generally poorer at inland freshwater sites than coastal sites because there is less dilution and dispersal of contaminants.

39 *E. coli* and enterococci are different species of bacteria that indicate the presence of faecal matter in fresh and coastal waters, respectively.

40 In some regions, the majority of monitoring sites are in or very close to, the main cities (e.g. harbour cities like Auckland and Wellington). In other regions, there are no monitoring sites in the main city (e.g. Hamilton is an inland city and most coastal monitoring sites in the Waikato region are around the Coromandel Peninsula). However sites are generally within easy reach of city dwellers.

41 The Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (Ministry for the Environment and Ministry of Health, 2003) are voluntary guidelines and can be adapted or interpreted in different ways by each council for public health management. This has resulted in some inconsistencies between methodologies being implemented around the country. For example, Waitakere City Council erects public warning signs after recording a single sample greater than 280 enterococci/100ml in coastal waters rather than two consecutive samples as the guidelines recommend. Due to the differences in methodologies used by the individual councils, the data shown here indicates the bacterial quality of the water rather than a complete assessment of the public health risk (i.e. a bacterial exceedance does not necessarily lead to sign erection and beach closure in all cases). The figures can be used as only a conservative estimate of actual public health risk.

## Beach and stream/lake water quality continued

### Monitoring of coastal and freshwater sites (2003 to 2007)

Region/City	Averages for 2003 to 2007			
	Coastal beaches		Freshwater beaches (rivers and lakes)	
	Number of beaches monitored	Percentage of samples exceeding guidelines <sup>42</sup> %	Number of beaches monitored	Percentage of samples exceeding guidelines <sup>43</sup> %
Auckland	88	5.0	7	15.0
Waikato	13	3.0	17	2.0
Bay of Plenty	33	2.0	41	5.0
Wellington	76	4.0	23	8.0
Canterbury	45	3.0	52	12.0
Otago	5	4.0	10	14.0

Data source: Ministry for the Environment

### Residents' perception of water pollution as a city problem

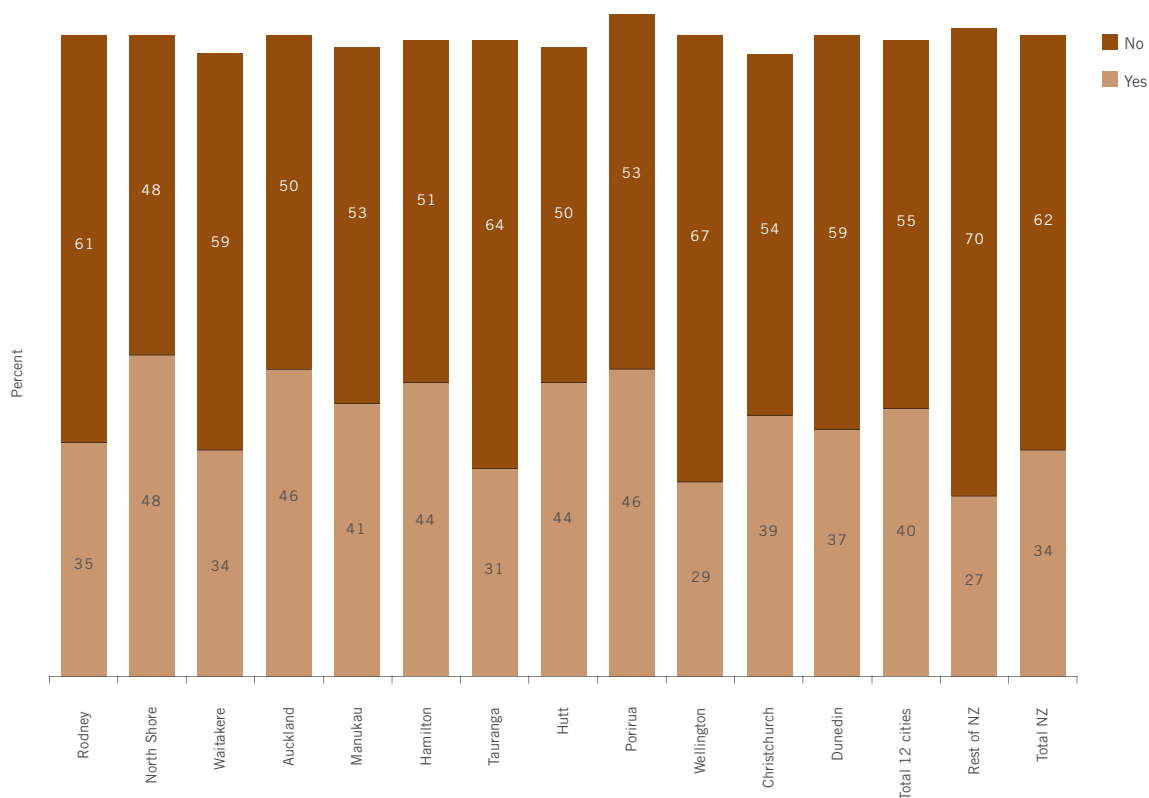
This measure looks at whether residents perceived water pollution as a problem in their city in the past 12 months, using 2006 Quality of Life Survey data.

Wellington residents were least likely to perceive water pollution as a problem (29.0%), as were residents in Tauranga (31.0%) and Waitakere (34.0%). Residents living in North Shore (48.0%),

Auckland and Hutt (both 46.0%) were more likely to consider water pollution as a problem.

Across the 12 cities, Maori (47.0%) and New Zealand European (43.0%) residents were significantly more likely than other ethnic groups to have indicated that water pollution had been a problem (Pacific Islands people 36.0%; Asian/Indian people 19.0%).

### Residents' rating of water pollution as a city problem (2006)<sup>44</sup>



Data source: Quality of Life Survey 2006

42 For the purpose of this report, the exceedance level for coastal waters is a single sample greater than 280 enterococci per 100mls. This is different from the approach advocated by the national guidelines for coastal waters (two consecutive samples) but is necessary because some councils do not take a second sample.

43 Exceedance level for freshwater is a single sample greater than 550 *E.coli* per 100mls.

44 Figures might not add to 100% as 'don't know' responses are not shown.



## Drinking water quality

### 10. Natural environment

- North Shore, Auckland, Waitakere, Manukau, Hamilton and Tauranga have excellent grades for drinking water quality.
- Nearly all residents in the 12 cities were served by water supplies that comply with *E. coli* standards.

#### What this is about

Clean drinking water is essential to all life and is fundamental in order for cities to operate effectively. In New Zealand about half of the drinking water supply is pumped from groundwater aquifers with the remainder coming mainly from rivers and lakes.

Access to a continuous and high quality supply of water is often taken for granted. However our activities on the land can compromise the quality of supply.

Pollution of drinking water sources from point (e.g. stormwater discharge and treated wastewater effluent) and non-point (e.g. agricultural run-off, particularly from dairy farms) pollution sources is of particular concern.<sup>45</sup> Other factors that may impact on the quality of our drinking water are the methods of water treatment used and the condition of the water reticulation network. Two measures are used for this indicator:

- Public health water quality grading
- *E. coli* compliance of water distribution zones.

#### What did we find?

##### Public Health Water Quality Grading

Water Information New Zealand (WINZ) states that a drinking water supply for 500 or more people should have a public health grading.<sup>46</sup> This consists of a single grading for each treatment plant/source combination, with gradings also given for distribution zones. Gradings are shown in the table.

Water treatment plant gradings		Distribution zone gradings of water reticulation networks	
A1	Completely satisfactory, negligible level of risk, demonstrably high quality	a1	Completely satisfactory, negligible level of risk, demonstrably high quality
A	Completely satisfactory, extremely low level of risk	a	Completely satisfactory, extremely low level of risk
B	Satisfactory, very low level of risk when the water leaves the treatment plant	b	Satisfactory, very low level of risk
C	Marginally satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory chemically	c	Marginally satisfactory, moderate level of risk
D	Unsatisfactory level of risk	d	Unsatisfactory level of risk
E	Unacceptable level of risk	e	Unacceptable level of risk
U	Ungraded	u	Not yet graded (Not yet required if less than 500 people)

Data source: [www.drinkingwater.co.nz](http://www.drinkingwater.co.nz)

<sup>45</sup> Report to the Minister of Health from the Public Health Advisory Committee. (October 2002). *The Health of People and Communities: The effect of environmental factors on the health of New Zealanders.*

<sup>46</sup> It should be noted that currently this grading system is voluntary. Until December 2004, all grades were calculated using the 1993 Public Health Grading specification. A new specification was released in 2003 and from January 2006, only grades from the 2003 specification were valid. However, most of the treatment plant and distribution zone gradings have not been updated with the new specification and have been reset as ungraded. Therefore, the results for this measure need to be looked at in conjunction with the other drinking water quality measure of *E. coli* compliance of water distribution zones.

## Drinking water quality continued

Treatment plant and source grading is based on the likely health risks to the community. The distribution zone refers to all or part of a city, district or community that receives similar quality water from its taps.

North Shore, Auckland, Waitakere, Manukau, Hamilton and Tauranga supplies had excellent grades for drinking water quality

(Aa). Although Porirua had the top grade achievable of A1 for its water treatment plant, its distribution zones were ungraded.

Christchurch, Dunedin and most of Wellington supplies were ungraded under the new water grading specifications.

### Public health water quality grading (May 2007)<sup>47</sup>

Water quality grading											
Rodney	North Shore	Auckland	Waitakere	Manukau	Hamilton	Tauranga	Hutt	Porirua	Wellington	Christchurch	Dunedin
Au	Aa	Aa	Aa	Aa	Aa	Aa	Bu	A1u	Uu	Uu	Uu

Data source: [www.drinkingwater.co.nz](http://www.drinkingwater.co.nz)

### *E. coli* compliance of water distribution zones

Standards for drinking water were introduced in 2000 and were last revised in 2005.<sup>48</sup> Under the Drinking Water Standards local authorities are required to test regularly drinking water to demonstrate its quality and safety.<sup>49</sup>

*E. coli* compliance can be achieved by regular monitoring of the distribution zone (i.e. at the tap) to demonstrate that *E. coli* is not present in water.

Drinking water in six of the 12 cities achieved 100.0%

*E. coli* compliance. However, it should be noted that the water supplies that did not comply were those that supplied very small communities (i.e. a number of supplies served populations of between one to ten residents). Nearly 100.0% of the population in the 12 cities was covered by water supplies that comply with *E. coli* standards.

### *E. coli* compliance of water distribution zones (2005)<sup>50</sup>

	Number of council tested water supplies	Number of council tested water supplies that complied	Water supplies that complied %	Population covered by water supplies that complied %
Rodney	17	12	71.0	99.8
North Shore	4	4	100.0	100.0
Waitakere	10	9	90.0	99.9
Auckland	9	8	89.0	99.9
Manukau	4	3	75.0	99.9
Hamilton	2	2	100.0	100.0
Tauranga	2	2	100.0	100.0
Porirua	6	6	100.0	100.0
Hutt	7	7	100.0	100.0
Wellington	11	11	100.0	100.0
Christchurch	8	7	88.0	99.9
Dunedin	14	13	93.0	99.9

Data source: Water Information New Zealand

47 The default method of summarising multiple drinking water zones to arrive at a single grading for a whole city is to use the grading from the worst zone in that city.

48 Ministry of Health. (2005). *Drinking Water Standards for New Zealand 2005*. Note: these standards are not legally enforceable.

49 Under this standard, drinking water is defined as 'water intended to be used for human consumption, food preparation, utensil washing, oral hygiene or personal hygiene'.

50 The supplies used in the calculation of compliance for the cities were those run by the local authority. This is given in terms of the number of distribution zones and the percentage of the population served by the supplies (as per populations in Water Information New Zealand database).



## Water consumption

### 10. Natural environment

- Water consumption in the 12 cities, both domestic and commercial/industrial, has increased slightly over recent years.

#### What this is about

High levels of water use can cause both environmental and economic problems. Environmentally, high water consumption places stress on rivers, lakes and groundwater aquifers and may require dams, which have ecological impacts. Increased consumption levels may lead to increased volumes of discharged water and if this water is polluted it can damage aquatic ecosystems. Economically, high levels of water use require increasing and expensive investments in water system infrastructure needed to gather, deliver and dispose of water (dams, reservoirs, water treatment facilities, distribution networks and sewage treatment). Measures used to assess this indicator include:

- Domestic water consumption per person
- Commercial and industrial water consumption.

#### What did we find?

##### Domestic water consumption per person

Increases in domestic water consumption were reported across most of the 12 cities. In general, the increases were relatively small, with some councils reporting fluctuating levels of water consumption. Tauranga and Wellington reported a slight decrease in daily water consumption by residents.

Water consumption is not measured the same way in each city. Some have domestic water meters for each household, whereas others have proportions of households using tank water, which means water use can only be estimated. In addition, some cities, such as Porirua, Dunedin and Hamilton, do not have universal water metering, so total population and bulk supply calculations were used in these cases.<sup>51</sup>

#### Domestic water consumption in litres per person per day (2001 to 2006)

	Year ending June				
	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006
Rodney	n/a	n/a	n/a	n/a	175.0
North Shore	196.2	198.7	198.9	205.3	202.0
Waitakere	163.0	167.0	167.0	169.0	165.0
Auckland	164.7	166.2	163.3	165.5	166.0
Manukau	178.0	179.0	188.0	191.0	190.0
Hamilton	237.9	225.5	218.6	241.4	230.2
Tauranga	n/a	265.1	247.0	256.2	250.7
Wellington	168.1	168.1	171.1	167.9	165.4
Porirua	n/a	334.0	322.0	327.0	352.0
Hutt	248.0	220.0	275.0	279.0	242.0
Christchurch	238.0	249.0	252.0	245.0	247.0
Dunedin	204.0	234.0	207.0	201.0	207.0

Data source: Participating councils, 2007

<sup>51</sup> Bulk supply refers to the total volume of water supplied by a water treatment plant. This volume includes water used for domestic consumption, as well as water losses through leakages in the water pipe network.

## Water consumption continued

### Commercial and industrial water consumption

The majority of the 12 cities reported increased water consumption in the commercial and industrial sectors. The amount of water used in commercial and industrial applications varied between the 12 cities, from the highest

use in 2005 to 2006 in Auckland (18,951,040 cubic litres) to the lowest for the same year in Rodney (311,700 cubic litres). This reflected the differing number of businesses and manufacturers in different cities across the country.

### Commercial and industrial water consumption in cubic litres per year (2001 to 2006)

	Year ending June				
	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006
Rodney	n/a	n/a	n/a	n/a	311,700
North Shore	2,976,000	3,133,000	2,253,000	2,146,000	2,556,000
Waitakere	2,235,700	2,308,900	2,006,100	2,135,300	2,847,000
Auckland	17,091,154	17,672,277	17,786,747	18,457,491	18,951,040
Manukau	9,793,000	9,952,000	9,811,000	9,796,000	10,276,000
Hamilton	5,191,244	5,346,982	5,507,391	5,602,258	5,813,989
Tauranga	n/a	2,652,000	2,912,350	2,802,600	2,920,500
Wellington	6,269,182	7,036,200	6,336,576	7,117,810	7,307,019
Porirua <sup>52</sup>	n/a	n/a	1,073,000	919,000	946,000
Hutt	2,365,000	2,330,000	2,157,000	2,252,000	2,298,000
Christchurch	11,369,982	12,621,100	12,953,144	12,800,983	13,097,828
Dunedin	5,532,942	5,784,976	5,846,049	5,779,836	5,686,204

Data source: Participating councils, 2007



52 Commercial and industrial consumption does not take into account other users of the bulk supply.



# Ecological Footprints

## 10. Natural environment

- Wellington, Bay of Plenty and Auckland regions recorded lower ecological footprints per capita than the national average.

### What this is about

An ecological footprint is a measure of how much biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using current technology and resource management practices.<sup>53</sup> Ecological footprints are usually measured in global hectares (gha)<sup>54</sup> as trade is global, an individual or country's footprint includes land or sea from all over in the world. A larger footprint means that more resources are being used to support people's lifestyles.

Ecological footprints are calculated using 'direct' land (e.g. land used for agricultural production or for roads and buildings) and 'indirect' land (e.g. land used for processing and packaging agricultural products), as well as the amount of 'embodied' land used (e.g. land overseas used for the production of goods that are imported into New Zealand for consumption in this country).

Regional, city or district councils are responsible for sustainably managing the natural resources in their area, so they need to know the level of consumption of these resources, the amount of waste produced and how that waste is dealt with, so they can measure the effect these activities have on the regions' environment. It also helps councils predict how the current action of residents will affect the regions' environment and economy in the future and the impact this may have on residents' quality of life. This indicator uses two measures:

- New Zealand's ecological footprint
- Regional ecological footprints.

### What did we find?

#### New Zealand's ecological footprint

The New Zealand ecological footprint has been calculated at 22.9 million gha for 2003/2004. This represents the total amount of land needed to sustain the New Zealand population in 2003/2004 according to estimated levels of consumption. In comparison, New Zealand's 1997/1998 ecological footprint was calculated at 19.9 million gha, which represents an annual average growth of 2.4 percent between 1997/1998 to 2003/2004.<sup>55</sup>

The biocapacity<sup>56</sup> of New Zealand has been estimated to be 58.2 million gha (this excludes national parks, forest parks and other non-productive land). On this basis, the ecological footprint of the New Zealand population occupies 39.4% of its biocapacity. For instance, if the per capita footprint remains unchanged, New Zealand could increase its population by 1.53 times before it 'overshoots' its carrying capacity.<sup>57</sup>

The per capita footprint for New Zealand has been calculated at 5.65 global hectares per person.<sup>58</sup> The United States, Canada and Australia all had higher per capita ecological footprints than New Zealand. These differences can be explained by factors such as higher incomes and higher levels of material affluence and consumption in these countries. There are a number of countries (the United Kingdom, the Netherlands and Japan) that have higher per capita income than New Zealand, but have lower ecological footprints per capita. There seems to be a greater level of separation between economic growth and ecological footprint in these countries, which may be due to factors such as higher population densities, diet, lifestyle factors and use of eco-efficient technologies, all of which reduce the use of embodied land.

53 Global Footprint Network. (2007). [www.footprintnetwork.org](http://www.footprintnetwork.org) Retrieved 6 July 2007.

54 A global hectare is a measure used to report both the biocapacity of the earth and the demand on biocapacity. A global hectare is normalised to the area-weighted average productivity of biologically productive land and water in a given year. Because different land types have different productivity, a global hectare of, for example, cropland, would occupy a smaller physical area than the much less biologically productive pasture land, as more pasture would be needed to provide the same biocapacity as one hectare of cropland. Global Footprint Network. (2007). [www.footprintnetwork.org](http://www.footprintnetwork.org) Retrieved 6 July 2007.

55 Ministry for the Environment. (2007). *Ecological Footprints of New Zealand and its Regions 2003-04*.

56 Biocapacity is a measure of the biological productivity in an area. It is the capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. Global Footprint Network. (2007). [www.footprintnetwork.org](http://www.footprintnetwork.org) Retrieved 6 July 2007.

57,58 Ministry for the Environment. (2007). *Ecological Footprints of New Zealand and its Regions 2003-04*.

## Ecological Footprints continued

### Regional ecological footprints<sup>59</sup>

Of the regions in this report, the Otago region recorded the highest ecological footprint per capita in 2003/2004 (3.3 local hectares (lha) per resident). This is due to the relatively low productivity of other types of agricultural land in this region as the land is predominantly used for extensive sheep and beef farming. This region ranks 15th in land productivity terms.

The Canterbury (2.66 lha) and Waikato (2.07 lha) regions recorded ecological footprints per capita near the national average of 1.9 lha, although the Waikato region had the second highest land productivity of any region.

The Wellington (1.7 lha), Bay of Plenty (1.6 lha) and Auckland (1.5 lha) regions all showed lower ecological footprints per capita than the national average. The lower footprints for the Wellington and Auckland regions is probably due to these regions being amongst the most urbanised in New Zealand - urban settlements and consumption patterns are more efficient in terms of land use, as they have low land requirements for housing, transport networks provisions, retail trade and infrastructure. In addition, these regions all exhibit very high land productivities and in the case of the Auckland and the Bay of Plenty regions, draw upon the highly productive Waikato region.<sup>60</sup>

### Ecological footprints and land productivity per resident (2003 to 2004)

Region	Ecological footprint (local hectares per resident)	Land productivity ranking
Auckland	1.5	3
Waikato	2.1	2
Bay of Plenty	1.6	1
Wellington	1.7	10
Canterbury	2.7	13
Otago	3.3	15
New Zealand average	1.9 <sup>61</sup>	-

Data source: Ministry for the Environment 2007

<sup>59</sup> Ecological footprints are often calculated on a per capita basis to allow comparison between nations, regions and cities. This requires land of different quality or productivity to be 'added up', which assumes that all land is equally 'valuable' or productive when measured on a local hectares basis. To make comparisons more rigorous, adjustments are made to take account of productivity differences. However, a lack of New Zealand specific data makes any productivity adjustment unfeasible. For this reason, the regional footprints are presented in local, rather than global, hectares. Apparent differences in the per capita footprint between regions can often be explained by land productivity, rather than any significant difference in levels of material consumption and resource use. Ministry for the Environment. (2007). Ecological Footprints of New Zealand and its Regions 2003-04.

<sup>60</sup> Ministry for the Environment. (2007). Ecological Footprints of New Zealand and its Regions 2003-04.

<sup>61</sup> Ministry for the Environment. (2007). Ecological Footprints of New Zealand and its Regions 2003-04.