

## Contents 4.6

Introduction	220	Controlling agricultural discharges	228
Developing targets for reducing PM <sub>10</sub> emissions	220	<b>Dairy shed wastes and dairy sludge</b>	<b>228</b>
<b>Reducing vehicle emissions</b>	<b>220</b>	<b>Dairy farm discharges</b>	<b>229</b>
<b>Reducing emissions from domestic fires</b>	<b>222</b>	<b>Other farm discharges</b>	<b>229</b>
<b>Controlling industrial emissions</b>	<b>223</b>	Managing contaminated sites	230
Controlling sediment from land disturbance	224	Managing urban pollution	231
<b>Controlling sediment runoff from cultivated land</b>	<b>226</b>	Controlling water taking, damming and diverting	232

# 4.6

## State of the environment and biodiversity – Responses

Stream enhancement and compensatory works	233	Lake restoration	240
Stormwater projects funded by Infrastructure Auckland	233	Lake Wainamu	240
Projects funded by the Environmental Initiatives Fund	234	Lake Ototoa	240
Compensation for lost stream values	234	Controlling the use of coastal space	240
Restricting stock access to waterways	235	Integrated planning for coastal areas	240
Improving urban stormwater discharges	236	Supporting community initiatives in the coastal environment	241
Network discharges	236	Vehicles on beaches	241
Non-network discharges	238	Protecting and enhancing terrestrial biodiversity	241
Other stormwater initiatives	239	Improving land use planning	241
Improving riparian management	239	Managing plant and animal pests	242
		Working with land owners and communities	245
		Conservation management: species recovery	249
		Case Study: Tawharanui Open Sanctuary	252
		Case Study: Lake Wainamu	254

# Responses

## Introduction

Managing the diverse range of land, freshwater and marine environments that are found in the Auckland region and protecting the air quality and native biodiversity is a complex task, especially when this environmental perspective has to be balanced against the environmental pressures generated by the needs of a growing population and the agricultural, industrial and commercial activities that underpin the economy.

The strategic response discussed in Part 2 is important in setting the general direction for long-term positive change. However, on a day-to-day basis the ARC has to manage all manner of immediate risks and, in that respect, a crucial part of our response is the suite of regional plans that have been prepared under the Resource Management Act (RMA). These regional plans provide the basis to control and work alongside various activities in order to get the best possible outcomes for the Auckland region. However, regulation through these regional plans is not the only way that the ARC responds. The ARC also deploys a wide range of other responses to environmental issues including advocacy, incentives and community education.

The responses discussed in this chapter focus around our regional plans and the rules and non-regulatory methods the ARC uses to respond to the actual and potential impacts on our land, water, air, coast and biodiversity on a day-to-day basis.

Many of the responses address more than one of the risks and impacts discussed in the previous chapters. When the ARC can achieve multiple benefits from what it does, it contributes to an effective and efficient integrated management approach. One of the major objectives is to promote and deliver integrated management in order to make positive change across the Auckland region.

## Developing targets for reducing PM<sub>10</sub> emissions

The concentrations of PM<sub>10</sub> particulates in the Auckland region are known to exceed the National Environmental Standards for air quality, therefore the council has set policy objectives to reduce the 2005 levels of PM<sub>10</sub> emissions by 53 per cent to ensure compliance with this standard by 2013.

In order to achieve this, the ARC has set net reduction targets for each of the following sectors in the Auckland urban airshed:

- industrial sector – 0 per cent reduction,
- domestic sector – 58 per cent reduction,
- vehicle (transport) sector – 58 per cent reduction.

Our ARC's primary statutory response to air quality is contained in the Proposed Auckland Regional Plan: Air, Land and Water. This sets out the objectives, policies and rules that apply to discharges to air within the Auckland region. It does not contain the PM<sub>10</sub> emissions reduction targets defined above because the need for specific sector reductions was not apparent when the proposed plan was developed.

While the rules and associated resource consent requirements in the proposed plan continue to play an important role in managing discharges to air (particularly those from the industrial sector), some sources of PM<sub>10</sub> emissions and other

pollutants cannot – or cannot easily – be controlled under the RMA. Consequently, a range of responses and management policies are required and these are discussed in the following sections.

It is important to note that, although the primary aim is to reduce PM<sub>10</sub> emissions, reductions in the levels of PM<sub>2.5</sub> particulates and NO<sub>2</sub> are also needed to meet national and international guidelines. These can also be achieved by reducing emissions from the transport (vehicle) and domestic sectors. Levels of other air pollutants that originate from these sectors are also expected to be reduced.

### Reducing vehicle emissions

To achieve the desired 58 per cent reduction in vehicle emissions within the Auckland region by 2013 the ARC needs to influence:

- traffic and demand management
- fuel quality and content
- vehicle technology
- vehicle maintenance.

#### Traffic and demand management

Traffic and demand management is achieved largely through strategic responses such as integrating land use and transport through the Auckland Regional Growth Strategy (ARGS), the Regional Land Transport Strategy (RLTS) and various sub-strategies such as those detailed in Box 1, and also through the provision and co-ordination of public transport (see Transport planning and public transport delivery in Part 3). However, the ARC realises that the bulk of reduced emissions will have to be achieved through more direct interventions.

#### Fuel quality, vehicle technology and maintenance

Fuel quality, vehicle technology and vehicle maintenance are difficult for the ARC to address because they are controlled by regulation at national level. Nevertheless, the ARC has taken a strong advocacy position on these issues and has liaised closely with central government agencies to help bring about a number of changes. These include:

##### Clean Fuels<sup>1</sup>

- Lead was banned in petrol in 1996 enabling catalytic converter technology to be used.
- Sulphur was progressively reduced in diesel (from 3000 ppm in 2002 to 50 ppm in January 2006) allowing Euro IV<sup>2</sup> diesel technology. By 1 January 2009 the sulphur content was reduced to a maximum of 10 ppm ('zero sulphur diesel') in New Zealand. This is a significant fuel improvement milestone as it allows Euro V diesel technology to be safely imported and operated in New Zealand, and will reduce fine particulate emissions from new diesel vehicles to equal that from new petrol vehicles.
- Benzene in petrol was progressively reduced to 1 per cent by 2006.

# Responses

## Box 1 Freight strategy and the management of arterial corridors

In addition to the land use and transport strategies and plans discussed in Part 3, the ARC has prepared an Auckland Regional Freight Strategy (2006) and a Draft Regional Arterial Road Plan (2008).

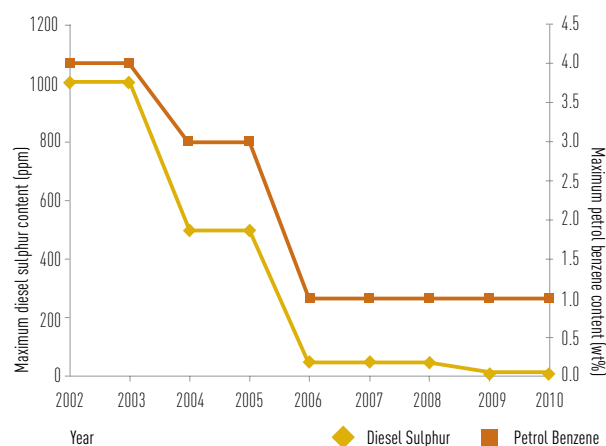
The Auckland Regional Freight Strategy acknowledges the need for better integration of freight and land use planning, and the potential for future population growth and increasing infill of the urban area. It recognises that these will impose environmental pressures and result in increasing conflict between residential and business activities. Consequently, it contains a range of objectives including a goal of improving, protecting and promoting public health and ensuring environmental sustainability. A number of specific policies and actions are proposed in response to these objectives including:

- reducing the environmental impacts of freight routes and traffic, and reducing the impact of freight on adjacent land use by designation of a strategic freight network and development of Local Area Freight Management Plans,
- encouraging low emission freight vehicles and clean fuels through advocacy for enhanced central government regulation and the possible use of incentives such as parking/loading concessions for low emission vehicles.

The Draft Regional Arterial Road Plan defines the role and function of the arterial road network, provides for the integrated management of the arterial network and surrounding land use, and provides a basis for project prioritisation and development of a rationale for more appropriate funding for arterial roads in the Auckland region.

It sets out a range of objectives, and strategic and operational policies to guide the management of the arterial road network. It stresses the importance of arterial roads and the need to recognise them in district plans, and the need to make the most efficient use of road space (including giving priority to bus lanes and the needs of cyclists and pedestrians) as well as supporting land use intensification that is consistent with the ARGs. A range of specific actions are proposed for implementation of the Draft Regional Arterial Road Plan including the preparation of Corridor Management Plans.

Since the mid-1990s, when New Zealand lagged behind the rest of the developed world in terms of fuel and emissions standards, the gap between New Zealand and the rest of the world has shrunk considerably. Levels of sulphur in diesel and benzene in petrol have fallen dramatically since 2002 (Figure 1).



**FIGURE 1** Changes in fuel specifications regulations for New Zealand petrol and diesel. (Source: Ministry of Economic Development).

### Clean vehicle technology<sup>3</sup>

In 2004 the Land Transport Rule: Vehicle Exhaust Emissions was introduced. Both used and new vehicles are required to meet a schedule of progressively tighter emissions standards over time, with used vehicles generally one standard below the new requirement. From 1 January 2009 the emissions standards are:

- new diesel and petrol vehicles (light and heavy duty) to meet Euro IV or equivalent
- used diesel vehicles (light and heavy duty) to meet Euro IV or equivalent
- used petrol vehicles (light and heavy duty) to meet Euro III or equivalent.

In addition, used vehicles entering the New Zealand fleet must now undertake a metered emissions test to ensure they continue to meet the emission standard to which they were manufactured.

In 2008, a Land Transport New Zealand rule was introduced that banned the tampering or removal of emissions control technologies from vehicles.

1 Mostly initiatives taken by the Ministry of Economic Development (MED).

2 European or "Euro" emissions standards are defined by a series of European Union directives staging the progressive introduction of increasingly stringent vehicle emission standards. Currently, emissions of nitrogen oxide (NO), hydrocarbons (HC), carbon monoxide (CO) and particulates (PM) are regulated for most vehicle types, and different standards apply to each vehicle type. Compliance is determined by running the engine at a standardised test cycle.

3 Mostly initiatives undertaken by the former Ministry of Transport and Land Transport New Zealand.

# Responses

## Vehicle maintenance

The ARC ran the 0800 Smokey campaign in 2000 to raise community awareness of vehicle emissions and motivate action. The campaign allowed people to report smokey vehicles and the owners were sent vouchers to tune their vehicle.

In 2001, the ten second rule for excessive smoke was introduced, targeting on-road 'gross emitting' smokey vehicles (mainly diesels).

The ARC conducted the first on-road testing campaign in 2003 to highlight the fact that 10 per cent of vehicles produced up to 50 per cent of emissions. The ARC conducted another on-road testing campaign in 2005 with Transit New Zealand. This signalled to motorists their vehicle emissions and encouraged maintenance.

A 5 Second Visible Smoke check was introduced to the Warrant of Fitness requirements in 2006 to target in-service smokey vehicles (mainly diesels). The Ministry of Transport also ran a Choke the Smoke campaign in 2006 promoting the new visible smoke check, and the use of car-pooling and public transport.

Although the ARC was not involved in all of these initiatives we encouraged them through strong advocacy. In 2006 the ARC, the Ministry of Transport and other central government agencies established a Joint Air Quality Task Force. This has been a useful mechanism for extending and enhancing similar initiatives.

## Minimum emissions standards for buses on ARTA-funded services

The ARC and the Auckland Regional Transport Authority (ARTA) worked together to set minimum emissions standards for bus service contracts in the Auckland region. This means that any bus services operating under contract to ARTA have to ensure that their vehicles meet these minimum emissions standards.

## National minimum standard for urban buses

The ARC recently made a submission on the proposed National Minimum Standard for Urban Buses that is being developed by the NZ Transport Agency (NZTA). The proposed standard would address a range of matters relating to the quality of urban buses, including compliance with vehicle emission rules.

The final version of this standard will form part of the Procurement Support Guide that is being developed by the NZTA. It will become a condition that must be met in order to receive NZTA funding for contracted public transport services.

Our submission was that buses less than five years old should have to meet the Euro III emission standard, while buses older than five years should have to meet Euro II emission standard and also be required to fit filters to capture the fine particulates created from diesel fuel combustion.

We also advocated for 'in-service' emission testing for buses in view of the fact that diesel vehicles in Auckland are estimated to be responsible for 73 per cent of the PM<sub>10</sub> fine particulate emissions from motor vehicles, despite making up only 17 per cent of the vehicle fleet based on mileage. Half of these emissions can be attributed to buses and trucks.

## Reducing vehicle emissions: is it working?

Levels of benzene, lead and SO<sub>2</sub> in the air have all decreased in recent years and there is a clear relationship with the removal of those pollutants from motor vehicle fuels. This shows that changes in the national regulations governing fuel specifications have been very effective. Although these changes were not (and could not) be made directly by the ARC, it has been a strong advocate.

Levels of CO are decreasing, although this is related to improvements in vehicle technology and catalytic converters rather than to any policy that the ARC introduced.

The introduction of minimum emission standards has also resulted in a gradual reduction of fine particulates from vehicle emissions. However, these gains have been offset by the growth in vehicle numbers, the increasing number of kilometres driven (see Indicator 35 in Part 3) and the increasing age of the vehicle fleet over the past few years (Figure 2).

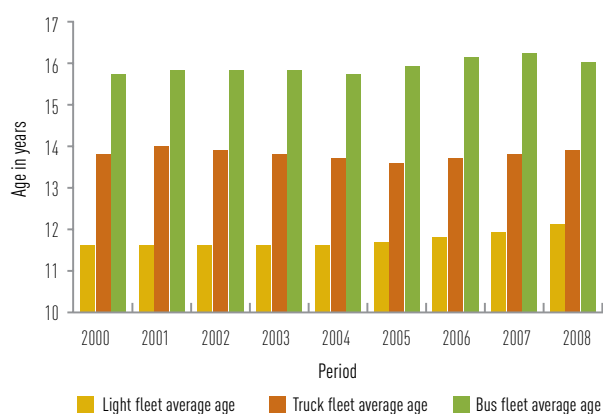


FIGURE 2 Average age of the national fleet, 2001-08. (Source: Ministry of Transport).

## Reducing emissions from domestic fires

To achieve the desired 58 per cent reduction in emissions from domestic fires within the Auckland region by 2013, the ARC needs to adopt a range of measures to reduce emissions from domestic fires.

## National regulation of wood burners

The NES for air quality (Box 1, Chapter 4.1, pg 98) impose an emission standard for wood burners of 1.5 grams of fine particulates for each kilogram of dry wood burnt and a thermal efficiency standard (measured as the ratio of usable heat energy output to energy input) of not less than 65 per cent.

The emission standard means that it is illegal to use any wood burner that was installed after 1 September 2005 (on a site less than two hectares) that does not comply with this standard. The RMA allows regional councils to impose more stringent rules in their regional plans but less stringent rules are over-ridden by the NES. However, this emission standard relates only to wood burners. Other types of domestic fires are not regulated, neither are wood burners that were installed before this date.

### Controlling other types of domestic fires

The ARC Proposed Auckland Regional Plan: Air, Land and Water also regulates domestic fires and, in some respects, extends the scope of the regulations within the NES on air quality. The proposed plan bans any type of domestic solid fuel fire (not just wood burners) that was installed after 1 September 2005 in urban areas, unless it can achieve emissions of not more than 4 g/kg of fuel burned (for appliances without catalytic combustors) or 2.25 g/kg of fuel burned (for appliances with catalytic combustors).

Other regulations also apply to ensure best practice in the design, installation and use of these appliances. They are intended to prevent the installation of most types of pot-bellied stoves, coal ranges and open fireplaces in urban areas within the Auckland region.

Domestic heating appliances (including open fires) that were installed before 1 September 2005, and those in rural areas, are allowed to continue but need to ensure that their emissions do not pose an unacceptable risk to human health beyond the site boundary. To achieve this, the ARC promotes best practice including the use of dry, well-seasoned wood. The Proposed Auckland Regional Plan: Air, Land and Water also prohibits burning waste in domestic fires; this includes wood that is painted or tanalised, green waste, plastic, rubber, oils, solvents and similar materials.

### Reducing emissions from domestic fires: is it working?

Although the NES and Proposed Auckland Regional Plan: Air, Land and Water can regulate the number and design quality of domestic heating appliances in use, they cannot easily control any other factors that also contribute to air pollutant emissions (such as the quality of the fuel and the way the appliance is operated). There are also difficulties associated with enforcement of the NES and with the actual performance of authorised domestic heating appliances.

Neither the NES or the Proposed Auckland Regional Plan: Air, Land and Water address the use of appliances installed before 1 September 2005: these pose a significant problem as they generally emit the highest levels of air pollutants.

Despite these challenges, research indicates that the use of solid fuels (wood and coal) in domestic fires is declining. Census data indicates that between 1996 and 2006 the number of homes burning wood in domestic fires decreased by approximately 16,000. Our home heating survey in 2007 found that only 29 per cent of households burn solid fuel, although 42 per cent could potentially do so as the properties were equipped with domestic heating appliances such as open fires and wood burners.

It is difficult to assess the effectiveness of our initiatives in contributing to this decline. Survey results indicate that environmental consciousness is not a major driver of change in home heating. Instead, the majority of people who burn wood appear to be influenced primarily by financial factors, with 52 per cent saying they burn wood because they have access to wood that is cheap or free. Only 8 per cent said

they would change their domestic heating for environmental reasons, with about two thirds of those saying they would need a financial incentive as well. A further 35 per cent said they would not change under any circumstances.

Although solid fuel use has decreased it remains a significant source of air pollutant emissions, and the survey results indicate that our current strategies will not achieve the significant reductions required from domestic fires by 2013. The ARC is investigating additional ways to achieve the desired reductions in emissions from this source.

### Controlling industrial emissions

All industrial emissions are controlled by rules in the Proposed Auckland Regional Plan: Air, Land and Water. These rules categorise emissions and require resource consents to be obtained when it is likely that the effects will extend beyond the site boundary.

The resource consent process provides an opportunity for the ARC to require use of the Best Practical Option (BPO) to avoid or minimise significant adverse effects arising from the discharge of pollutants to the air. Compliance with these practices is ensured by imposing conditions on the resource consents granted.

The proposed reduction target for PM<sub>10</sub> particulates from industrial emissions is zero per cent. However, in order to allow new businesses within this sector to establish and operate, the ARC has set a provisional target of a 15 per cent reduction in discharges for all existing industrial emitters. This reduction from existing industrial emitters will allow new industrial emitters to operate while keeping all industrial emissions within the zero per cent overall cap.

This is being achieved through the resource consent process (discussed above) and by applying the policies of the Auckland Regional Policy Statement (ARPS) and the Proposed Auckland Regional Plan: Air, Land and Water that require industries to use the BPO and minimise emissions.

### Controlling industrial emissions: is it working?

The resource consent process for industrial emissions is limiting the discharge of various hazardous and objectionable emissions to the air within the Auckland region.

The reduction target for PM<sub>10</sub> particulates that needs to be met by existing emitters is in the early stages of implementation and is not yet reflected in ARC plans. At present it is too early to assess its success.

# Responses

## Reducing exposure risk to air pollution

Although the resource consent process is designed to minimise the effects of discharges to the air, it is seldom possible to contain all effects within a site boundary. Consequently, our approach to air quality management recognises the need for effective land use planning, in order to separate activities associated with discharges to air from sensitive activities (such as residential use and early childhood education centres). This separation protects both the health and amenity values of residents and the rights of industry to continue established activities. This concern for 'reverse sensitivity' is reflected in both the ARPS and the Proposed Auckland Regional Plan: Air, Land and Water.

Implementation of this approach relies largely on territorial authorities applying the policies sensibly, as part of their control of land use. The ARC is also trying to achieve this type of separation by participating in the inter-agency Air Quality Advisory Panel that was set up to investigate developing location criteria for early childhood education centres in Auckland. This panel will provide recommendations on the location of early childhood education centres in order to prevent exposure to air pollution. The results are likely to be factored into our planning processes.

### Reducing exposure risk: is it working?

There is little quantified data on the extent of incompatible land use although there is significant anecdotal evidence of some poor land use decisions which are likely to expose occupants to air pollution that could have been avoided by better planning.

We are monitoring this issue carefully, particularly in light of the urban growth strategy that emphasises intensification of residential development in nodes and along transport corridors (see Chapter 3, Box 7, Evaluation of the Auckland Regional Growth Strategy in Pressures, pg 80).

## Controlling sediment from land disturbance

Although natural erosion processes can generate sediment and expose bare soil, human activities have disturbed the land through the removal of vegetation, cultivation, intensive grazing and earthworks. These types of land use activities can generate large amounts of sediment if not properly managed.

The adverse environmental impacts on the rivers and coastal areas in the Auckland region that are caused by elevated levels of sediment discharged from land development activities have long been recognised as a major issue (Chapter 4.2 pg 134 and 4.4 pg 188).

Controlling sediment from land disturbance can have flow on benefits for fresh water and marine ecosystems.

## Box 2 Regulating sediment generation in the Auckland region

The Auckland Regional Authority (the ARC predecessor) first addressed the problem of sediment generation in 1979. Initially, a voluntary control system was developed in conjunction with the distribution of an Urban Earthworks Guideline to encourage land developers to undertake sediment control measures. However, this was only partially effective with a large number of sites, in our view, having inadequate sediment control measures.

In June 1988, the ARA introduced direct controls on urban land disturbance activities in the Auckland region. An Urban Earthworks Notice was issued under Section 34(2) of the Soil Conservation and Rivers Control Amendment Act (1959). This Act provided for a public notice requiring prior consent for activities 'likely to cause soil erosion, floods or deposits in watercourses, lakes or the sea' and it became a statutory requirement for anyone carrying out major urban earthworks to seek approval from the ARA. Consents required a satisfactory erosion and sediment control plan that complied with predetermined minimum standards, and monitoring of sediment control was carried out to ensure compliance with the plan. Associated activities involved public education programmes, extensive liaison with the earthworks industry and, latterly, research.

In 1990, a further Section 34 Notice was introduced, requiring forestry operations in areas greater than two hectares to apply to the ARC for consent. An erosion and sediment control plan was also required.

After the introduction of the Resource Management Act (1991) the existing Section 34 Notices were carried over into a Transitional Regional Plan. These notices expired on 30 September 1993 and were replaced by the Auckland Regional Plan: Sediment Control. This was one of the first regional plans that the ARC prepared and it effectively continued the previous measures that were used to control sediment discharge. It is now recognised as having limitations compared to more recent regional plans; in particular, it does not provide for archaeological, contaminant or geotechnical issues to be considered and addressed through sediment control resource consents. In addition, the performance standards specified for permitted activities are not well-defined, making effective monitoring and enforcement difficult. The Auckland Regional Plan: Sediment Control is currently being reviewed.

# Responses

The principal regulatory approach to controlling sediment is contained in the Auckland Regional Plan: Sediment Control. This plan controls specific soil disturbance events related to land development activities including earthworks, forestry (vegetation clearance) and quarries.

It permits small-scale land disturbance in areas that are not high risk, subject to performance standards, but requires resource consent for larger scale land disturbance. The type of resource consent that is required is determined by the scale and location of the land disturbance. The ARC currently receives between 150 and 220 applications for earthworks each year and up to ten applications relating to quarries. At any one time there can be 400 to 500 active earthwork and quarry sites in the Auckland region.

The basic requirements for earthworks resource consent applications are to ensure that water is kept off bare soil sites (through bunds or similar techniques) and that any flow generated by rainfall is treated before it runs off the site as stormwater. The ARC aims to achieve a 75 per cent sediment removal rate from stormwater through this approach.

## Box 3 Auckland Regional Council Technical Publications that cover erosion control and sediment generation

We have produced two important Technical Publications on the management of erosion and sediment:

- Technical Publication 90 (TP90) was introduced in 1999 to replace an earlier guide and was updated in 2007. TP90 provides comprehensive guidelines for anyone engaged in land use activities that result in soil disturbance on how to best manage erosion and sediment. It explains the principles and also provides detailed technical advice on the range of erosion and sediment control practices and techniques that can be used to help meet our regulatory requirements. TP90 also provides a guide to the rules of the Auckland Regional Plan: Sediment Control and is a key input into resource consent application processes made under that plan. TP90 provides a clear indication of the likely requirements (in terms of the content of erosion and sediment control plans) for projects, compliance with conditions of consent and performance standards for activities permitted by the Auckland Regional Plan: Sediment Control.
- Technical Publication 223 (TP223) builds upon TP90 but focuses specifically on forestry operations and therefore contains some control measures that are not required in TP90. TP223 provides guidance on regulatory requirements and how forestry operators can meet those requirements by using the sediment control practices and techniques detailed within it.

This goal is achieved through compliance with Auckland Regional Council Technical Publication 90 (Box 3) and, in particular, the use of appropriately sized stormwater retention (sediment) ponds. In many cases the ARC also requires chemical treatment (the addition of a coagulant to the water in sediment ponds) to change the ionic charge of the sediment grains so that they drop out of suspension and settle quickly to the bottom of the pond. This technique enables up to 95 per cent of the sediment to be removed.

We also apply various other controls to reduce the risk of sediment being released into stormwater. For example, bulk earthworks are not generally permitted during the winter months and resource consents include a condition that requires bare soil sites to be closed down (covered with straw to reduce sediment generation) after 14 days if they are not being worked.

Forest harvesting (or vegetation clearance) is a permitted activity but moving the felled trees to loading sites and associated activities can, potentially, result in significant land disturbance and sediment generation. For this reason, the ARC requires at least two weeks notification of vegetation clearance before the work is undertaken. Foresters must use effective erosion and sediment control measures such as contour drains and retention ponds as well as covering bare ground. The range of measures can be constrained on steep forestry land due to the terrain. The ARC manages the risks through frequent inspections during harvesting: this activity is made possible by a \$40 per hectare per year monitoring charge made under the Auckland Regional Plan: Sediment Control that applies to forest owners in the Auckland region.

In new urban developments, runoff from hard surfaces (other than roofs) must be treated using a technique suitable for the risk posed. This may mean installation of sand filters and rain gardens, or perhaps swale and pond systems for larger volumes of runoff.

### Controlling sediment from land disturbance: is it working?

Our compliance monitoring programme involves a weekly visit to every active bulk earthworks site (potentially over 400 sites), two to three visits to every quarry each year, and six-monthly visits to forestry operations.

The inspections result in the degree of compliance being scored (using the scoring system described in Dairy farm discharges). A key performance indicator for assessing the level of compliance by earthworks sites is calculated as the percentage of Grade 1 and 2 scores throughout the earthworks season. Figure 3 shows a summary of the scores for key performance indicators for earthworks since 2003 that demonstrates a positive general trend towards a greater level of compliance over time.

# Responses

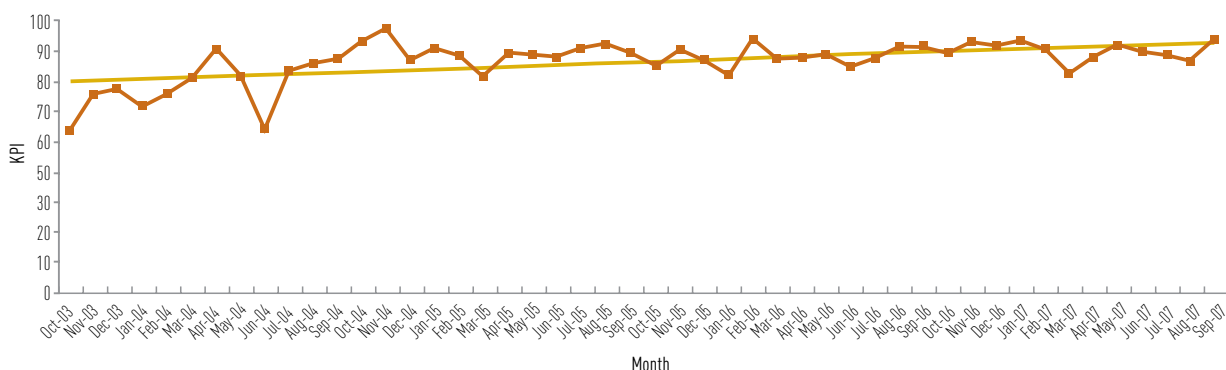


FIGURE 3 Compliance with earthworks rules and consent conditions, 2003-07. (Source: ARC).

The compliance monitoring process also results in the major earthworks contractors being ranked on their performance. Contractors that perform well are recognised by the ARC and can receive concessions regarding certain requirements. This also creates an incentive for good performance.

### Controlling sediment runoff from cultivated land

Land cultivation and the associated discharge of sediment is managed under the Proposed Auckland Regional Plan: Air, Land and Water. This permits cultivation and discharge of sediment (except to the immediate margins of significant coastal areas, wetlands or lakes) provided the land is not steeper than 15 degrees and provided that appropriate stormwater management measures are implemented and maintained in accordance with best management practices. This can be achieved by compliance with an erosion and sediment control guideline derived from the Doing It Right – Guide to Sustainable Land Management (Box 4).

Cultivation of land with slopes greater than 15 degrees (27 per cent) and associated discharge of sediment is not permitted by the Proposed Auckland Regional Plan: Air, Land and Water and a resource consent is required by anyone wanting to undertake such cultivation.

### Box 4 Doing It Right – Guide to Sustainable Land Management (Franklin Sustainability Project)

In 1997, the Franklin Sustainability Project was set up to test a range of sustainable land management techniques and involve growers in planning and monitoring these techniques.

This followed severe floods during the mid to late 1990s, when large volumes of sediment were generated from land used for market gardening in the Auckland region. The project was intended as a partnership between the growers, regulatory authorities and MfE.

The Pukekohe Vegetable Growers Association (PVGA) and Agriculture New Zealand led the development of the Doing it Right – Guide to Sustainable Land Management (2000) based on field-testing of various land management techniques.

Erosion management options were developed, related to the development and use of paddock plans, erosion co-ordination, raised access ways, wheel track ripping, silt traps, cover crops, headlands, hedges, cultivation techniques and contour drains. The project also covered integrated pest management and other land management research relating to nitrate leaching, hygiene, irrigation and soil quality monitoring.

All growers subsequently received a copy of Doing it Right – Guide to Sustainable Land Management and workshops and field days were held. The initiative was acknowledged at the time by a Ministry for the Environment Green Ribbon Award. The PVGA subsequently received funding from MAF to employ a person to promote the guide.

The best management principles in the guide are included as an appendix to the Proposed Auckland Regional Plan: Air, Land and Water. These require the diversion of sediment laden stormwater into silt traps (excavated pond-like areas) or long-bunded areas. The appendix specifies the design requirements for silt traps, including the size and depth according to the size of catchment, slope and length of cultivated rows.

# Responses

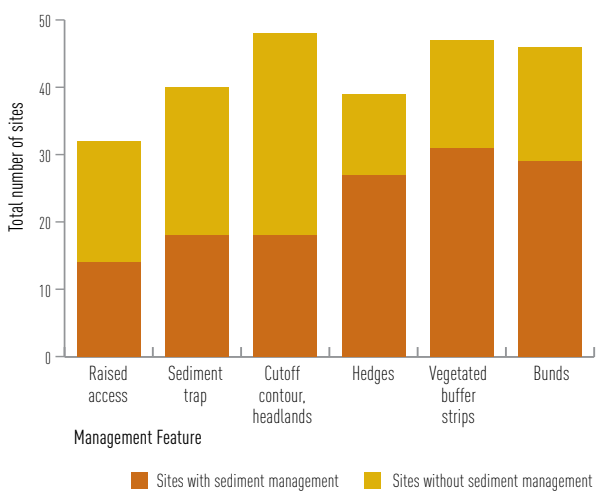
## Controlling sediment from cultivated land: is it working?

Many of the traditional measures that were used to control soil erosion were not capable of managing 'at risk' areas under cultivation. Between 2001 and 2006 the ARC visited sites in Bombay, Pukekohe Hill and Patamahoe that were identified as 'at risk' for soil erosion and sediment discharge. The aim was to continue support for, and provide advice on, implementation of sediment control measures explained in the Doing It Right guide.

Our experience has found limited, localised progress since the Doing It Right guide was launched. Although most growers are aware of sediment issues, there has been no consistent effort within the growing region to address ongoing sediment loss. Growers are often reluctant to remove land from production and use it for non-productive sediment controls. Existing control devices tend to be significantly undersized, poorly designed or not maintained. Consequently, sediment continues to be discharged during rainfall events.

A benchmarking survey in 2004 found that the growers' use of best management practices declined between 2002 and 2004. For example, the use of cutoff drains seemed to decrease by 20 per cent, contour drains by 23 per cent, vegetated strips by 15 per cent, silt traps by 5 per cent and raised accessways by 2 per cent.

In 2009, a study was conducted in the Whangamaire catchment, near Pukukohe. This study found that 52 per cent of the sites surveyed in August 2009 had no sediment or erosion management problems identified. Problems found on remaining sites were attributed to either an absence of control measures, or to undersized, poorly designed, or poorly maintained controls. The management features with the least uptake were the use of cutoff or contour drains and headlands followed by sediment traps. These can be the most difficult to implement and maintain. Positively, the use of vegetative buffer strips and hedges to control discharges is apparent at over half of the sites (Figure 4).



**FIGURE 4** Types of sediment management features in the Whangamaire catchment, 2009. (Source: ARC).

The ARC is continuing to work with growers to encourage implementation of the measures detailed in the Doing it Right guide by taking a catchment based approach to sediment management on cultivated land.

## Catchment management: Mahurangi Action Plan

Catchment management of non-point source (diffuse) rural discharges and soil degradation issues focuses on the scale of the catchment rather than its individual properties, because the ARC recognises that meaningful improvements rely on collective action.

Where environmental monitoring suggests that concentrated effort is required at the catchment scale, the ARC has initiated catchment management projects. The most significant of these projects recently is for the catchment surrounding the Mahurangi Harbour.

In 2004, monitoring of the Mahurangi Harbour showed high rates of sediment accumulation and a decline in abundance of species known to be sensitive to sediment. In response, the ARC established the Mahurangi Action Plan (MAP) in conjunction with Rodney District Council. The MAP involves a range of land use management, regulatory, research and community education initiatives. The aim is to halt, slow, or reverse the adverse effects of sedimentation on the ecological health of the Mahurangi Harbour. Emphasis was placed on direct engagement with land owners in the surrounding catchments, and on work to revegetate riparian margins and exclude stock from particularly vulnerable catchments.

The MAP was implemented in 2004 and since then the ARC has committed approximately \$1.37 million to it. Since 2004, the following has been achieved within the surrounding catchments:

- 80km of stream and coastal edge fencing on private land
- 870 hectares of vulnerable land
- 150,000 native seedlings have been planted.

This has been achieved through ARC grants, planting days and around 9500 hours of volunteer effort. The ARC has also held education workshops, organised field trips, prepared farm plans, started a Catchment Management Plan and commissioned further research.

Following this experience at Mahurangi Harbour, the ARC identified that a similar plan was needed for Whangateau Harbour. Work is currently underway to scope this plan, engage with the community and to assess the surrounding catchment and the issues and threats to it.

Experience in the Mahurangi Harbour catchments has highlighted the benefits of intensive catchment management. Consequently, the ARC has developed a broader sustainable catchment management programme that applies the lessons learnt in Mahurangi to other harbour catchments, prioritised according to their current state, environmental value and significance of threats.

# Responses

## Controlling agricultural discharges

A significant environmental stressor on freshwater and marine environments are discharges from intensive land uses, in particular agricultural and horticultural activities in the surrounding catchments. Examples include:

- nutrient-rich point source discharges from dairy farms and intensive farming operations such as piggeries, poultry farms and glasshouse-based horticulture,
- sediment-laden discharges from market gardening activities (discussed earlier),
- diffuse discharges of nutrients, sediment and faecal material associated with stock farming (particularly from excessive fertiliser application and stock in waterways).

We seek to manage these point and non-point source discharges using a mix of regulatory and non-regulatory methods.

Most agricultural discharges are permitted by the Proposed Auckland Regional Plan: Air, Land and Water provided they can meet the prescribed levels of performance.

This places a responsibility on the ARC to monitor and inspect sites to ensure that discharges (or land uses that may give rise to discharges) are occurring in accordance with the rules, and to respond to complaints received from any individuals or community groups who are concerned about discharges that they see occurring.

### Dairy shed wastes and dairy sludge

Dairy farms use large volumes of water for washing down dairy sheds, machinery and yards after milking to clear away effluent. The resulting untreated wastewater (known as 'wash water') has a high biochemical oxygen demand, elevated levels of nitrogen and phosphorous, and contains microbial contaminants and suspended solids.

Many dairy farms also generate large volumes of dairy sludge (accumulated organic solids from dairy oxidation ponds, barrier ditches, storage ponds, wintering barns or hard stand areas). Dairy sludge needs to be disposed of but, like wash water, contains high level of nutrients and microbial contaminants that can have significant adverse effects if it enters freshwater.

We have prepared the Auckland Regional Plan: Dairy Farm Discharges specifically to manage the dairy shed waste and dairy sludge (Box 5) in the Auckland region. The plan contains rules that permit the discharge of wash water and dairy sludge onto or into land, subject to a range of conditions. These limit the amount of nitrogen that may be applied on a per hectare basis over a given period, effectively limiting the cumulative application rate of wash water, dairy sludge and nitrogen fertiliser. The conditions also state that wash water and dairy sludge may not be applied in such a manner that enables it to enter the water. Around 250 dairy farms in the Auckland region currently dispose of wash water to land.

Dairy farmers that cannot meet the conditions for land-based discharge, or those operating a two-pond treatment system and wanting to discharge treated waste to freshwater, require a resource consent. No discharge may be made to natural wetlands, freshwater lakes or waterways draining into specified lake catchments. Two-pond systems and subsequent disposal to water is not encouraged and no consents for such discharges have been issued in recent years. Currently, about 70 farms in the Auckland region operate under resource consents that authorise disposal of treated wash water to freshwater. Discharges of untreated wash water or dairy sludge to freshwater are prohibited under the Auckland Regional Plan: Dairy Farm Discharges.

### Box 5 The Auckland Regional Plan: Dairy Farm Discharges

The Auckland Regional Plan: Farm Dairy Discharges became operative in 1999. It was one of the first regional plans that the ARC prepared under the RMA. It was given priority because the ARC recognised the threat that dairy waste from the (then) 600-odd dairy farms with about 100,000 dairy cows posed for the small rural streams in the Auckland region.

The plan recognises the potential of dairy farm waste, if inappropriately disposed of, to:

- decrease dissolved oxygen in water leading to the suffocation of aquatic life
- be toxic to aquatic life due to high levels of ammonia,
- increase nutrient levels in the water resulting in nuisance growths of aquatic weeds and algae
- increase bacteria levels, making the water unsuitable for swimming, food gathering or stock drinking
- increase siltation of rivers and the amount of suspended solids in the water, with adverse aesthetic and ecological consequences
- elevate nitrate levels in potable water giving rise to human health risks.

The objective of the plan is to maintain water quality in water bodies and coastal waters that already have good water quality and to enhance water quality that is currently degraded. The main approach is to encourage disposal of dairy farm waste to land.

The Auckland Regional Plan: Dairy Farm Discharges is currently due for review.

## Dairy farm discharges

### Compliance monitoring

We inspect dairy farms annually for compliance but do not regularly monitor other types of farming. Our compliance monitoring role focuses mainly on dairy farms as these probably pose the greatest risk to rivers in the Auckland region. The results of our compliance monitoring provide an indication of the effectiveness of this approach. For compliance monitoring purposes dairy farms are graded as follows:

- Grade 1: Full compliance with permitted activity or resource consent requirements.
- Grade 2: Minor non-compliance, minor in nature and potential environmental impact, caused by poor system construction, operation or maintenance.
- Grade 3: Moderate non-compliance, with potential to have, or had, adverse effects on the environment.
- Grade 4: Major non-compliance, with significant adverse environmental effects.

Unfortunately, previous data from compliance monitoring is not considered reliable so an analysis of longer-term trends is not possible. Compliance monitoring was outsourced for a period but is now conducted by the ARC again and the data is considered to be more reliable. With about half of all the dairy farms inspected for the 2008/09 year, the most recent data show only 46 per cent of farms as Grade 1, 35 per cent as Grade 2, 11 per cent as Grade 3, and 8 per cent as Grade 4.

This means that, of the 325 farms inspected in the 2008/09 dairy season, 8 per cent had major non-compliance problems and a further 15 per cent presented an actual or potential risk of adverse environmental effects. 45 per cent of dairy farms inspected were fully compliant.

It is difficult to draw firm conclusions from the data about the overall effectiveness of our response to dairy farm discharges but this regime has now been in place for ten years and a significant level of non-compliance still remains. This suggests that there is cause for concern.

### Enforcement

When the conditions for permitted activities such as wash water disposal, land cultivation and fertiliser application cannot be met a resource consent is, in theory, required. In practice, however, the ARC works with land owners to bring their activities into compliance or take enforcement action where necessary. Between 1 July 2005 and 28 February 2009, 40 abatement notices and 35 infringement notices were issued. Over half of these were issued in the 2008/09 year.

## Other farm discharges

Agricultural and horticultural activities produce a variety of discharges. Stock farming can be associated with discharges from feedlots and hard stand areas, silage pits, offal holes and wintering barns. As already noted, most dairy farms spray wash water onto pasture while greenhouses can be associated with discharges of nutrient-rich solutions. Pastoral and arable farming involves the application of nitrogenous fertiliser.

The ARC manages these types of farm discharge through the Proposed Auckland Regional Plan: Air, Land and Water (Box 6). The general approach is to permit these discharges subject to conditions (performance standards). The conditions vary according to the type of discharge but typically control the scale and location of the discharge. There is an additional requirement for no discharge into any surface water body and no contamination of groundwater.

The plan also limits the application rate of nitrogen (including nitrogen in wastes and also in nitrogenous fertiliser) to grazing land. The standard is 150kgN per hectare per year and 30kgN per hectare in any 31 day period in areas underlain by aeolian sand or volcanic basalt, and 200kgN per hectare per year and 50kgN per hectare in any 31 day period on all other soil types.

Conditions also apply to the application of fertiliser that, essentially, require compliance with the relevant codes of practice.

# Responses

## Box 6 The Proposed Auckland Regional Plan: Air, Land and Water

The Proposed Regional Plan: Air, Land and Water was notified by the ARC in 2001. (It is referred to as 'proposed' because there are appeals against specific provisions that remain to be resolved). The proposed plan contains objectives, policies, rules and other methods relating to the use of air, land and water including the soil, rivers, streams, lakes, groundwater, wetlands and geothermal water.

The land and water provisions apply to that part of the Auckland region not covered by the Auckland Regional Plan: Coastal. The air discharge provisions apply to the entire Auckland region, including the coastal marine area.

The proposed plan is the largest and most comprehensive of our regional plans and its provisions cover:

- discharges to air (including domestic fires, mobile sources, outdoor burning, dust, emissions from industrial processes and the application of agrichemicals),
- discharges to land and water (including stormwater and wastewater, runoff from cultivation, fertiliser use, contaminated land and landfills),
- the taking, damming and diversion of water (including surface and groundwater),
- structures on, or disturbance of, the beds of lakes and rivers.

The proposed plan does not address every land and water issue in the Auckland region, as some land and water issues outside this plan are addressed by regional plans prepared in the 1990s. However, it does control the use of most major resources within the Auckland region and responds to most major environmental issues and risks in a (largely) comprehensive manner. The proposed plan therefore provides integrated management of our resources, ensuring that our efforts are both effective and efficient.

The proposed plan forms a crucial part in environmental management within the Auckland region because the RMA states that, unless permitted by a rule in a regional plan or a resource consent, people may not discharge to the environment, take water or disturb the beds of rivers and lakes. Consequently, the proposed plan is extremely important, not only because it regulates activities that may harm the environment, but also because it provides access to resources without the need for people to seek individual resource consents. This means that many everyday activities carried out across the Auckland region that are necessary for people's well-being and prosperity are lawful.

## Managing contaminated sites

Discharges from contaminated sites are regulated by the Proposed Auckland Regional Plan: Air, Land and Water (Box 6) and managed by the ARC's Contaminated Sites Team.

The total number of contaminated sites within the Auckland region is not known. The ARC does know of many contaminated sites, but it also knows that there are many other contaminated sites, both urban and rural, for which it has no information.

The ARC takes a largely reactive role in contaminated sites issues. When a land owner or occupier, or prospective land owner or occupier, becomes aware that the land may be contaminated, they will often investigate the state of soil and any discharges.

In general, there is a strong incentive for the owners of land that is potentially contaminated due to past land uses to ensure that any discharges are consented and that contamination is appropriately managed. The appropriateness of the management depends on the intended future land use. Change in the land use (and associated territorial authority consent requirements), or the sale and purchase of land often trigger a site investigation. Land use change or sale and purchase agreements often cannot be concluded until any contamination issues or risks have been resolved.

The Proposed Auckland Regional Plan: Air, Land and Water sets out standards (with reference to a range of national and international guidelines for contaminated sites) that define the permitted level of contaminants in discharges and, correspondingly, the types of discharge that require resource consent. Resource consent is required only if a discharge is occurring. Some industries, such as the oil industry, are proactive in seeking certificates of compliance from the ARC and verifying that sites comply with permitted activity standards. In the 12 months to June 2009 the ARC granted 41 resource consents for discharges from contaminated sites and seven for landfills.

Managing sites through resource consent conditions may involve a range of approaches, from leaving the soil intact and simply covering the site with an impervious surface, to minimising the discharge risk through the removal of soil offsite and subsequent site monitoring. Soil that is removed from a contaminated site can be disposed of only at a facility or site authorised to accept such material.

The work done by the Contaminated Sites Team revolves around assessment to determine if resource consent is required, consenting including imposing appropriate conditions, monitoring to ensure that resource consents are being complied with and to oversee the situation at about 60 closed landfills in the Auckland region, and follow-up (including major pollution incidents) to assess whether remedial action is required.

# Responses

## Managing contaminated sites: is it working?

The main difficulty with contaminated sites within the Auckland region is a general lack of information. It is not known how many sites there are, how contaminated they are, or the level of risk they pose. The ARC is currently compiling a Register of Land Quality.

The ARC is also aware of sites that do not have resource consent but are likely to be contaminated to such an extent that a resource consent is required. Similarly, although the ARC monitors resource consents for about 60 closed landfills in the Auckland region, it is likely that there are an equal number (at least) that do not have resource consent.

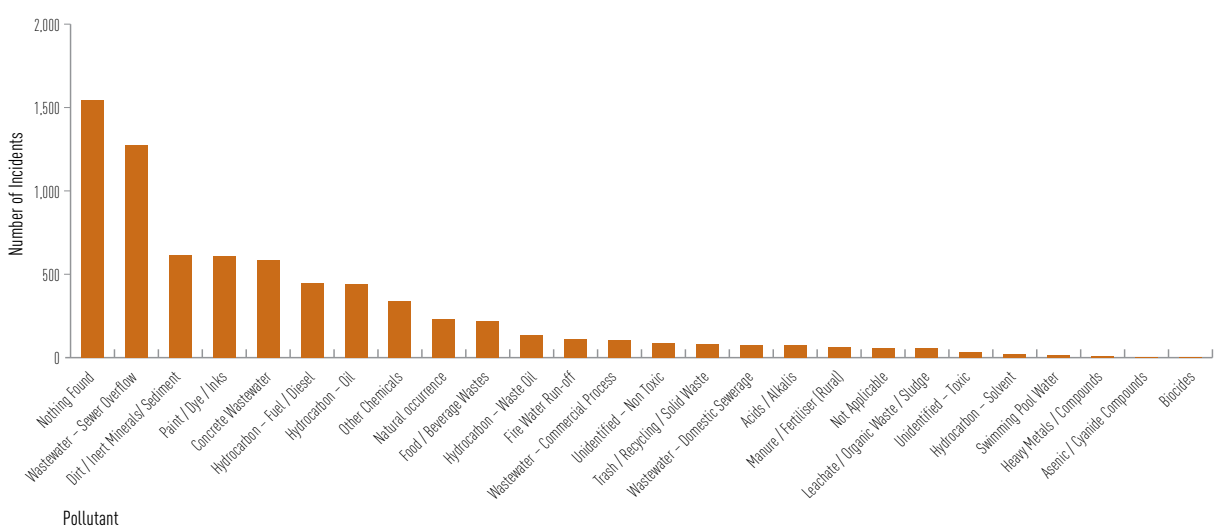
Therefore, while the ARC is confident that the sites it has assessed and consented are being appropriately managed, there is an on-going risk from sites that have yet to be assessed or that are not known. Some level of risk from contaminated sites will remain unless the ARC actively seeks out and monitors them.

## Managing urban pollution

We maintain a pollution response team and operate a 24-hour pollution hotline. The ARC staff, or an external contractor in the case of backyard burning complaints, are available 24 hours a day, seven days a week, to respond to pollution incidents or complaints. Members of the public, industry, territorial authorities or other ARC staff can alert the pollution response team to incidents. The ARC may also be called to pollution incidents by the Fire Service.

When a pollution incident occurs, an ARC staff member will visit the site and assess the clean-up needs, and will also try to identify who is responsible for the pollution incident and direct the responsible party to clean-up according to ARC requirements. If the cause of a spill cannot be determined the ARC will generally take responsibility for the clean-up. Large incidents may require the assistance of external contractors.

The types of pollution incidents addressed in this way include a broad range of deliberate or accidental discharges to land, water and air. The most common spills to land and water include hydrocarbons (petrol and diesel), concrete, sewage, sediment and paints. Air pollution incidents include industrial emissions, backyard burning and odour. Figure 5 shows the number and type of pollution incidents (excluding air pollution incidents).



**FIGURE 5** Total numbers of land and water pollution incidents, 2004-09. (Source: ARC).

In recent years the ARC has typically responded to between 1000 and 1200 land or water pollution incidents each year and up to 330 air pollution incidents.

In addition to arranging clean-ups, the pollution response team also takes enforcement action by issuing abatement and infringement notices, and prosecuting under the RMA (Table 1) when necessary.

The ARC also has an industrial and trade processes team who undertake proactive pollution prevention and compliance assessments on a wide range of industries. The aim of the assessments is to identify pollution issues and whether resource consents are required. If pollution issues are identified, the team works with the company to prevent land and water contamination. The team has previously worked with the metal finishing industry (i.e. electro platers, galvanisers, and anodisers) and is currently working with scrap metal and automotive dismantlers, timber treatment and concrete batching industries, amongst others.

# Responses

TABLE 1 Enforcement action resulting from pollution incidents. (Source: ARC).

Enforcement action	2008 to 30 March 09	2007/08	2006/07	2005/06	2004/05	2003/04
Warnings	22	Not available	Not available	Not available	Not available	Not available
Infringement notices	84	87	92	187	141	192
Abatement notices	80	79	60	50	54	114
Prosecutions	3	6	2	3	3	Not available

The ARC's pollution response team also undertakes pollution awareness exercises. These involve visiting specific business areas to highlight pollution issues, advising on pollution risk and educating businesses about their environmental responsibilities. Geographic areas are selected for these pollution awareness exercises on the basis of the potential pollution risk according to the types of businesses present, history of pollution incidents and sensitivity of the receiving environments. These pollution awareness exercises are generally done with only limited prior notice.

## Litter collection in the Waitemata Harbour

The ARC, the city councils, Watercare Services Ltd and initially the Ports of Auckland financially support the Waitemata Harbour Clean Up Trust. The trust works with community groups to remove litter from the Waitemata Harbour, using a boat donated by the Ports of Auckland. Rubbish is scooped up from the harbour and taken to shore for appropriate disposal. The trust has removed 1786 m<sup>3</sup> of rubbish from the sea (the equivalent of about 46 standard shipping containers) since it began in 2002. The trust also works with schools to show people how easily rubbish can end up in the sea if not appropriately disposed of on land.

## Controlling the taking, damming and diverting of water

Water is taken from surface waters (rivers and lakes), abstracted from groundwater through boreholes or collected from rainwater under the provisions of the RMA.

The ARC control the taking, damming and diversion of water through the Proposed Auckland Regional Plan: Air, Land and Water (Box 6). This plan identifies High Use Stream and High Use Aquifer management areas: these are waterbodies subject to high levels of demand for water abstraction. These areas, and other specified areas, receive a higher level of protection and management than those that experience less demand.

This regulatory approach to water allocation also recognises the vulnerability of the generally small, short rivers within the Auckland region. It favours water takes from groundwater rather than surface water, and new off-stream rather than on-stream dams. Most aquifers have groundwater availability limits that are defined in the Proposed Auckland Regional Plan: Air, Land and Water.

While there are no restrictions on the taking of water for domestic purposes and stock drinking, most other water takes require resource consent. In High Use Aquifer management areas only 5m<sup>3</sup> of water may be taken each day without resource consent, and in High Use Aquifer management areas that are already fully allocated (such as Omaha and Kumeu) a resource consent is required for all water takes.

When considering whether or not to grant a resource consent for water taking, the ARC considers a wide range of matters that are set out in the Proposed Auckland Regional Plan: Air, Land and Water. Applicants are required to:

- justify the quantity of water sought
- show that the quantity of water sought is available at the location of the proposed water take
- show that the water take will not significantly effect the environment or other users of the same water body.

The proposed plan also stresses the need for water conservation and water efficiency. When assessing the need for water the ARC compares the volume sought with guidelines (and historical water metering records for similar activities) for water consumption by land use type. If there are discrepancies, the ARC works with the applicant to verify the demand estimates. This might involve, for example, industries undertaking water audits (either in association with an application or as a condition of resource consent).

Applications to take water for municipal supply must include a:

- demand management plan, to maintain a reasonable per person consumption
- network efficiency and conservation plan that specifies the measures that will be put in place to minimise unaccounted for water loss
- drought management plan.

Resource consent conditions ensure that limits are reported against quarterly.

When managing water body takes the ARC aims to ensure that, for each waterbody, the metered water use is less than water allocated, and that consented allocation is less than that available. These measures are specified as performance indicators for the water allocation team and the ARC reports against these in an annual water quantity statement. This reports the data collected from the eight High Use Aquifer management areas, as these are under the greatest pressure from the demands of water abstraction.

When water allocation is nearing the available limits, and if resource consent conditions allow, the ARC reviews the resource consents and redistributes water from those with unused allocations to other users that have a demonstrated need. This approach has been used in the Omaha and Kumeu High Use Aquifer management areas and in one of the zones within the Kaawa High Use Aquifer management area.

Resource consents are usually issued for about 15 years. The expiry dates vary by catchment or aquifer as there is a policy of synchronising the review and expiry of resource consents in each catchment or aquifer. This allows for integrated and effective management of any cumulative effects as well as any changes in demand. Resource consents are issued with conditions, allowing for the review of conditions at concurrent five-year intervals if necessary.

In addition to regulating water takes, the water allocation team also monitor compliance, send out a quarterly newsletter to all consent holders, and develop and publish educational material and factsheets.

Water take monitoring relies on self-reporting by the water users, who send the ARC quarterly records of their water meter readings or directly update our electronic database. This knowledge is critical as it enables the ARC to assess whether water use is being kept within allocation limits. It is also used for the annual water quantity statements. The ARC follows up instances of non-reporting and recovers the follow up cost from consent holders. Auditing meter readings is also undertaken with the frequency related to the risk posed by the particular take. Larger, complex resource consents and those that take water from particularly sensitive rivers or aquifers are audited annually.

#### **Controlling water takes: is it working?**

The annual water quantity statements show that water takes of groundwater are within allocations, and that the allocations are within the availability limits set by the Proposed Auckland Regional Plan Air, Land and Water. On that basis, the approach is working.

However, it is getting more and more difficult to meet the demand for water in several High Use Aquifer management areas. Managing the water to meet demand in these areas has often been achieved only because of the removal of a major water user (such as a dairy farm), where a major user has been able to make significant water savings (as at the Glenbrook Steel Mill), or where new abstractions could be directed to other less pressured aquifers. Fully allocated aquifers have no capacity for takes by new users.

While surface water takes are managed within allocation limits, it is uncertain whether those allocation limits are appropriate as the ARC is yet to define minimum flows for most of the rivers in the Auckland region. The ARC's current management approach for maintaining minimum flows, protecting water quality and requiring mitigation is through resource consent conditions.

Water use monitoring by self-reporting has been consistently high, with 80 to 90 per cent of the water users returning information over the past five years. This has given the ARC a robust information base.

## **Stream enhancement and compensatory works**

Whenever possible, the ARC tries to stop rivers from being damaged or degraded. However, in order to achieve a diverse and healthy freshwater environment the ARC also tries to improve and enhance rivers that are already degraded. It does this in a number of ways.

### **Stormwater projects funded by Infrastructure Auckland:**

- The (now disestablished) Infrastructure Auckland (IA) funded a number of stormwater projects (Box 7) to enhance urban streams. These included projects that focused on riparian planting and streambank stabilisation.
- The most significant is the Twin Streams Project that began in 2004. It covers the stream catchments that drain into Henderson Creek and Huruwharu Creek. These include the Lower Oratia and Lower Opanuku streams and the Waikumete, Swanson and Pixie streams.
- The Twin Streams Project aims to improve both the water quality and ecological health of these waterways largely through weed and rubbish removal, geotechnical work such as bank stabilisation and revegetation of 56km of streambanks. It also aims to develop wetlands to help manage stormwater and flood risk. This involves the purchase of 75 residential properties located in and around natural drainage channels (although it should be noted that only the stormwater aspects were funded through IA). By the end of 2008, the project had planted 373,000 native plants.
- The Twin Streams Project received funding approval as six separate projects totalling \$39.5 million (almost half of the funds committed to stormwater projects). From mid 2004 to February 2008 the ARC paid out almost \$25.5 million on behalf of the former IA, with a further \$14 million still to be paid.

# Responses

## Box 7 Funding from Infrastructure Auckland

Infrastructure Auckland (IA) was established in 1998 as the custodian of a fund of regional investments worth approximately \$1.3 billion that had been inherited from the former Auckland Regional Services Trust. IA was tasked with managing those investments to provide tangible benefits for the community through grants made to transport and stormwater projects. Around \$150 million of the available cash reserves were notionally allocated to stormwater projects with about \$550 million notionally allocated to transport projects.

IA was disestablished by a change to the Local Government Act in 2004 that involved reorganisation of Auckland's regional assets and the creation of ARTA (to manage regional transport) and Auckland Regional Holdings Ltd (ARH). Under the new legislation, the ARC was tasked with the responsibility for ongoing stormwater grants and ARTA with the responsibility for transport grants.

When IA was disestablished it had already approved \$103 million for stormwater projects but the majority of this had not yet been paid out. A wide range of stormwater projects had been funded including new public stormwater pipes, separation of older combined sewers, installation of catch-pit filter systems, litter booms, treatment ponds, artificial wetlands and stream improvement projects. Funding decisions were made on the basis of a rigorous assessment process at the time but without the benefit of integrated catchment management plans, as these were then largely non-existent. Recipients were mainly local authorities (as network operators) but a small amount of funding was allocated to community groups.

By March 2009, \$36.5 million had been paid out to regional stormwater projects with a further \$34.5 million committed but not yet paid. The allocation of funds to IA-approved stormwater projects is likely to be completed by about 2014 although the exact date will depend on the start and completion dates of these projects.

The remaining \$47 million (of the \$150 million notional allocation) was retained for stormwater purposes but is no longer available for physical works. Instead, it was allocated to the ARC with the major portion going towards the development of integrated catchment management plans (ICMPs) by stormwater network operators (local councils). This fund is now administered by the stormwater action team.

## Projects funded by the Environmental Initiatives Fund

In 2007, the Environmental Initiatives Fund (EIF) allocated \$500,310 to 212 applicants in the region (Box 8). The projects included waste reduction, sustainable gardening, an educational nature trail, environmental awareness workshops

and newsletters, restoration of dunes, native forest and historic buildings, native plant propagation, animal plant pest control, erosion control, and riparian and wetland fencing and planting.

137 applicants received a total of \$362,236 for biodiversity related projects (native planting, fencing and/or an animal and plant pest control). A total of 28,415m of fencing was installed, 4,850m of stream edges were fenced and 77,262 native plants were planted in 2008.

## Box 8 The Environmental Initiatives Fund

The ARC established the Environmental Initiatives Fund (EIF) in 1999 to support individuals and groups who wanted to improve and care for the natural, cultural and physical environments within the Auckland region. The EIF is an umbrella for other funds including the Honda Tree Fund.

About \$500,000 is available annually to support projects and about 200 applications are received each year. To be eligible, projects must be consistent with the EIF vision and purpose and fit at least one of the funding outcomes.

Since the first funding round in February 2000, 1,235 grants worth \$3 million were provided to community projects. These projects focused on biodiversity, cultural heritage, and education projects such as organic gardens and worm farms for schools and communities.

## Compensation for lost stream values

Freshwater habitats and native fish populations are at risk from activities undertaken in rivers, such as excavation ('cleaning') and the placement of structures such as bridges, pipes and culverts.

The ARC controls these activities through the Proposed Auckland Regional Plan: Air, Land and Water. This proposed plan includes rules that control the disturbance of rivers by distinguishing between rivers (and stretches of rivers) that are in a relatively unmodified state with high natural values, and those that are more modified and therefore have lower natural values.

Piping, culvert installation and excavation of the more modified rivers is permitted, subject to conditions that are designed to minimise both temporary and long-term adverse environmental effects such as flood risk, sediment generation and restricted fish passage. The scale of disturbance is also controlled (e.g. a 30 metre limit is imposed on any culvert, piping or channelling and a 100 metre limit is applied to excavation work).

Disturbance of a river bed that is in a more natural state, or disturbance that cannot meet the performance standards requires a resource consent.

When there are significant and unavoidable adverse environmental effects (e.g. when an urban river has to

# Responses

be piped) the ARC requires compensation for the lost environmental values. Until recently this was done through a financial contribution (calculated at \$330 per metre and payable by the resource consent holder) to restore or enhance the environmental values of other rivers within the catchment (or elsewhere if necessary). Recently this approach has been modified to ensure that the compensation more accurately reflects the lost environmental values. The new approach uses the ecological stream valuation methodology developed for the ARC. The approach calculates the recommended length of riparian restoration by taking into account the ecological value of the river that is being lost and the existing ecological value of the river to be enhanced.

## Box 9 The Dairying and Clean Streams Accord

The Dairying and Clean Streams Accord is an industry self-management initiative that aims to improve the environmental performance of dairy farming. It was signed by Fonterra Ltd., regional councils, the Ministry for the Environment and the Ministry of Agricultural and Forestry in 2003. Fonterra Ltd. and the regional councils developed regional action plans for the main dairying regions to implement this Accord by June 2004. The principal priorities and performance targets of the Accord are outlined here:

- Dairy cattle are excluded from streams, waterways, lakes and their banks. Streams are defined as permanently flowing waterways that are deeper than a 'Red Band' (ankle depth) and 'wider than a stride'. However, fencing may not be required where natural barriers already prevent stock access, and the type of fencing erected will depend on factors such as terrain, stock type and costs. Performance target: dairy cattle excluded from 50 per cent of streams, waterways, lakes and their banks by 2007, 90 per cent by 2012.
- Farm races include bridges or culverts where stock regularly (more than twice a week) cross a watercourse. Performance target: 50 per cent of regular crossing points have bridges or culverts by 2007, 90 per cent by 2012.
- Farm dairy effluent is appropriately treated and discharged. Performance target: 100 per cent of farm dairy effluent discharges to comply with resource consents and regional plans immediately.
- Nutrients are managed effectively to minimise losses to ground and surface waters. Performance target: 100 per cent of dairy farms have systems in place to manage nutrient inputs and outputs by 2007.
- Existing regionally significant or important wetlands (as defined by regional councils) are fenced and their natural water regimes are protected. Performance target: 50 per cent of regionally significant wetlands to be fenced by 2005, 90 per cent by 2007.

## Restricting stock access to waterways

Stock in waterways can have a range of adverse environmental impacts. These include increased nutrient levels, damage to freshwater and marine ecosystems, increased sedimentation and turbidity as a result of discharge of animal waste directly into the water, disturbance of the river bed, and vegetation loss and erosion along the riverbanks.

Currently, the ARC does not control stock access to waterways. However, the Proposed Auckland Regional Plan: Air, Land and Water does contain a commitment to introduce an appropriate response in the future. Our current strategy relies largely on education and advocacy and dairy farmers' compliance with the Fonterra Accord (Box 9).

The ARC and Fonterra have agreed on an Auckland Regional Action Plan that reflects the performance targets of the Fonterra Accord. Under the terms of this plan, the ARC has committed to a range of programmes such as guidance material for land owners to assist with compliance, and Fonterra has agreed to 'report publicly on progress annually'.

We also provide some public funding for fencing private land through our Environmental Initiatives Fund (Box 8).

### Stock access to waterways: are the strategies working?

There is no historical record of the rate at which rivers in the Auckland region have been fenced to exclude stock. This makes it almost impossible to compare the effectiveness of this provision in the Dairying and Clean Streams Accord (Box 9) against the time before it was introduced.

Fonterra commissioned an assessment of compliance with the performance targets, as part of its requirement to report progress made towards its performance targets and found that the targets set in the Fonterra Accord were being met.

The ARC performed a comprehensive study of stock access to rivers in 2008 and aimed to provide a benchmark against which the effectiveness of our future responses to the issues around stock access to rivers could be assessed. Using 60 sample units (each a 500 metre length of river that was randomly selected from identified units spanning all major rural land uses), researchers undertook field survey work and recorded the fencing status. The research was designed to yield statistically robust results that would reflect the situation (within confidence levels) within the Auckland region as a whole.

Using that methodology, the ARC determined that the proportion of rivers fenced along both sides was 24.8 per cent overall. Rivers through dairy farms, with 26 per cent fenced, were better protected from stock access than the regional average. Rivers through drystock farms were less protected, with 60.7 per cent of rivers unfenced and a further 18.3 per cent fenced one side only. Rivers through dairy farms had 38 per cent with no fence and a further 36.8 per cent fenced on one side only. Rivers through rural residential properties showed similar results to those through dairy farms.

There is a difference between the ARC research findings and the Accord figures. Different data collection and interpretation account for some of this.

# Responses

## Improving urban stormwater discharges

A large variety of chemical contaminants, representative of a range of activities from various land uses, enter fresh water and marine environments through the stormwater network.

### Network discharges

The vast majority of local stormwater and wastewater networks within the Auckland region are owned by the territorial (city and district) councils and by council-owned enterprises such as Metrowater Ltd. The bulk wastewater network is operated by Watercare Services Ltd.

Although the stormwater and wastewater networks are constantly being expanded as a result of urban growth and redevelopment, most were designed and built before the RMA and before the ARC developed a good understanding of their impact on the coastal environment. Consequently, although they represent acceptable practice for their age, they have many design limitations compared to current environmental expectations (see Chapter 3: Wastewater and Stormwater, pg 61).

The RMA required all operators of stormwater and wastewater networks to apply to the ARC for new resource consents by 2001. This provided an opportunity to take a comprehensive look at the performance of the existing networks and to improve that performance over time. It had long been recognised that interactions between the wastewater and stormwater networks produced adverse environmental effects resulting from events such as wet weather and dry weather overflows (see Indicator 26, Chapter 3: Pressures, pg 61).

The Proposed Auckland Regional Plan: Air, Land and Water established a regulatory framework of objectives, policies and rules to control both stormwater and wastewater network discharges.

Resource consents for stormwater network discharges cover the discharge of stormwater from any point in the network, including the final discharge point into the receiving environment as well as overflows and leakages.

Resource consents for wastewater network discharges cover the discharge of wastewater that occurs as a result of overflows at designated relief overflow points (as well as elsewhere) and as a result of leakages that may occur before the wastewater arrives at a wastewater treatment plant.

This regulatory approach encourages the network operators to prepare an Integrated Catchment Management Plan (ICMP), see Box 10. In theory, applications by network operators for discharges from the networks would be considered after the relevant ICMP has been prepared. As part of this consenting process, network operators are required to adopt the Best Practical Option (BPO). This means that the ARC considers, on a case-by-case basis, the most appropriate means of improving performance given the issues with that network and its receiving environment, the particular catchment and the options available to address those issues, as well as the financial implications in terms of available funding and priorities relative to other catchments.

Although resource consent applications were first lodged in 2001, most have been on hold pending the collection of better information through the ICMP and resource consent process. However, in recent years the ARC has started to issue network resource consents.

### Box 10 Integrated Catchment Management Plans (ICMPs)

ICMPs are plans for the management of stormwater and wastewater discharges, diversions and associated activities within the catchment or district. This is a ten year programme that began in 2004. These plans identify:

- the stormwater or wastewater issues facing the catchment and the range of effects from those discharges, diversions and associated activities,
- strategic objectives for the management of stormwater and wastewater discharges, diversions and associated activities within the catchment or district,
- a range of management options and the preferred management approach for avoiding, remedying or mitigating environmental effects and risks,
- roles and responsibilities for implementation of the management approach,
- tools to support implementation of the management approach,
- a process for review.

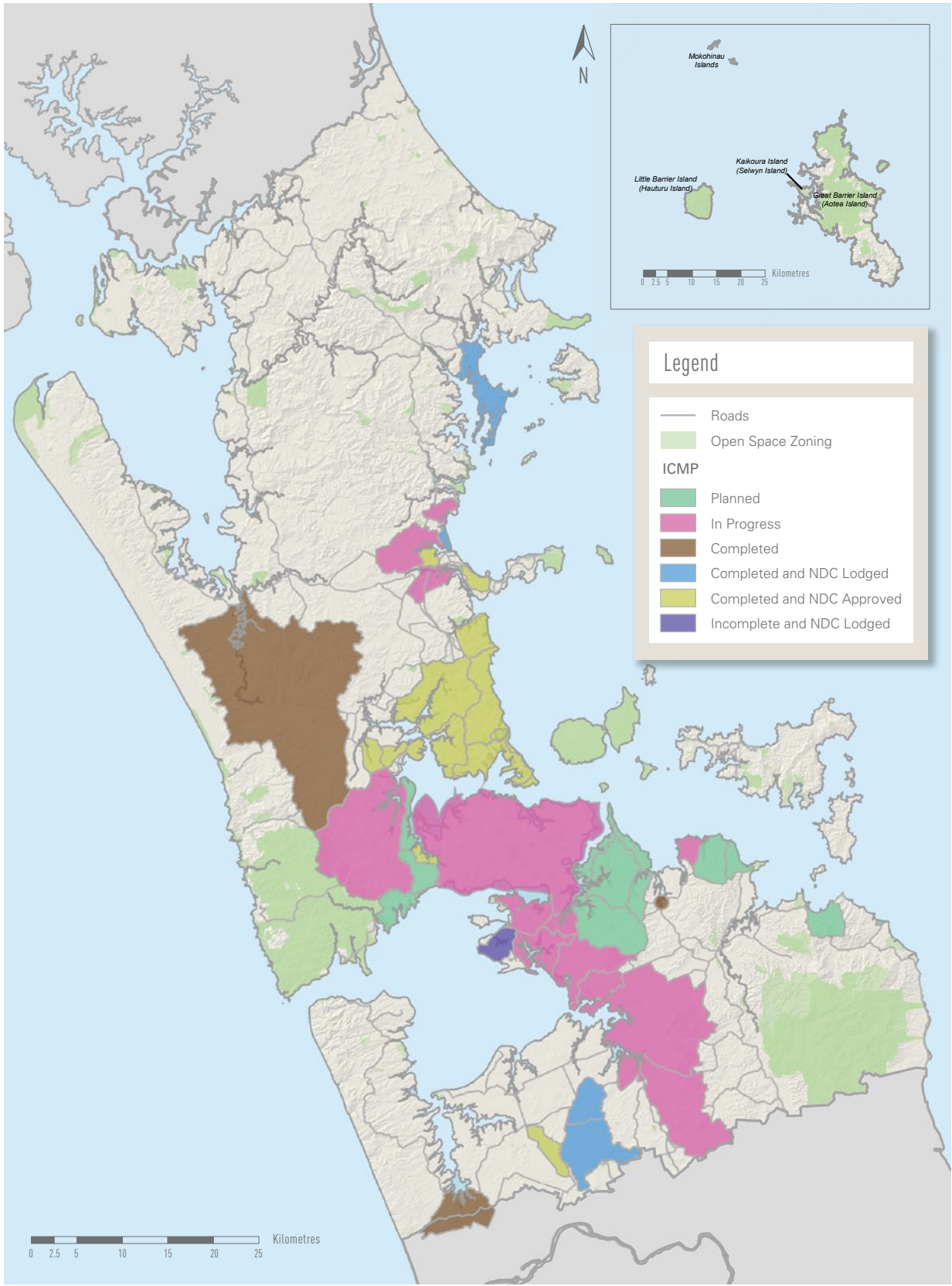
Importantly, ICMPs should take into account all types of discharge within the catchment (both network and non-network). They aim to address the full range of actual or potential flood events, water quality and ecosystem health issues.

Integrated catchment management planning can be a lengthy process that requires a detailed understanding of the current performance of the network and its effects and risks on the receiving environment. It also requires an understanding of likely future inflows, based on projected increased development within the catchment and the implications of this on the network performance.

These requirements usually mean that modelling and other technical work is needed to assemble the necessary data and devise an appropriate management approach. In recognition of the costs involved in preparing an ICMP (and the regional benefit that is derived from that work) Auckland Regional Holdings Ltd (ARH) provides funding to network operators through us, to assist with timely preparation of ICMPs.

As at June 2008, \$6,150,562 was available from ARH (through us) for the development of ICMPs. Coverage of these plans is shown in the map.

# Responses



**FIGURE 6** Progress of ICMPs in the Auckland Region (2008). (Source: ARC).

# Responses

Reporting the overall progress is difficult because each network operator has elected to seek resource consents in different ways. E.g. NSCC sought single (global) resource consent for entire networks while WCC submitted multiple applications on a catchment basis. Watercare Services Ltd. has submitted 76 applications, one for each pumping station (potential overflow points), 49 have been granted and the remaining 27 are being processed.

Applications for network resource consents can be made for existing networks or for future development areas (as part of a single application or as separate applications, depending on the applicant).

While there will often be significant limitations around the potential to improve stormwater management in some areas, a wide range of stormwater management techniques is available for others, particularly future development areas.

Since the network resource consent applications were lodged and the Proposed Auckland Regional Plan: Air, Land and Water introduced, much has been done to refine and develop a high quality stormwater management regime. A major review in 2004 identified five areas that needed improvement in order to deliver better stormwater outcomes. These were:

- improving the quality and timeliness of ICMPs,
- improving the range of measures and solutions, with particular emphasis on controlling the sources of contaminants rather than treatment of contaminated stormwater,
- improving and co-ordinating education and awareness of stormwater issues,
- improving organisational capacity and leadership,
- improving and securing sufficient funding for stormwater responses.

We responded to the review by preparing the Auckland Regional Stormwater Action Plan (SWAP) which explained how the ARC would meet these five challenges. The ARC also established a stormwater action team to deliver the commitments set out in the SWAP.

## Non-network discharges

The ARC also regulates stormwater discharges from sites that are not connected to stormwater networks. The Auckland Regional Plan: Air, Land and Water requires that discharges of stormwater from sites with more than 1000m<sup>2</sup> of impervious surface need resource consent, unless otherwise permitted. This requirement is designed to control the discharges from a range of industrial and commercial activities, both inside and outside the MUL (Figure 1, Introduction, pg 9).

When considering whether to grant a resource consent, ARC considers the management of three issues in particular:

- Contamination (mostly from hydrocarbons and heavy metals). The ARC requires some form of treatment to be applied in accordance with the guidelines in Auckland Regional Council Technical Publication 10 (Box 11). Contaminant particles adhere to sediment in the water column so removing the sediment is the principal means of stormwater treatment. The Auckland Regional Plan: Air, Land and Water requires of 75 per cent of the total suspended solids to be removed from stormwater.
- The physical effect on aquatic habitats through, for example, riverbank erosion. The ARC requires stormwater retention devices that can cope with a 34.5mm rainfall event and release the retained water over a 24-hour period.
- The potential for flooding. The ARC imposes conditions on resource consents that are designed to ensure overload flood paths have the capacity to cope with two, ten or (in some cases) 100 year flood events, depending on the particular risk profile of the site and wider environment.

## Box 11 ARC Technical Publications on stormwater discharges

- Auckland Regional Council Technical Publication 10 (TP10) was developed in 1992 and updated in 2003 to assist in compliance with ARC stormwater management requirements. It sets out an accepted design approach for structural stormwater devices that provides benefits for both water quantity and water quality. More specifically, it provides design guidance for ponds, wetlands, filtration practices such as sand filters and rain gardens, infiltration practices such as trenches and dry wells that divert runoff to groundwater rather than into streams, biofiltration practices such as swales and filter strips, and other preferred stormwater management. TP10 has had a significant influence on the type and nature of stormwater management across the Auckland region. Other technical publications that assist with stormwater management are:
  - TP108 provides guidance on rainfall runoff modelling to be used for stormwater management design within the Auckland region.
  - TP124. This presents an alternative approach to site design and development from a stormwater management perspective, and is primarily applicable for residential land development. The low impact design advocated is another stormwater management tool aimed at reducing the adverse impacts of stormwater runoff. This is becoming recognised as an important element of good urban form.

### Other stormwater initiatives

In addition to the regulatory approaches to stormwater management, the ARC seeks to improve knowledge and skills within the Auckland region through a range of non-regulatory initiatives. These include running training courses and seminars, sponsoring a Low Impact Design competition at the University of Auckland, operating a Low Impact Design Innovative Grant programme, supporting demonstrations of low impact design at the Regional Botanic Gardens and similar educational programmes. The Infrastructure Auckland (IA) grant scheme is another significant non-regulatory initiative aimed at improving stormwater outcomes (Box 7 page 234).

### Improving urban network discharges: is it working?

The new regulatory regime should result in new investment (in networks and the use of techniques to control the quality of stormwater entering the network) that would otherwise not have occurred, as well as improvements to the aquatic receiving environment. However, it will be difficult to determine the extent of both outcomes.

There has been a considerable investment in upgrading the older networks within the Auckland region over recent years. Much of this was driven by the asset management planning process combined with a generally recognised need to improve environmental performance, rather than as a result of our new regulatory framework. However, this investment was made in the knowledge that our regulatory framework was being tightened.

The extent to which the various non-regulatory activities of the Stormwater Action Plan (SWAP) are influencing change is difficult to gauge. An independent review of the SWAP in 2008 found that the ARC was successfully performing an important task and facilitating implementation of ICMPs in the Auckland region. Progress was also being made in delivering on the specific actions set out in the SWAP.

At present, it is too early to say whether our regulatory and non-regulatory activities are delivering improvements in the aquatic receiving environments.

### Improving riparian management

Effective riparian management has many beneficial effects on the river and evidence suggests that the monitoring sites with riparian vegetation and fencing have higher water quality and higher ecological quality than those without. This suggests that there is an opportunity to improve both the water quality and ecological quality of degraded rural streams through improvements in riparian management (Box 12), particularly as over 60 per cent of the rivers in the Auckland region flow through rural catchments. Additional benefits to marine environments are also acknowledged, evident in the Mahurangi Action Plan.

#### Box 12 Riparian management (looking after the trees and shrubs that grow alongside a river)

Effective management of riparian margins can greatly influence the water quality and ecological quality of river systems. The presence of established woody vegetation on riverbanks can have numerous benefits to the river, including:

- shading, which prevents high water temperatures
- stabilisation, which prevents riverbank erosion
- food provision, from leaves and wood falling into the river
- habitat for the terrestrial phases of aquatic insects.

These benefits of riparian management can be achieved without compromising the productivity of rural land and within a relatively short timeframe. The photographs below show an example of the difference made by good riparian management along a river at the Awhitu peninsula. The upper photograph was taken in 1993 and the lower in 2003.



# Responses

## Lake restoration

### Lake Wainamu

See case study on page 254.

### Lake Ototoa

Lake Ototoa is Auckland's most pristine lake, with very high water quality and extensive beds of native aquatic plants. In early 2007 a highly invasive aquatic pest plant, hornwort (*Ceratophyllum demersum*), was identified in the north-west arm of the lake. This caused great concern due to its potential impact on the lake's ecology.

The ARC officers immediately carried out surveys to determine the extent of the spread. The ARC also installed two large barrier nets in an attempt to contain the hornwort within the north-west arm of the lake. The aquatic herbicides Diquat and Endothal were also applied to kill the hornwort infestation and these appeared to work successfully.

Unfortunately, further infestations of hornwort outside the contained area were discovered in March 2009. These appear to be too widespread to allow for eradication, leaving no easy options for future management of the lake.

## Controlling the use of coastal space

The ARC controls activities within the CMA around the Auckland region through the Auckland Regional Plan: Coastal. This plan sets out the objectives, policies and rules about what people can do in the CMA and also applies to the wider coastal environment that includes an area landward of Mean High Water Springs.

Everyday passive recreational use of the CMA is permitted by the Auckland Regional Plan: Coastal but any activities that permanently or exclusively occupy coastal space (such as moorings, aquaculture and marinas) or that have potentially significant adverse environmental impacts (such as dredging or reclamation) are regulated.

A specified number of swing moorings are permitted in defined Mooring Management Areas, although consent must be obtained from the Harbour Master under bylaws prepared under the Local Government Act (1974). Moorings outside these defined areas or that exceed the permitted number require resource consent. A similar approach is taken to marinas.

Structures and buildings in the CMA such as seawalls, wharves, jetties and boatsheds are categorised as permitted, discretionary or non-complying activities, depending on the scale and location of the activity. The ARC considers applications on the basis of whether they are appropriate for the proposed location, and take account of any effects on public access and the coastal environment.

Over recent years, the ARC has been assessing and legitimising existing structures in addition to considering applications for new structures. Many of the existing structures had no prior approval as they were built well before the introduction of the RMA.

Although few applications are declined through the consenting process, any larger projects that the ARC approves are typically required to provide some level of mitigation, such as planting, provision of public access or other amenities.

A compliance monitoring programme ensures that the resource consent requirements are met. This programme involves inspections during the construction stages and subsequent visits to check that activities continue to comply and that structures are kept in good order. The frequency of these inspections is determined by the level of risk posed by the activity.

### Integrated planning for coastal areas

In 2004 the ARC recognised the need for a strategic approach to coastal planning that would span the land/water interface and provide a framework to assist making regulatory decisions. Therefore, the ARC began to prepare non-statutory Coastal Compartment Management Plans (CCMPs) in conjunction with relevant territorial authorities.

These plans cover discrete parts of the coast that have an identifiable physical and/or social character. At the time of writing this report, three plans have been prepared for Pahurehure Inlet, Algies Bay and Waiuku Estuary. Although the breadth of issues that may be addressed in a CCMP is wide, the plans prepared so far have tended to focus on access, erosion control and mangrove management.

Implementation of CCMPs may be done through regulation (the incorporation of key provisions into plans prepared under the RMA) or through non-regulatory means including, in particular, council-funded works and services. Initially the ARC expected to prepare five CCMPs each year but progress has been much slower than expected.

### Supporting community initiatives in the coastal environment

The ARC operates a Coastal Enhancement Fund (CEF) that provides grants to support individuals, organisations and community groups who want to enhance, restore or protect the coastal environment.

For the 2009/10 financial year, total funds of \$336,000 were available from the CEF. The funds are distributed evenly between three categories of projects:

- environmental enhancement activities such as dune restoration, coastal wetland enhancement, beach clean-up, removal of derelict coastal structures and beach re-nourishment
- safety and navigation improvements such as the provision of training courses, education campaigns, signs and navigation lights.
- public works in the coastal zone such as building boat ramps and walkways, and wharf restoration.

The largest grant of \$54,000 in the 2009/10 financial year was made to the University of Auckland to continue research into Brydes Whale's in the Hauraki Gulf. In general, individual grants are relatively small with most projects producing localised benefits.

Our EIF also supports projects that respond to coastal issues (Box 8 page 234). Most of the coastal projects supported by the EIF over the past few years have been related to fencing and restoration of coastal and estuarine margins although some dune restoration, biodiversity protection and clean-up projects have also been funded.

### Vehicles on beaches

The use of vehicles on Auckland's beaches has grown substantially in the last couple of decades. This has developed into a form of recreation that – at certain locations – has resulted in risks to public safety, alienation of non-vehicle users, damage to Auckland's coastal environment and significant ongoing infrastructure costs for the agencies involved. This has been a long-standing issue for the ARC but more recently has been brought to prominence due to a number of serious incidents at Muriwai Beach and Te Oneone Rangatira.

In 2008, the ARC confirmed its desire for greater control of vehicles on beaches to ensure necessary access is identified and protected, while damaging and dangerous use is stopped. The ARC has identified a multi-pronged, staged approach to achieve this. This approach encompasses joint agency bylaw reviews and development, education, enforcement and monitoring.

## Protecting and enhancing terrestrial biodiversity

### Improving land use planning

The way in which land is used and developed poses many threats to the terrestrial biodiversity of the Auckland region although, conversely, management by regulatory authorities present opportunities for biodiversity protection and enhancement.

We seek to minimise threats and maximise opportunities for biodiversity through the policies in the Auckland Regional Policy Statement (ARPS) that are designed to guide land use management by the territorial authorities within the Auckland region (Box 13). The ARC promotes these policies through our regional advocacy role, by ensuring that the policies are reflected in the plans and resource consents issued by territorial authorities.

#### Box 13 Biodiversity policies in the Auckland Regional Policy Statement (ARPS)

The ARPS includes a chapter that addresses natural, geological and historic heritage and landscape. Natural heritage relates essentially to native biodiversity within the Auckland region. The policies contained in the ARPS:

- establish criteria for assessing the significance of natural heritage (this is important because the degree of protection offered is related to the assessed significance of places and habitats),
- require the control of subdivision, use and development so that heritage resources of significance are preserved or protected from significant adverse effects. If this is not possible, the policy requires any significant adverse effects to be remedied or mitigated,
- define significant adverse effects (in the context of heritage),
- promote natural heritage restoration, mainly through use of incentives and provision of information.

The ARPS requires regional and district plans to include provisions that implement policies and set out the range of mechanisms that should be considered to achieve protection. It also directs regional and district plans to consider a range of statutory and non-statutory provisions that enable financial contributions to be taken in order to offset unavoidable effects on natural heritage.

The ARPS also includes a schedule of Sites of Ecological Significance in Appendix B. The schedule includes areas of 'regional significance' but is not considered to be a complete record of all significant natural heritage resources in the Auckland region.

# Responses

## Bonus subdivision rights and conservation covenants

One of the ways that local authorities seek to meet their obligations to protect biodiversity under the RMA and the ARPS is to allow subdivision in return for permanent legal protection of native vegetation.

Protection is usually secured through the use of covenants. Rodney District Council (RDC) and Franklin District Council (FDC) have good databases that provide statistical information on bush lots and covenanted areas. Other councils have not yet extracted this data from their property files to create an accessible database of their covenants.

To promote protection of Significant Natural Areas (SNAs), RDC has provided subdivision rights through its district plan in return for the creation of conservation covenants. When significant areas of native bush, wetlands and other habitat types are permanently protected, land owners are given the opportunity to subdivide. Further incentives have also been provided; these allow native vegetation to be replanted, or weeds and pests to be managed, in exchange for subdivision rights.

The covenants established under the RMA include several specific conditions that seek to preserve the health and integrity of the biodiversity values of the area. These conditions are enforceable under the RMA.

### Conservation covenants: are they working?

At present, there are 3543 conservation covenants in Rodney District. Together, these protect 8641 hectares of wetlands, native forest fragments and revegetation areas that have an average size of 2.5 hectares.

However, a pilot exercise showed that current land owners were often unaware of the location of the conservation covenant, the reasons for its existence, and its conditions and legal requirements. As a result, compliance with the conditions of conservation covenants was often low. Consequently, RDC intends to implement a bush lot monitoring programme and an associated communications plan to raise awareness and compliance amongst land owners.

### Rules controlling vegetation clearance

Another common way in which territorial authorities seek to implement regional policy is through rules that limit the amount of vegetation clearance allowed and protect identified SNAs.

However, there is considerable variation in the scope and nature of rules in place at territorial level and little monitoring information available to assess their effectiveness. In addition, the effectiveness of such rules in protecting native vegetation can be undermined by both discretionary and non-complying resource consents (see case study: vegetation clearance on the North Shore, pg 214).

## Managing plant and animal pests

One of the greatest threats to terrestrial biodiversity in the Auckland region comes from introduced plant and animal pest species.

While MAF Biosecurity New Zealand is responsible for keeping potential pest species out of New Zealand, responsibility for managing the pest species that are already in the country rests largely with the regional councils.

The ARC plays a major role in pest control within the Auckland region using the powers available to the ARC under the Biosecurity Act (1993) and the Auckland Regional Pest Management Strategy that the ARC prepared in accordance with that Act.

### The Auckland Regional Pest Management Strategy

Recently the ARC prepared a new Auckland Regional Pest Management Strategy (RPMS) under the Biosecurity Act (1993) in order to implement our preferred approach to pest management across the Auckland region. The new RPMS covers the period from 2007 to 2012 and replaces the previous RPMS that covered 2002 to 2007.

The new RPMS continues the general strategy of the previous RPMS. It sets out a programme for addressing major pest threats using a mix of regulations, ARC-funded pest control operations, public education programmes and surveillance.

Under the RPMS, land owners and occupants are responsible for most pest control operations. However, the ARC controls a range of low-incidence but high-threat pest plants, as well as pest mammals such as possums, feral goats, feral deer, feral pigs and mustelids (weasels, stoats, and ferrets) that damage areas of high ecological or conservation value.

Pest plants are controlled in strategic locations in order to protect the regional park network and also undertake eradication work against key terrestrial pests in high value areas (e.g. Argentine ants on Great Barrier Island). The ARC also ensures that land owners or occupants are aware of, and comply with, a number of rules relating to pest plants and animals, such as the requirement to keep boundaries clear of ragwort in rural areas.

The ARC implements the RPMS through a team of biosecurity officers who ensure that the RPMS is applied consistently throughout the Auckland region by:

- managing pest control work (often through contracts to private sector operators)
- investigating complaints
- monitoring and releasing biological control agents
- advising on best practice pest control methods
- publicising pest issues in the community
- inspecting and controlling Total Control pest plants (for which the ARC has assumed management responsibility)
- general surveillance inspections
- nursery and retail shop inspections.

Individual biosecurity officers are also responsible for a range of regionwide projects such as liaison with landcare groups and management of the pest plant control programme within regional parkland.

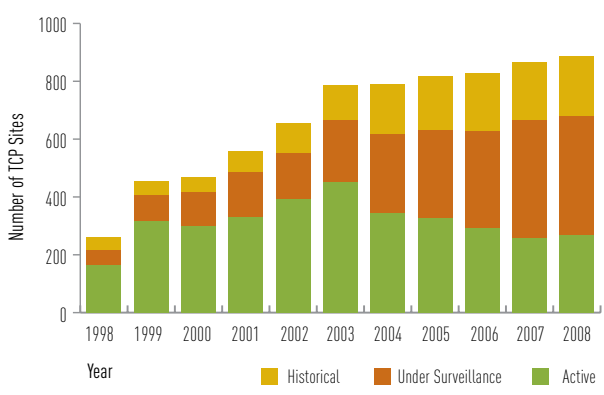
# Responses

The ARC currently spends approximately \$6.3 million annually on implementing the RPMS and associated biosecurity measures.

### Terrestrial pest plants

The pest plant control work that the ARC performs can be divided into the following:

- Species-led work. This focuses on a single species within an area or across the Auckland region because of the particular threat posed by that species.
- Site-led work. This focuses on managing the values of a particular site by targeting a broad range of pest plant species on that site.
- The RPMS classifies pest plants as Total Control plants, Containment plants or Surveillance plants, and our role differs according to the classification.
- Total Control. These pest plants have a low incidence but pose a high threat. The ARC carries out or arranges all the control work for these types of pest plant at no expense to the land owner. Total Control pest plants are banned from sale, propagation, distribution and exhibition within the Auckland region. The objective for Total Control pest plants in the RPMS is to eradicate all currently known sites within five or ten years, depending on the species.
- Containment. These pest plants are abundant in certain habitats or areas within the Auckland region. Land owners or occupants are required to remove these plants or to perform boundary control (depending on the particular species) whenever these plants appear on their land. ARC's role is to enforce these rules.
- Surveillance. These plants have significant adverse impacts on the biodiversity values of the Auckland region. The ARC tries to prevent these plant species from becoming established or spreading further by prohibiting their sale, propagation, distribution and exhibition. ARC staff regularly monitor establishments such as plant nurseries and other places where plants are grown or offered for sale.



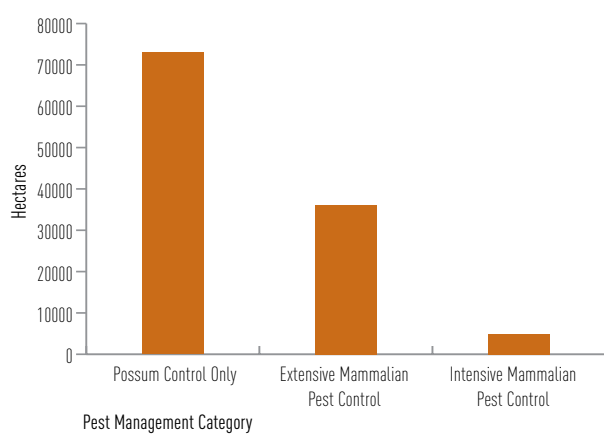
**FIGURE 7** Annual trends in the number of Total Control pest plant sites and the relative proportion of their status categories across the Auckland Region. (Source: ARC).

Figure 7 shows the numbers and status of known Total Control plant sites in the Auckland region; including sites where control is underway, sites where control has been completed but frequent checks are carried out to monitor reoccurrence and, finally, historical sites where the pest plant has been eradicated.

### Mammalian pests

Management of terrestrial pest mammals is performed by government agencies, community groups and private land owners using a variety of control methods (Figure 8 and Table 2). These include eradication, large-scale single species control of possums or ungulates (deer, goats, and pigs) and intensive small-scale multi-pest control of mammalian predators such as stoats, rodents, feral cats and hedgehogs.

The particular approach taken depends on a number of factors such as the level of knowledge about the relative impacts of different pest mammals on native biodiversity, their distribution, ecological requirements and behaviour patterns, and the technological challenges and resource constraints associated with their management.



**FIGURE 8** Amount of land (hectares) under management for terrestrial pest mammals in the Auckland region, 2008. (Source: ARC).

# Responses

**TABLE 2** Summary of animal pest control programmes in the Auckland region. (Source: ARC).

Pest	Location	Agency/group	Timing/frequency
Possums	Auckland region	ARC led, DoC contribution, community groups	3 to 7 year rotation depending on rate of re-invasion
Feral goats	Hunua Ranges	ARC	Annual
Feral pigs	Waitakere Ranges	ARC	Twice a year
Mustelids	As part of site-led integrated management programmes, e.g. Ark in the Park	ARC, DoC, community groups	Variable
Feral cats	As part of site-led integrated management programmes, e.g. Tawharanui regional park	ARC, DoC	Variable
Feral deer	Auckland region, outside of South Kaipara peninsula	Combined ARC & DoC programmes	As and when reported
Rabbits	As site-led projects on ARC parkland and community projects on private and public land, e.g. Bethells beach	ARC, DoC, community groups	Variable
Rodents	As part of site-led integrated management programmes, e.g. Tawharanui regional park	ARC, DoC, community groups	Variable
Reptiles	Auckland region	ARC	Collection of red-eared sliders from the wild as and when reported.
Rooks	Auckland region	ARC	As and when reported
Argentine ants	Great Barrier Island, Tiritiri Matangi Island	ARC, DoC, community	Annually, over summer months
Wallabies	Kawau Island	ARC, some private land owners	During the RPMS period (2007-2012)

## Pest fish

Twelve lakes within the Auckland region and their surrounding catchments have been assessed as High Conservation Value (HCV) water bodies due to their high natural values. These are listed and mapped in the RPMS. All fishing activities are prohibited in these lakes apart from trout fishing in Lakes Ototoa, Whatihua and Tomorata.

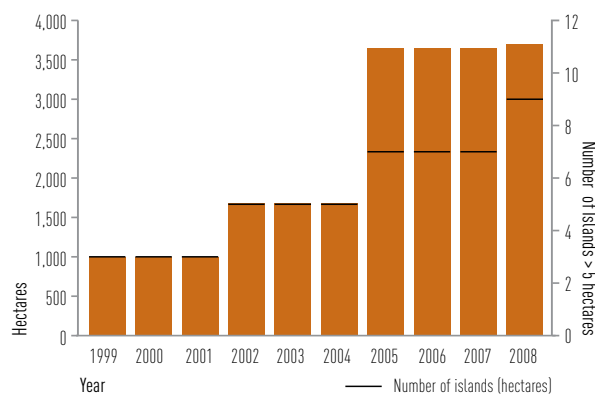
It is important to note that perch, rudd and tench are designated as pest fish only within these HCV lakes, and are designated as sport fish elsewhere in the Auckland region.

### Pest management: is it working?

Pest plants in the Auckland region are managed by a number of agencies and groups including us, the DoC, territorial authorities, community groups and individuals. In 2008, approximately 6260 hectares across the region were controlled for invasive plant species by private land owners and community groups.

Since 1999, the number and total area of offshore islands that have been declared free of pest mammals has increased

considerably (Figure 9). This positive trend looks set to continue with initiatives to remove pest mammals from the 500 hectare Kaikoura Island (off Great Barrier Island) and the Rangitoto/Motutapu Island complex of 3500 hectares.



**FIGURE 9** Changes in the number of islands and hectares in the Hauraki Gulf that are free of pest mammals, 1999-2008. (Source: ARC).

# Responses



Pest control on both the mainland and the larger offshore islands is occurring on an increasingly larger scale and is reducing the numbers of target pest species to extremely low levels. For example, between 2004 and 2007, possum control on 42,803 hectares of HCV land achieved a residual trap catch of less than 3 per cent.

Although control and eradication of pest mammals is generally improving, it is increasingly recognised that the ecological consequences of pest control are not always clear. This is because the direct and indirect interactions between different pest species are not easy to predict. For example, in the podocarp-broadleaf forests of the central North Island, the numbers of ship rats increased five-fold following possum control operations. This increase was attributed to the greater availability of, and reduced competition for, seeds and fruit.

To address these difficulties, improvements are being made to pest control operations through a more integrated approach. This will help to ensure that the relative advantages and disadvantages of different pest control operations can be determined.

### Working with land owners and communities

Community groups and private land owners play an important role protecting and restoring native biodiversity on public and private land. For example, over 300 community groups exist in the Auckland region with more than 4000 people actively involved in the restoration of biodiversity.

Biodiversity-focused groups operating within the Auckland region range from longstanding, organised and registered community groups and landcare groups, to smaller, less formalised groups, schools and individuals. Examples of community based support for conservation on regional parkland and DoC estate include Tawharanui Open Sanctuary Society, Shakespear Open Sanctuary Society, Ark in the Park, and Supporters of Tiritiri Matangi.

The ARC recognises the value and importance of this voluntary work and fund these groups and individuals to ensure they can continue to undertake projects that contribute significantly to local and regional biodiversity.

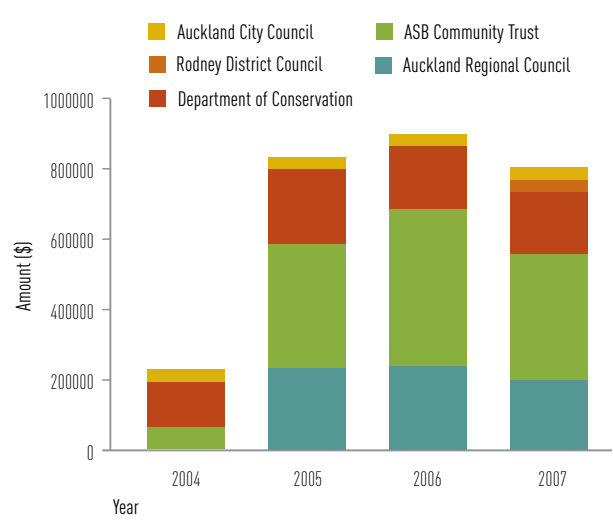
### Funding for community groups and private land owners

Approximately half of the native land cover in the Auckland region is on private land which contains many rare and threatened native species. Consequently, private land owners play a critical and increasing role in the protection and restoration of native biodiversity. Community groups are hugely important in biodiversity management on many public land areas (e.g. Shakespear Regional Park).

Both national and local government agencies fund biodiversity-focused community groups (Figure 10). Some of the major biodiversity funding available in the Auckland region include:

- Environmental Initiatives Fund (EIF) administered by the ARC
- Biodiversity Condition and Advice Fund administered by DoC and MFE
- Natural Heritage Funds administered by local councils, e.g. ACC and RDC
- ASB Community Trust.

The ARC established the EIF in 1999 (Box 8). About \$500,000 is available each year to support projects. This is at the upper end of funding compared to other regional councils but relatively low on a per capita basis (Table 3 page 246). Biodiversity projects funded by EIF can be separated into education, planting, fencing, and animal and plant pest control activities. At least one of these activities is usually the main focus of the funding applicants.



**FIGURE 10** Total amount and relative proportions of community funding allocated to biodiversity projects by regional agencies, 2004-07. (Source: ARC).

Table 3 compares the total annual funds that are available from eight of the 16 regional authorities in New Zealand. This funding is specifically to support members of the community who are carrying out conservation and restoration of biodiversity on private or public land. The total amounts vary greatly between the regional authorities as a result of different funding and eligibility criteria.

# Responses

**TABLE 3** Comparison of annual biodiversity funding available from eight regional authorities. (Source: ARC).

Regional Authority	Annual funding amount	Eligible projects
Northland Regional Council	\$520,000	Environmental
Auckland Regional Council	\$500,000	General: Biodiversity, sustainability and cultural heritage
Environment Bay Of Plenty	\$450,000	Environmental
Taranaki Regional Council	\$112,000	Biodiversity
Horizons Manawatu Regional Council	\$369,000	\$324,000 for bush and wetland sites and remainder for general biodiversity
Greater Wellington Regional Council	\$170,000	Biodiversity
Environment Canterbury	\$220,000	Environmental enhancement and the Honda Tree Fund
Otago Regional Council	\$200,000	Environmental enhancement

## Contributions from community groups and private land owners

Community groups and individuals carry out a variety of valuable biodiversity-related activities including:

- propagating and planting native vegetation
- pest control operations for terrestrial pest plants and pest mammals
- environmental monitoring
- species translocations
- increasing public awareness through advocacy and education.

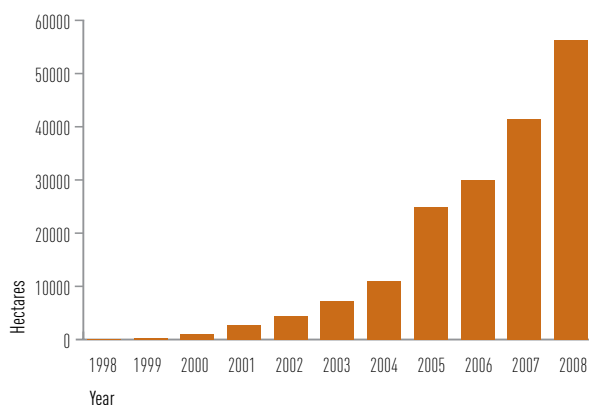
The amount of time and resources that are provided voluntarily by members of the community in order to carry out these activities contribute significantly to the restoration and protection of native biodiversity in the Auckland region, on both private and public land. For example, members of the community planted over 45,000 native plants in 2007 with assistance from our EIF. In 2008, community groups and private land owners worked together to conduct pest control operations on more than 56,300 hectares, an enormous increase on the 100 hectares in 1998 (Figure 11).

### QEII covenants in the Auckland region

The ARC is not the only agency working with land owners to help protect terrestrial biodiversity within the Auckland region. The QEII National Trust has been active for many years and works closely with us, DoC and the district councils (Box 14).

We actively promote QEII covenants through liaison activities with land owners and biodiversity protection work, and the ARC provides technical support to QEII representatives.

The first QEII covenant within the Auckland region was registered in 1981. Since then, 2795 hectares have been protected under 216 covenants (Figure 12). These include areas of podocarp-broadleaf forest, coastal forest, coastal wetlands, lowland forest, scrublands, wetlands and archeological sites.



**FIGURE 11** Number of hectares under pest control by community groups or private land owners in the Auckland region, 1998-2008. (Source: ARC).

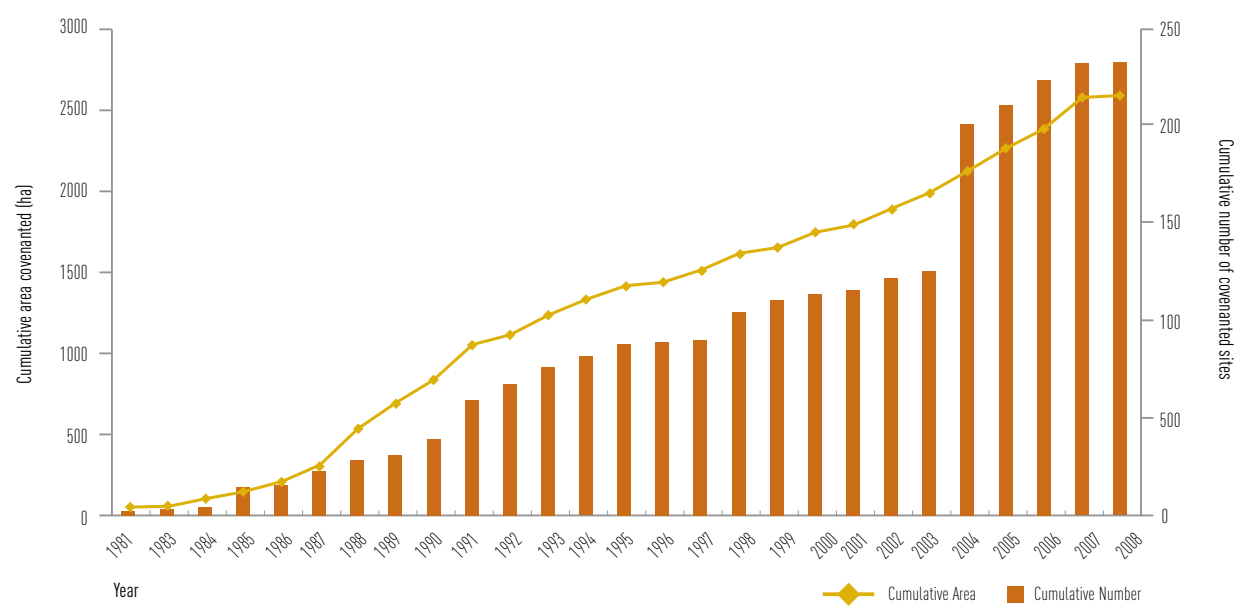
## Box 14 The Queen Elizabeth II National Trust

The Queen Elizabeth II National Trust (QEII) is an independent statutory organisation that was set up in 1977 to encourage and promote (for the benefit of New Zealand), the provision, protection, preservation and enhancement of open space.

It helps private land owners to protect significant natural and cultural features on their land through open space covenants, and acts as a perpetual trustee to ensure that these values remain protected forever. Features that can be protected include landscapes, forest remnants, wetlands, grasslands, threatened species habitats, and cultural and archaeological sites.

A QEII open space covenant is a legally binding protection agreement registered on the land title. It is voluntary but, once in place, binds the current and all subsequent land owners. Each covenant is unique, with varying applicable conditions.

# Responses



**FIGURE 12** Cumulative area (hectares) and number of QEII covenants in the Auckland region, 1981-2008. (Source: ARC).

### QEII covenants: are they working?

The number of QEII covenants on private land continues to grow in the Auckland region, reflecting the commitment and support from private land owners for biodiversity protection.

QEII national monitoring shows that the majority of covenants not only meet the terms and conditions of their covenants but exceed them. This is partly because a QEII covenant is a voluntary partnership normally requested by the land owner, and partly due to the ongoing support and involvement provided by QEII.

The QEII model of protection has proven to be a robust, simple and cost-effective tool for resource management and biodiversity protection.

### Acquisition and management of regional parks

The most significant and direct impact that the ARC has made towards protecting and enhancing terrestrial biodiversity across the Auckland region results from the management and expansion of our regional park network.

Regional parks are managed according to the Regional Parks Management Plan (RPMP). This plan sets out the overall management policies and principles, including guidance on how the regional parks will be used, developed and restored. The RPMP also includes specific policies and actions for each regional park.

Although the aims and purposes of the regional park network are much broader than the protection of our terrestrial biodiversity, their management and planning framework favours the protection of existing valuable and sensitive ecological features. Therefore, the regional park network provides a haven for remaining native vegetation and habitat types that might otherwise be lost or degraded through development.

Policies in the RPMP promote biodiversity protection by restoring, expanding and enhancing different habitat types and engaging in species recovery programmes. Other major benefits to the ARC's regional park network include the protection of coastal values (Box 15).

### Box 15 Coastal protection resulting from the acquisition of regional parkland

Our 1999 Parks Acquisition Plan includes a parklands acquisition policy that identifies, as a priority, the future acquisition of prime coastal locations that have high recreational potential associated with the beaches.

The Regional Open Space Strategy produced by the Regional Growth Forum also identifies the preservation and protection of the natural character of the coastal environment as a desired outcome.

The effect of these policies is evident in the recent additions to our regional park network, as all recent acquisitions including Pakiri (2005), Atiu Creek (gifted to the Auckland region in 2005), Te Rau Puriri (2006) and Te Arai Point (2008) were coastal properties.

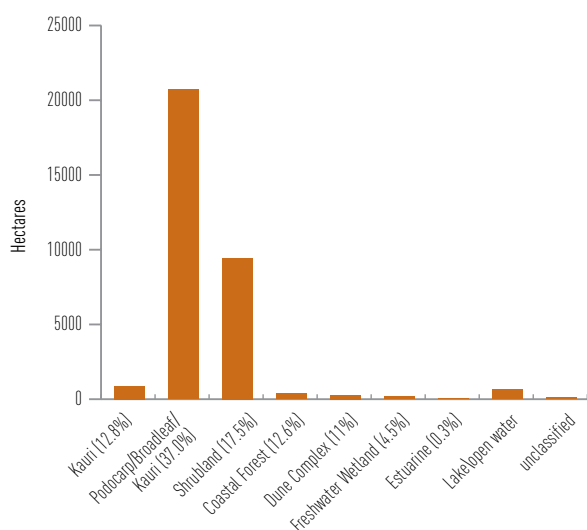
Another benefit resulting from these additions to the regional park network is the protection of these coastal areas from development.

# Responses

## Extent of the regional park network and habitat types

The regional park network presently covers about 40,700 hectares (8.1 per cent of the total land area within the Auckland region) and includes a number of native ecosystems of ecological significance.

Collectively, the regional parks protect a number of nationally and regionally important ecosystem and habitat types such as broadleaf/podocarp/kauri forest, shrublands, freshwater wetlands, dune systems and estuarine areas (Figure 13). Even though the regional park network covers less than one tenth of the land area within the Auckland region, it contains almost one quarter (24 per cent) of the native ecosystems found within the Auckland region.



**FIGURE 13** Size (ha) and relative proportion of each ecosystem type in the Auckland region that exist within the regional parks. (Source: ARC).

Podocarp/broadleaf/kauri forest is well-represented, largely due to dominance of this ecosystem type within the regional parks in the Hunua and Waitakere Ranges. The regional parks network also provides protection for threatened ecosystem types such as wetlands, dune systems and coastal forest. Many of the remnant ecosystems are the best examples of their type in an ecological district. Examples include, coastal forest at Wenderholm, Tawharanui, Scandrett and Duder regional parks, dune systems at Pakiri, Whatipu and Muriwai, and protected and restored wetland at Awhitu, Whatipu and Tawharanui. Te Arai protects nationally rare dune lake ecosystems.

The regional park network supports a large proportion of the native terrestrial biodiversity found in the Auckland region including 49 per cent of birds, 54 per cent of reptiles, one of the two native bat species, the single amphibian and (at least) 13 of the 17 species of native freshwater fish.

## Threatened species in regional parks

Non-threatened native ecosystem types make up the majority of ecosystem types in the regional park network, but the importance of the regional parks in maintaining native terrestrial biodiversity is clearly shown by the number and proportion of threatened species within them.

In total, almost 100 nationally threatened plants and vertebrates are known to exist in the regional parks. These represent 46 per cent of the threatened plants and vertebrates that are known to occur in the Auckland region and reflect the quality and quantity of habitat types found within the park network. Threatened invertebrates are also known to occur within the regional parks but detailed information on these has not been collated.

Several regional parks act as national or regional strongholds for some threatened species, e.g. the only population of North Island kokako on the mainland in the Auckland region exists in the Hunua Ranges regional park. The regional parks in the Waitakere Ranges and Hunua Ranges act as national strongholds for populations of Hochstetter's frog.

In some cases, regional parks are the only known remaining locations for some threatened plant species, e.g. the Waitakere Ranges regional park supports the only known location of *Hebe bishopiana* in New Zealand. This species is endemic to the Waitakere Ranges.

Although a list of regionally threatened fauna has not yet been developed, there is a list of 300 regionally threatened plants. At present, only 13 of the 26 regional parks have been surveyed closely but already two thirds (200) of these regionally threatened plants have been found within them. This suggests that much of the native flora is protected within regional parkland, and that a range of protected habitat types provide opportunities for a diverse range of plant species to persist.

Few surveys of threatened plants and secretive, rare or cryptic fauna have been completed on private land. Consequently, it is possible that more threatened species may yet be found within the Auckland region. This possibility also applies to the regional parks that have not yet been surveyed.

## Parkland acquisition and conservation management: is it working?

Regional parks provide critical protection for terrestrial biodiversity in the Auckland region, as shown by the range of habitat types and number of threatened species within them. However, when viewed purely from a terrestrial biodiversity protection perspective, the existing parkland acquisition strategy is, by itself, not sufficient to achieve the regional biodiversity protection objectives.

About half of the remaining native land cover in the Auckland region is protected, as district or regional council parks or DoC estate, but the proportion of protected native land cover varies across different ecosystem types and ecological districts (Table 4). On the positive side, 73 per cent of the remaining kauri forest and 70 per cent of the remaining dunelands are protected. On the negative side, only a tiny amount (0.5 per cent) of lava forest remains and of this, only 17 per cent is protected. Similarly, only 38 per cent of the remaining 4 per cent of freshwater wetlands or wetland forest is protected.

TABLE 4 Extent (hectares) of native ecosystems and areas under protection. (Source: DoC).

Vegetation Class	Remaining hectares	% remaining	Protected hectares	% protected
Brackish estuarine	14093	Unknown	2289	16
Coastal forest	3160	3	1356	42
Dune vegetation	2577	15	1806	70
Freshwater wetland and wetland forest	3731	4	1427	38
Kauri forest**	6972	9	5119	73
Lava forest*	29	0.5	5	17
Podocarp/broadleaf/kauri	56030	20	31736	56
Shrublands	54096	Unknown	20201	37
Unclassified	6362	Unknown	732	11
Total	132957	24	66476	49

\* This excludes Rangitoto Island which is considered to be early successional lava forest.

\*\* Accuracy of data is uncertain.

Consequently, there is a strong case for future efforts to protect native terrestrial biodiversity in the Auckland region through habitat protection that will focus on lava forest, freshwater wetlands and wetland forest, and coastal forest.

### Conservation management: species recovery

Many ecosystems in the Auckland region have lost significant components of their fauna so efforts to reinstate these components in order to restore important ecological functions such as pollination, seed dispersal and recycling of nutrients is supported by conservation agencies.

Recent advances in pest management and habitat restoration efforts on both public and private land have enabled a number of species to be transferred to sites where they were known (or were likely to have been) present in the past. Such transfers are known as 'translocations' and are often necessary to help the recovery of threatened species or to restore the ecological integrity of degraded ecosystems.

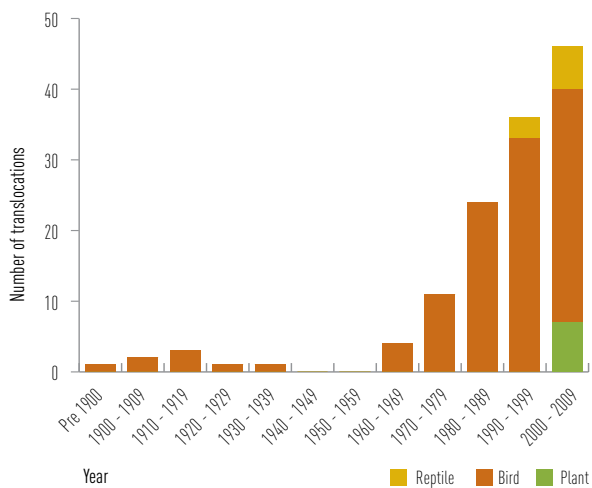
We instigate and project manage (in collaboration with DoC) translocations to our regional parks and, in some instances, assist with translocations on private land.

### Translocations

Given the increasing number of offshore islands and ecosystem types that are now free of pest mammals, there are growing opportunities to translocate native species. Correspondingly, there is an overall trend of increasing numbers of translocations and an increased variety of species are being translocated (Figure 14).

The proportional increase in non-bird translocations (including lizards, invertebrates and plants) is due partly to an increasing recognition that these species also form important components of ecosystems, and partly to improved translocation techniques (e.g. for reptiles).

# Responses



**FIGURE 14** Number of translocations in the Auckland region per decade, pre-1900 to 2009. (Source: ARC).

The high proportion of bird translocations is expected to remain, partly because compared to more secretive species (e.g. reptiles), it is usually very clear if a bird species is absent from a chosen release site. Also the risk of failure is too high for some other species (particularly plants and invertebrates) due to insufficient knowledge about their habitat requirements, key threats or the most suitable translocation procedures. Bird translocations are also very popular with the public.

### Translocations: are they working?

Currently there is no database that records whether a translocation has succeeded or failed, and in some cases the level of monitoring performed after the release is inadequate to determine the outcome.

In some instances, the size of the founder population is small and this may compromise the genetic diversity of the population in the long-term. However, translocations have contributed very positively to threatened species recovery and ecosystem health in the Auckland region, with a total of 22 translocated species known to persist at ten sites (Table 5).

**TABLE 5** Translocations where the translocated species are known to persist. The term ‘persist’ includes species that are well established and breeding in the absence of conservation management, species that have been recently translocated, and species that persist in low numbers and require active management. (Source: ARC).

Species	Translocation date	Release location
Little spotted kiwi	1993/96	Tiritiri Matangi Island
North Island brown kiwi	1863/64	Kawau Island
	1903/19	Little Barrier Island
	1964	Ponui Island
	1999	Motuora Island
	2006/08	Tawharanui Open Sanctuary
Black petrel	1986/90	Little Barrier Island
	1987-2002	Tiritiri Matangi Island
Brown teal (Pateke)	2008	Tawharanui Open Sanctuary
	1991/95	Tiritiri Matangi Island
Takahe	1991/95	Tiritiri Matangi Island
Red-crowned parakeet (Kakariki)	1974/76	Tiritiri Matangi Island
	2008	Motuihe Island
North Island robin	1992/93	Tiritiri Matangi Island
	1999	Wenderholm Regional Park
	2004/05	Great Barrier Island
	2005	Waitakere Ranges (Ark in the Park)
	2007	Tawharanui Open Sanctuary

Contd...

# Responses

**TABLE 5** Translocations where the translocated species are known to persist. (Source: ARC). (Contd)

Species	Translocation date	Release location
Whitehead	1989/90	Tiritiri Matangi Island
	2004, 2008	Waitakere Ranges (Ark in the Park)
	2007	Tawharanui Open Sanctuary
New Zealand fernbird	2001/02	Tiritiri Matangi Island
North Island kokako	1997-2000	Tiritiri Matangi Island
North Island saddleback (Tieke)	1984/88	Little Barrier Island
	1984/90	Tiritiri Matangi Island
	2005	Motuihe Island
Stitchbird (Hihi)	1995/96	Tiritiri Matangi Island.
		Waitakere Ranges (Ark in the Park)
Common diving petrel	2007/08	Motuora Island
Rifleman	2009	Tiritiri Matangi Island
Weka	1863 (approx.)	Kawau Island
Northern tuatara	2003	Tiritiri Matangi Island
Duvaucel's gecko	2005	Tiritiri Matangi Island
	2006	Motuora Island
Forest gecko	2005	Tawharanui Open Sanctuary
Auckland green gecko	2006	Tawharanui Open Sanctuary
Shore skinks	2006	Tiritiri Matangi Island, Motuora Island
	2008	Motuihe Island
Flax snails	Unknown	Noises Island
Kauri snails	Unknown	Waitakere Ranges
	Unknown	Awhitu Peninsula
<i>Clianthus puniceus</i> var. <i>puniceus</i> (Kakabeak)	1997	Moturemu Island (Kaipara harbour)
<i>Dactylanthus taylorii</i>	1998	Tiritiri Matangi Island
<i>Ileostylus micranthus</i> (Green mistletoe)	1996	Whakatiwai
	2005	Waitakere Ranges (Ark in the Park)
<i>Euphorbia glauca</i>	2002	Brown's Island (Crater Bay)
	2003	Brown's Island
<i>Lepidium flexicaule</i> (Shore cress)	2000	Rangitoto Island

# Responses

## Case Study: Tawharanui Open Sanctuary

Tawharanui (588 ha) is one of Auckland's best loved coastal regional parks. It lies at the tip of Takatu Peninsula, a long finger of land, which reaches out into the Hauraki Gulf towards Little Barrier Island.

The landscape is an attractive mix of sandy ocean beaches backed by extensive dunelands, rocky coves and headlands, saltmarshes, freshwater wetlands, coastal broadleaf forest, scrublands and open pastureland.

Tawharanui has one of the best swimming beaches on Auckland's east coast and there are numerous shady picnic sites, a spacious campground and many well marked walking trails. A no-take marine park extending several kilometres along the northern coast holds good populations of various reef fishes, rock lobsters and other marine life characteristic of the sandy and rocky shores of Auckland's east coast.

Since the park was acquired in 1973, about 400 ha of natural habitats and steep gullies have been progressively retired from grazing, with about 150 ha retained as a working sheep and cattle farm. Some retired areas have been left to regenerate naturally, and other areas, including some wetlands, have been actively revegetated with thousands of ecosourced plants and trees. This revegetation is restoring lost habitats and rebuilding linkages through the landscape.

In the 2002 Regional Parks Management Plan, Tawharanui was identified for development as an open sanctuary to be protected by a pest-proof fence along the park's western boundary. In the mid-1990s, intensive pest control was established in the Hunua Ranges to protect a relict kokako population and at Wenderholm Regional Park to protect nesting kereru. With the experience the ARC gained at Hunua, and in particular at Wenderholm, it was clear that Tawharanui would benefit from so-called mainland island management to protect its natural values, and that this management would enhance the public's enjoyment of an already popular regional park. Elsewhere in New Zealand, DoC and various community groups were also establishing successful mainland islands following big improvements in pest-proof fencing technology and aerial poisoning to remove predatory mammals.

A working group comprising ARC staff and contractors, representatives of the local community and iwi was created to co-ordinate the development of the sanctuary. A specialist open sanctuary co-ordinator was also appointed. A supporters' group, the Tawharanui Open Sanctuary Society Inc. (TOSSI), was also established to assist the ARC to raise funds for the pest-proof fence, and to support and help generally with management of the open sanctuary. Fundraising and volunteer support by TOSSI has been essential to the success of the project. The society has also raised the profile of the sanctuary through its website and newsletters, and its biennial 'Art in the Woolshed' has become a very well attended fundraising event in the local arts calendar.

A 2.5km Xcluder pest-proof fence costing \$650,000 was installed across the inner boundary of the park in July 2004, and two aerial poison drops to eradicate pest mammals were carried out in September and October of that year. Although there have been some pest incursions around the coastal fence-ends, the sanctuary remains largely free of the most important predatory mammals such as possums, rats, feral cats and mustelids.

Low pest numbers in the sanctuary quickly resulted in significant recoveries of existing fauna in the park such as shore skinks, tui and kereru. Several locally-extinct species have recolonised, and a number of reintroductions of other missing species have been carried out. Bellbirds, formerly absent from most parts of the Auckland mainland, colonised the park en masse from nearby Little Barrier in early 2005 and are now the second most abundant forest bird, while kaka and grey-faced petrels are also now breeding at Tawharanui after a long absence. Since 2005, green and forest geckos, brown kiwi, pateke, red-crowned kakariki, whiteheads and North Island robins have also been reintroduced. Several species are now so abundant that Tawharanui is being used as a source of fauna for translocations to other sites. Shore skinks have been transferred to Motuora, Motuihe and Tiritiri Matangi, while bellbirds will be transferred from Tawharanui to Motuihe and Waiheke in 2010. Plans are afoot to apply the successful Tawharanui open sanctuary model to Shakespear Regional Park, where Auckland's second predator-fenced open sanctuary will be established.



Photo: Bringing back pateke to Tawharanui. (Source: ARC).

# Responses



Photo: The Tawharanui Peninsula. (Source: ARC).

# Responses

## Case Study: Lake Wainamu

Wainamu is a 14 hectare dune lake located near Bethells Beach on Auckland's west coast. It was formed by a large sand dune that dammed three streams (Plum Pudding, Houghton and Wainamu) and which is now the lake's dominant feature.

Most of the surrounding land is regenerating bush administered by the Queen Elizabeth II National Trust but managed by the ARC. Some pastoral farming is still carried out on the lake's north-eastern perimeter. In summer the lake is a popular spot for swimming and sightseeing, and it is regularly used as a location by film crews.

Unfortunately the lake has been compromised by the introduction of a suite of unwanted fish and aquatic weeds that threaten its recreational and ecological values.

From the mid-1970s the exotic fish rudd, tench and perch were illegally introduced to the lake. Other exotic species introduced include brown bullhead catfish, goldfish and gambusia. Together these fish have caused considerable damage to the lake's ecology, they hunt and compete for food with native fish species and disturb the lakebed through their feeding habits.

It is possible that the invasive aquatic weed *Egeria densa* (oxygen weed) was also introduced to the lake with these illegal fish introductions. Although *Egeria*, which is designated a Surveillance Pest Plant under the Regional Pest Management Strategy, was not recorded in Lake Wainamu prior to 1990 it was likely present at very low levels. By 1995 however, it had become so established that it had colonised the entire available habitat in the lake to 4m depth. Extensive meadows of native charophytes were smothered and reduced to small pockets around the lake, while large surface-reaching swards of *Egeria* extended around much of the lake's shoreline, raising local community concerns about the possibility of swimmers becoming entangled.

By 1996 the lake could no longer support the amount of *Egeria* and the vegetation collapsed, leading to a drastic decline in water clarity. This catastrophic change further heightened community concern for the lake and investigations undertaken in 2001-2003 implicated exotic fish as a contributor to the *Egeria* collapse, while confirming the negative role these fish had on the re-establishment of native aquatic plants.

In order to address the threat of introduced fish to the lake, the ARC instituted a fishing programme in 2004. Since then, over 10,000 fish have been removed from the lake and the water quality has shown a corresponding improvement. The amount and size of exotic fish caught using gill nets has also decreased over this time, indicating that the ongoing fishing pressure is effecting the populations of exotic fish in the lake.



Photo: Lake Wainamu showing dune feature. (Source: ARC).

# Responses



Photo: NIWA scientists gather weed from Wainamu. (Source: ARC).

As a result of the increase in water clarity, *Egeria* began to re-establish in the lake and its density is now reaching levels seen prior to its collapse in 1996.

To prevent this same boom/bust cycle from repeating itself, ARC staff investigated options to manage *Egeria* within the lake. Mechanical control methods (suction dredging, hand removal by divers or mechanical harvesting) were all discounted as being expensive, logistically difficult and unable to deliver a long-term solution to the problem.

Likewise, chemical control using herbicides was rejected as offering only temporary control, likely to be opposed by the local community and tangata whenua.

The most cost-effective and environmentally-friendly option was the use of biological control, namely the introduction of herbivorous grass carp (*Ctenopharyngodon idella*). It was also the only option that could completely eradicate *Egeria* from the lake, thereby eliminating the need for an ongoing long-term control programme.

Grass carp are native to Asia and have been successfully used to eradicate *Egeria* from a number of water bodies in New Zealand. They are a different species from the pest fish koi carp and are unable to breed in New Zealand, making them suitable for weed control.

In March 2009 we released 270 grass carp into the lake with the approval of DoC, Fish & Game, local community and iwi. Each fish is radio-tagged so their numbers and growth rates can be tracked.

The ARC expects that these fish will completely eradicate *Egeria* from Lake Wainamu within five years, at which point they may be removed. The native vegetation that once dominated will naturally regenerate from the seed bank still present in the lake's sediment, resulting in a more stable and natural ecosystem than has existed recently.

Yearly monitoring of the grass carp and six-monthly weed surveys allow us to track the progress of the lake restoration and assess the effectiveness of the grass carp over time.

This case-study illustrates the complex nature of ecosystems that have been affected by the introduction of exotic pest species, and highlights the need for a range of management solutions to deal with their impacts.



Photo: Grass carp release. (Source: ARC).