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MAF

Water Programme of Action

Potential Water Bodies of National Importance

Technical Working Paper

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Water Programme of Action: The Effects of Rural Land Use on Water Quality – Technical Working Paper, July 2004

The interdepartmental Working Group involved in the Water Bodies of National Importance project comprises of the following government departments:

- Ministry for the Environment
- Ministry of Agriculture and Forestry
- Ministry of Economic Development
- Ministry of Culture and Heritage
- Ministry of Tourism
- Te Puni Kokiri
- The Treasury
- Department of Conservation.

Contents

1 Purpose

The purpose of this summary report is to describe progress with the potential water bodies of national importance sub-projects. This is the first stage of work within the Water Programme of Action on how the nationally important values in water may be protected or secured. Completion of the sub-projects is only the first phase of work in the development of methods and criteria for determining the nationally important values of water bodies. The project aims to ensure that water bodies with nationally important natural, economic, social or cultural values are protected or secured.

2 Why Identify Water Bodies of National Importance?

The overall objective of the Water Bodies of National Importance project is to ensure appropriate recognition and protection of nationally important values in the management of New Zealand's water bodies. Water bodies include lakes, rivers, groundwater aquifers and wetlands. As an initial step, methods were trialled to create separate lists of potential water bodies of national importance for irrigation, energy generation, tourism, recreation, industrial and domestic use, and natural heritage. In addition, a method has been developed to enable identification of potential water bodies of national importance for cultural and historic heritage.

Many countries identify and protect water bodies that are important for natural heritage, scientific or scenic values (for example, Australia, Canada and the United States of America have Heritage River programmes). However, there is little evidence to suggest that the identification of water bodies of national importance within a sustainable development framework is widespread.

In the past, water bodies of national importance for natural, social or cultural heritage values have been protected on a case-by-case basis by site-specific legislation and a range of other tools. Examples of the tools include:

- special lake protection statutes such as the Lake Wanaka Preservation Act 1973 and the Lake Waikaremoana Act 1971
- regulations in the form of (National) Water Conservation Orders
- the establishment of statutory Guardians of Lake Manapouri, Monowai and Te Anau.[1]

Non-legislative methods have included the establishment of different types of Reserves or National Parks such as Natural Reserves (eg, Lake Christabel), Faunistic Reserve (Lake Chalice), Scientific Reserve (Waikanae River Mouth and Estuary) and National Park (Lake Te Anau).

Where a water body is of both national importance and importance to tangata whenua, special co-management agreements and legislation have sometimes been established such as for Lake Taupo in 1926 and 1990, Lake Ellesmere/Waihora in the Ngai Tahu Claims Settlement Act 1994, and for Lake Horowhenua (various reserves and eel protection status).

Recent examples of the government's approach to managing nationally important water bodies include contributing to addressing the water quality problems of Lake Omapere, Lake Taupo and Lakes Rotorua and Rotoiti. The principles of the Sustainable Development Programme of Action require a more strategic approach for securing nationally important values associated with water bodies. This initial project starts to provide specific criteria and greater clarity about which water bodies may be of national importance and why.

The initial work in developing methods, criteria and lists of potential water bodies of national importance will contribute to the overall work on the national interest in water. The Water Bodies of National Importance project should not be considered in isolation. Under the Water Programme of Action there is ongoing work on water quality, and water allocation and use. However, potential uses of the methods and lists are outlined below.

[1] The Guardians provide independent advice to Minsters and local authorities on lake levels and river flows.

Potential use	For example
Assist local/regional government processes	Provide information to assist in the development of local/regional policies and plans.
Provide a basis for developing a whole of government view on the nationally important values of individual water bodies	Provide a framework for assisting the development of local/regional/central government partnerships to enable proactive management. Competition between uses may be able to be resolved on a regional or catchment scale, rather than at individual locations. Testing methods and criteria for each of the values. Identifying gaps in available data and evaluate costs/benefits of filling those gaps. Central government contributes to multi-agency investigations on water bodies or catchments with multiple values. Development of whole of government plans of action for particular water bodies (eg, instead of independent Regional Plans, and National Park or Reserve Plans).
Once developed, methods and lists provide the basis for individual departments to prioritise advocacy and/or operational investment for particular water bodies.	The natural heritage list shows where the Department of Conservation could focus future work on the protection of biological diversity, required under the Biodiversity Strategy.
Enhanced use of existing tools to secure both individual and multiple values of national importance.	National Policy Statements with differentiated policy direction for water bodies of national importance. National Environmental Standards with differentiated standards/processes for water bodies of national importance The call-in provisions of the Resource Management Act could be used for water bodies of national importance The existing water conservation order provisions of the Resource Management Act could be used to protect outstanding instream values such as tourism, natural heritage, and recreation. Formal designation as Ramsar sites of those water bodies of national importance that meet international importance criteria under the Ramsar Convention on Wetlands. Beds of water bodies of national importance could be legally protected by transferring them to National Park or Reserve status from unallocated Land of the Crown.
Basis for investigation and development of new tools to secure both individual and multiple values of national importance.	Pilot projects could be used to test new tools developed under the allocation and quality projects. Central government could adopt an approval role on regional plans for freshwater.[2] A schedule could be attached to the Resource Management Act, specifying individual water bodies and the values that are nationally important. Special legislation could be developed to impose standards or procedures to help manage individual catchments (eg, Lake Wanaka Preservation Act). The Water Conservation Order provisions of the Resource Management Act could be modified or replaced to enable abstractive values to be secured outside of the amenity and intrinsic values.
Central government funding.	The lists of nationally important water bodies could be used to prioritise existing funding (eg, biodiversity funds or sustainable management funds). Future funding could be investigated for initiatives associated with particular water bodies.

[2] Consistent with current central government role in approving Regional Coastal Plans.

Potential use	For example
Requiring monitoring, reporting and evaluation.	Monitoring and reporting could be required at the national level.[3] A monitoring programme could measure aspects of tourism, historic heritage, industrial uses, population growth, recreational use, energy generation and land use practices.

Potential uses of the water bodies of national importance work are not necessarily mutually exclusive. It is possible that many of the above potential uses may be appropriate.

The national interest in freshwater and water bodies generally arises from two sources. Firstly, the right to use water is vested through law in the Crown, which delegates management responsibility to regional councils through the Resource Management Act 1991. Despite the devolution of most decision-making powers, the accountability under international conventions still lies with the Crown. The inability of the Crown to deliver on international convention expectations for water bodies was highlighted by the recent report of the Auditor-General on the Ramsar Convention.

Secondly, an important aspect of Government's role is to safeguard the values that are of national importance.

While water management in New Zealand is largely the responsibility of regional councils, central government involvement may be considered when issues of national interest are at stake. Particularly when the respective local authority has weak incentives to take these values of the broader community, into account. This is likely to occur when benefits of local-level activity (eg, investment) are not captured solely by the region, but accrue to the nation as a whole.

National interest is not a static concept and may be defined in specific circumstances through political and legal processes. In general terms, Central Government may be interested when the effects of regionally-based decision-making impact significantly on the wider national community. These may occur in such circumstances where there is:

- a disproportionate cost (economic, social, cultural or environmental or a combination) to the nation through a proposal not proceeding
- a significant benefit (economic, social, cultural or environmental or a combination) to the nation through a proposal proceeding
- a need to ensure that Crown vested resources are allocated in a way that provides for the full range of existing and future needs of the nation
- a need to ensure efficient integration of infrastructure that crosses local government boundaries
- the water body largely contained within a National Park or other Crown vested park or reserve.

Agreement on the national interest may involve trade-offs between different national interest outcomes.[4] Specific proposals may affect matters of national interest depending upon their location, scale, the risks involved if they do not go ahead and the values of the environment in which they are proposed.

[3] Triennial reporting is currently required for all Ramsar sites to the Convention Secretaria.

[4] Methods are yet to be developed to resolve conflicting values.

2.1 What are we aiming for?

Local government is largely responsible for managing freshwater. Reconciling the diverse interests is difficult. Differences can arise at the regional level, and between local and national interests. An important aspect of Government's role is to safeguard the values that are of national importance. The proposed outcome for this project is that nationally important natural, social, economic or cultural values of water bodies are protected or secured.[5]

We will have succeeded if:

- proactive action secures nationally important values
- the best available information supports decisions
- mechanisms across landholdings, catchment, district, regional and national levels are integrated
- decisions are made at the lowest practical level of governance
- high compliance costs are avoided
- uncertainty and risk are minimised
- decisions are timely.

2.2 What is the problem?

Since the Resource Management Act (RMA) was passed in 1991 New Zealand has generally not adopted a proactive approach to determining the national interest in freshwater. There is no general statement of the national interest in freshwater. The approach for individual water bodies has been largely reactive, and involves responding to projects and regional plans as they arise rather than providing a national context. This has resulted in a lack of certainty for local government and stakeholders, and *ad hoc* decision-making.

Potentially conflicting interests in water at national level, and between national and regional level are difficult to address proactively. Potential synergies are not necessarily identified without information about the relative significance of those interests and their dependencies. Existing frameworks and processes for resolving competing national interests and optimising complementary outcomes are poorly developed and inadequately used.

The national instruments currently available in legislation (eg, national policy statements, national environmental standards) have been under-utilised.

[5] This suggested outcome differs from that specified in the Sustainable Development Programme of Action. Securing economic values has subsequently been proposed as an outcome, to ensure the project is consistent with a sustainable development approach. The outcome agreed in the Sustainable Development Programme of Action is that "water bodies with nationally significant natural, social or cultural heritage values are protected".

3 Potential Water Bodies of National Importance

The Water Bodies of National Importance Working Group was tasked with the completion of seven sub-projects. Each would develop a method for identifying water bodies of national importance for that value and a potential list.[6] Most of the projects have developed methods and identified initial lists of water bodies or catchment areas that are of potential national importance. The data sets available to develop the lists have been of varying quality. Projects have been undertaken and potential lists determined for the following values:

- natural heritage
- recreation
- tourism
- energy generation
- industrial and domestic use
- irrigation.

The Maori Reference Group advised that it was inappropriate for individual water bodies to be identified as nationally important for Maori cultural values. Identification of individual water bodies is inconsistent with the view that all water bodies are important to Maori for spiritual, physical and customary reasons. A methodology for determining water bodies of cultural and historic heritage value has been developed, however an initial list of water bodies is yet to be produced.

3.1 Methods used

Methods appropriate for each value have been developed. No common method of determining importance for the different values has been developed, due to the different nature of the values being considered. This has led to some projects identifying relatively few water bodies (eg, 21 water bodies that contribute greater than $5 million of farmgate gross domestic product by supplying irrigation water have been identified), while other projects have identified many water bodies. For example, over 300 water bodies have been identified as potentially nationally important for natural heritage.

Consistent practices were adopted for each of the projects as follows:

- A common spatial framework for recording information (catchments and large sub-catchments) was developed by the National Institute of Water and Atmospheric Research (NIWA).
- Consistent timescales across sub-projects (potential development within 20 years).
- Consistent units to describe national importance as appropriate (net present value and gross domestic product).

[6] A water body has been defined as a river, stream, lake, wetland or groundwater resource.

Although water bodies have been identified on a catchment basis, some projects have identified water dependent values at different scales. For example, the energy sub-project has identified entire catchments, which in some cases include a number of individual water bodies. This does not imply that the whole catchment is important for hydroelectricity generation. Some of the individual water bodies within the catchments have been identified for other values.

At this stage the purpose of the work has been to develop methods and criteria, and identify potential water bodies, rather than identifying areas of potential conflict or complementary uses. It is premature to align the lists and rank the water bodies at this stage.

3.2 Natural heritage (biodiversity and geodiversity)

The criteria for determining national importance were based on identifying the minimum set of water bodies required to achieve the national policy goals for natural heritage protection set out in the Purpose[7] of the Reserves Act, and the Objectives[8] of the New Zealand Biodiversity Strategy for freshwater. Natural heritage includes biodiversity (ecosystems and species) and geodiversity (water body dependent features and geothermal systems).

3.2.1 Approach for biodiversity

Department of Conservation developed a biogeographic framework to help define the full range of natural diversity in freshwater systems. The framework identifies 29 geographic units or zones based around catchment boundaries. The units are likely to have experienced similar catastrophic disturbance histories (eg, glaciation or volcanism), have shared recolonisation source populations and pathways, and the same geographic barriers to the dispersal of freshwater biota.

The candidate list of water bodies of national importance for biodiversity values was calculated from a set of 4706 river catchment units. The work does not yet identify separate lakes and wetlands. The candidate list was produced on the basis of one or both of two rules:

1. The site was listed in the minimum set required for representation of 100 percent of the river classes, and listed among the top ten sites ranked by natural heritage value within the biogeographic unit.
2. The site contained special features (ie, threatened species, floodplain forests), or was connected to a nationally important wetland or estuary.

A wide range of river types were required to fully represent different river systems. The candidate list attempts to cover the full range of biodiversity, including at least 38 species of fish, approximately 70 aquatic bird species and thousands of endemic invertebrate species.

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[7] "The preservation of representative samples of all classes of natural ecosystems and landscapes which in the aggregate gave New Zealand its own recognisable character."

[8] "Protect a full range of remaining freshwater ecosystems and habitats ... using a range of appropriate mechanisms."

Assumptions and limitations

- The list does not fully meet the goal of the New Zealand Biodiversity Strategy – to protect a full range of biodiversity values. Meeting this goal could require the protection of many additional rivers and sub-catchments.
- Minimal weighting has been given to connectivity and buffer functions of rivers to nationally important lakes and wetlands.
- On the West Coast of the South Island, Fiordland, and East Cape North Island, available data on the distribution of introduced fish species is sparse. Identification of systems free of introduced species was unlikely.
- Presence/absence data used for aquatic birds does not differentiate between major populations and single sightings.
- Some major catchments had to be listed because the sections containing values of national importance are found in the lower catchment (eg, mouth of the Waikato River).
- The analysis does not consider groundwater systems or communities.

Results

A total of 177 whole catchments and 57 sub-catchment units were identified as the most valuable rivers for sustaining New Zealand's freshwater biodiversity. These units represent just over 5 percent of the units that were assessed and account for an average of 76 percent of the range of river classes present in New Zealand. An additional 45 catchments were identified as containing sections of river, special features, or populations of threatened species that were also of national significance. With the inclusion of these, the lists covers almost 90 percent of river environments and a viable range of key sites for most threatened species. The final candidate list therefore took a combination of the most natural sites, catchments that made the greatest contributions to the range of river environment classes, and systems with significant populations of threatened species.[9]

Further work to be completed

A more comprehensive list that includes nationally important wetlands, lakes estuaries and groundwater communities is yet to be completed. This is planned to be completed by February 2005.

3.2.2 Approach for geodiversity

The New Zealand Geological Society has been publishing and refining a National Geopreservation Inventory since 1988. The inventory identifies and ranks geological and geomorphological features according to their relative significance and vulnerability to damage, and has been used extensively in RMA planning and prioritising. Department of Conservation (DoC) has selected a subset of those geodiversity features and geothermal systems that are dependent upon associated water body condition and functioning, and which were ranked as either nationally or internationally important.

[9] See Appendix 1 for details.

Assumptions and limitations

- Features of international importance are assumed to also be nationally important.
- The candidate list does not include all features that might be vulnerable to the development of high dam impoundments, but this could be incorporated when the sites of potential dams are known.
- The approach using expert panels of professionals in iterative evaluations is assumed to have progressively identified and ranked the most important elements.
- Additional peer review of the candidate list is required.

Results

We identified 81 geodiversity features, karst/cave or geothermal systems of national importance which were vulnerable to changes in the management of water bodies. Several of the cave and karst systems contain well known features that are also individually ranked as nationally important. These are referred to in Appendix 2. The highest concentrations of these are in the West Coast, Canterbury, Bay of Plenty and Waikato regions.

Further work to be completed

The geographic clustering of several types of systems and features reflects New Zealand's underlying geological regions. There is potential for bias based on the geographic distribution of experts. Peer review and refinement will be possible as the underlying inventories become web-based.

3.3 Recreation

Ministry for the Environment completed three strands of research into recreational activities associated with water bodies:

- a national telephone survey to determine how and where freshwater is used for recreation by the general public in New Zealand
- an internet-based online survey targeted at recreational organisations with an interest in freshwater
- a review of existing information including NIWA angling surveys (2002, 1994), Wetlands of National Importance (1978), Wild and Scenic Rivers of National Importance (1982), Freshwater Recreation in New Zealand (2003), Water Conservation Orders, and anecdotal information about whitebaiting.

A candidate list of water bodies was generated from the three different sources of information. The numbers of responses within each recreation category were ranked for the telephone and internet survey information. The top water bodies for each of the existing information sources were identified, along with the water bodies subject to Water Conservation Orders. The water bodies have not been ranked.

Assumptions and limitations

- Some of the initial list (survey, angling and whitebaiting information) is based on numbers of people using water bodies for recreational activities. This approach assumes there is a correlation between the number of people who visit a water body and its value for recreation. Under this approach the very special and remote places that are not highly visited may be under represented.
- Some of the initial list is based on dated reports or unclear information.
- Comparison across the different sources of information may not be a valid approach.

Results

A total of 106 water bodies were identified as potentially nationally important for recreational use. See Appendix 3 for details.

3.4 Irrigation

The Ministry of Agriculture and Forestry led a process that identified a list of water bodies that support large areas of irrigation throughout New Zealand, or are under active investigation to supply new irrigated areas in the next 20 years. The aggregate area irrigated from each water body was used as the initial criteria for determining which water bodies were of national importance for irrigation. The potential irrigated areas were taken from a survey of the 21 community scheme development proposals currently being investigated.

Land use of the irrigated land was determined using AgriBase and local knowledge to identify the farm types within the irrigated areas. An assessment was also made of alternative uses for the land if it was not irrigated.

The net farmgate returns were determined for irrigated and dryland farm types throughout New Zealand. These were based on 2002/03 prices and include adjustments for changes in farm type and scale.

The water bodies have been valued for the additional Gross Domestic Product (GDP) produced at farmgate from irrigated farms, minus the GDP that would be produced if the same land was in dryland farm types. The result is an indication of the net contribution of irrigation from each water body to farmgate GDP. A threshold value of $5 million annual farmgate GDP was adopted for this project. The water bodies above this threshold represent 78 percent of the total irrigated area in New Zealand and produce 62 percent of the total economic output attributed to irrigation.

Assumptions and limitations

- The basis of determining national interest was total net GDP from the presence of irrigation. Value estimates are at the farmgate. Flow-on impacts through the economy are not included in this analysis.
- Tributaries from which water is taken for irrigation before it reaches the water body are assigned to the destination water body. The results are presented as being attributed to the whole catchment.

- The list is based on aggregate farmgate GDP generated from the supply of irrigation water from the particular water body. Water use information is not available to calculate the marginal return from each additional unit of water.
- The values identified for current irrigation exist alongside the other current values from those water bodies. Potential for irrigation from water bodies may be able to be realised without the loss of other values or indeed may create other benefits for those values.
- The potential area of irrigation and therefore of the value of some water bodies for irrigation is limited by existing legislative conditions. For example, new water abstractions are limited by existing water conservation orders on several water bodies.

Results

A total of 21 water bodies currently produce over $5 million of farmgate GDP by supplying irrigation water. Twelve of these have potential for more development that would produce additional farmgate GDP, and there is one other river not on the initial list that is also being investigated for irrigation development. See Appendix 4 for details.

3.5 Energy

3.5.1 Hydroelectric

The Ministry of Economic Development commissioned East Harbour Management Services, to assess New Zealand's potential hydroelectricity developments with a high to medium confidence level of proceeding over the next 20 years. Potential developments were combined by catchment and the catchments ranked. The Ministry also collated information on existing hydroelectric generation by catchment.

Assumptions and limitations of the East Harbour Management Services Report

- The report has drawn on existing, publicly available information only. In some cases this information is dated which will affect the confidence that can be placed on it. No new surveys of potential hydroelectricity developments were undertaken. In addition, there are likely to be a number of generation opportunities being investigated by interested parties (usually developers or potential developers) that the authors will not be aware of.
- The report identifies *potential* hydroelectricity developments – the potential developments listed have not necessarily been proposed or planned. Development would still be subject to gaining access rights, standard Resource Management Act and Conservation Act processes, and any other relevant legislative requirements.
- Judgement of whether a potential hydroelectricity development has a high to medium probability of proceeding has been undertaken by the consultant, based on a number of criteria further described in the report. The consultants note in the report that this judgement is very subjective. In general:

- potential developments in national parks have been excluded from consideration
- potential developments covered by water conservation orders have not been excluded from consideration as water conservation orders are able to be modified under the Resource Management Act, for example if the outstanding values for which they were protected are no longer present. However, these potential developments have generally been listed as 'prohibited' and the presence of water conservation orders has been noted
- most potential developments in the conservation estate have been excluded because of the high potential adverse effects. However some have been included where, in the consultants view, there is a possibility that the potential development might proceed. Some developments listed are not possible under the Conservation Act, given the specially protected status of the areas in question. The report does not always note which potential developments are located in the conservation estate.

Results

The Ministry of Economic Development set generation of 230 GWh per annum in any one catchment as a threshold for national importance. This threshold was decided upon as it represents one percent of New Zealand's current hydroelectric resource, a proportion that the Ministry considers significant. However, this is essentially an arbitrary judgement and could be re-evaluated. Any catchment that has greater than 230 GWh per annum of either existing or potential generation was therefore identified as potentially nationally important.

Seven nationally important water bodies for existing hydroelectric energy generation were identified, along with ten potentially nationally important water bodies for potential hydroelectric energy generation. See Appendix 5 for details.

3.5.2 Geothermal

The Ministry of Economic Development collated information on New Zealand's existing and potential geothermal resource for electricity generation. Potential electricity generation from geothermal fields was derived from the East Harbour Management Services 2002 report, *Availabilities and costs of renewable sources of energy for generation electricity and heat*. For purposes of consistency, the same 230 GWh threshold for national importance was used.

Three nationally important water bodies for existing geothermal energy generation were identified, along with ten potentially nationally important water bodies for potential geothermal energy generation. See Appendix 5 for details.

3.6 Industrial and domestic uses

The Institute of Geological and Nuclear Sciences Limited was commissioned by the Ministry of Economic Development to attribute economic values to catchments in relation to the water supplied for industry and domestic uses. The work was carried out in four stages:

1. acquiring water allocation information from resource consent databases and attributing the water to various uses
2. determining the proportion of the allocation that is actually used
3. attributing an economic value to a unit of water for each use
4. calculating the value of domestic and industrial water for each catchment.

Projections of future domestic water use were made by multiplying current water use by the projected growth rate in regional populations (between 2001 and 2021). These projections of future domestic water use were used to rank potential water bodies of national importance. Projections of future industrial water use were not made.

Assumptions and limitations

- Information on water allocation could only be identified where there was an individual consent. Industry will often take water from municipal supply, rather than having an individual resource consent. It was assumed that 76 percent of municipal water was allocated to domestic uses and 24 percent of municipal water was allocated to industrial uses. This assumption was based on the Institute of Geological and Nuclear Science Limited's surveys of water suppliers in six districts. However, these percentages were based on limited data and varied considerably among locations.
- Most of the information on consents was collected in 1999. Some of the consent information was incomplete; for example, some consents do not specify use or they contain multiple uses.
- It was assumed that a usage/allocation ratio of 46 percent was typical for domestic water supplies, and a usage/allocation ratio of 40 percent was typical for industrial water supply. Again, these percentages were based on limited data and varied considerably among locations.
- For the purposes of this work, 'total value added' figures of water for various industry uses (derived in a 2001 report to the Ministry of Agriculture and Forestry by Ford et al 2001) were adopted for valuing industrial water use. There are a number of weaknesses associated with this approach:
  - the use of 'total value added' as a proxy of water value is not ideal as it does not take into account the other factors of production that contribute towards the added value
  - averages of the specific uses within each industry category were used which may not provide a good proxy for the specific use of the water. As the specific use is not detailed in the consent information, it is impossible to know.
- There is uncertainty around the value of water for domestic use. For the purposes of this work, the economic value of water for domestic use was assumed to be $\$1/m^3$. This value was derived from a "willingness to pay for water" study undertaken in Christchurch.

- We have not predicted water use for industry in 2021 due to the lack of estimates available on the type and location of industry in 20 years. Predictions of demands for domestic water in 2021, were based on regional population growth projections. These estimates do not take into account intra-regional population change or changes in the efficiency of water use.

Results

As a result of the need to make significant assumptions in relation to water use ratios and water values for each use type, there is a great deal of uncertainty around the economic values attributed to catchments. Nevertheless, the economic values are still of use as a means for comparison within the domestic and industrial categories. As the 'total value added' method used to estimate value of industrial water is different to the 'willingness to pay' method used to estimate value of domestic water, the economic values should not be compared between industrial and domestic categories.

As a result the rankings of catchments are used as a proxy for their importance to the nation. The top ten surface and groundwater bodies from each list are considered to be potentially nationally important. See Appendix 6 for details.

Other alternative methods for identifying national importance include:

- using an index system (ie, attribute an index of 1000 to the economic value of the top ranked catchment in each list and proportional values to each catchment down the list). This approach would allow us to measure relative value rather than just ranking and would also allow comparability between the industrial and domestic lists
- use the volume of water allocation as an indication of importance. This does not take into account the varying values of different uses but would seem to allow a reasonable comparison between the industrial and domestic lists as the top ranked catchment in each list allocates roughly the same volume of water to their respective uses.

3.7 Tourism

The Ministry of Tourism led the tourism sub-project to identify a potential list of water bodies nationally important for tourism in New Zealand. Data from the 2002 International Visitor Survey was used to provide information on water-based tourism activities undertaken by visitors to New Zealand. The total number of people who reported undertaking any freshwater activity in each location was determined to identify the top eight destinations of importance for international visitors. The most popular freshwater activities for international visitors were:

- jet boating
- glow worm caves
- scenic cruise
- caving
- beaches
- swimming
- white water rafting
- fishing in rivers and lakes
- river kayaking
- black water rafting

- other water sports
- sailing
- diving.

The Domestic Travel Survey 2001 data was used to provide information on water related activities undertaken by domestic tourists. The total number of people who reported doing any freshwater activities in each location was determined to identify the top 10 locations. The top 10 freshwater activities were:

- rafting
- swimming
- sitting on the beach
- fishing
- other water sports
- kayaking
- jet boating
- glow worm caves
- sailing/boating
- visiting Huka Falls.

Assumptions and limitations

- Assumptions were made about the actual water bodies visited based on the location and the type of activity undertaken, and from discussions with regional tourism organisation representatives, local councils and tourism operators.
- The list does not include water bodies that may be nationally important for tourism outside of the nine regions identified by the International Visitor Survey and Domestic Travel Survey, with the exception of those identified for their scenic values.
- Information is based on 2002 data for the International Visitor Survey and 2001 data for the Domestic Travel Survey.
- The list does not include water bodies that may be of national importance for tourism in the future.
- The economic value of tourism for individual water bodies has not been determined.

Results

The following nine locations were identified as important for participating in freshwater based activities by domestic and international visitors:

- Queenstown
- Te Anau
- Waitomo
- Taupo
- Rotorua
- Christchurch/Canterbury
- Hanmer Springs
- Auckland
- Hamilton/Waikato.

A total of 81 water bodies of national importance for tourism values have been derived from those locations. In addition, 16 water bodies have been identified as they are potentially nationally important for tourism due to their significant scenic value. See Appendix 7 for details.

3.8 Cultural and historical heritage

The Ministry of Culture and Heritage has completed the first phase of the project on cultural and historical heritage values associated with freshwater bodies. Cultural heritage is defined in the International Council on Monuments and Sites New Zealand Charter as possessing historical, archaeological, architectural, technological, aesthetic, scientific, spiritual, social, traditional or other special cultural significance, associated with human activity.

The definition of historic heritage contained in the Resource Management Act 1991 was used as the definition for this project:

> *"those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and culture, deriving from any of the following qualities: archaeological, architectural, cultural, historic, scientific, technological; and includes: historic sites, structures, places, and areas; scientific; archaeological sites; sites of significance to Maori, including wahi tapu; surroundings associated with the natural and physical resources"*.

The report takes into account the relationship of Maori to water bodies from a heritage perspective. However, we have not developed a method to identify water bodies of national importance for Maori values.

We have developed criteria for identifying water bodies of national importance for cultural and historic heritage values, along with a process for completing the next phase of the work. The following criteria were developed for determining water bodies of national importance for cultural and heritage values:

- an association with extant heritage objects, structures, sites or places
- an association with past activities or events
- an association with a particular community or the public at large.

In addition, three categories of values were identified – physical, historical and social. This is in recognition that places of cultural and historic value have one or more of a range of values that may include such things as historic, archaeological, architectural, aesthetic, technological, and social.

Further work to be completed

The process outlined in the Cultural Heritage Assessment Report needs to be completed to develop a list of nationally important water bodies for cultural and historic heritage values.

3.9 Maori cultural values

A fundamental difficulty with any proposal to combine Maori cultural perspectives and national perspectives is that Maori culture is whanau/hapu/iwi based. Therefore, a water body of great importance to one iwi may not be considered culturally important by another iwi. Similarly, there may be water bodies that are important to some but not all hapu and whanau groups within an iwi.

A second difficulty in assessing Maori cultural values is that many water bodies have been substantially changed in character since European settlement (eg, through changes in land ownership, drainage schemes, dam construction, pollution and the introduction of exotic species). This raises the question of whether it is the traditional Maori cultural value or the current value that should be considered as important.

The Maori Reference Group suggested that rather than attempting to identify water bodies of particular importance to Maori through the water bodies of national importance process, any new tools developed for the sustainable management of water should provide for Maori cultural values to be incorporated in water management decisions. Although Maori cultural values are not to be included as a specific project within the water bodies of national importance project, the relationship between Maori and water should be identified as nationally important.

3.10 Next steps

A discussion document will be developed for public release. The discussion document will describe progress with the potential water bodies of national importance sub-projects. The discussion document will also include the policy options for water quality and water allocation and use.

Consulting on this work will provide the public with an opportunity to comment on the value of determining water bodies of national importance, the methods developed to identify potential water bodies of national importance and the initial lists. Consulting on methods and criteria may result in ideas for alternative approaches for determining national importance. It is likely that the initial lists of water bodies will change following the consultation process and the public will have been given an opportunity to play an important part in critiquing the lists.

The consultation process will generate debate and will also highlight the need for national objectives for water management. Options for managing important water bodies at the national and regional level could also emerge.

The consultation process might indicate that identifying water bodies of national importance is not a useful approach. If the initial approach is to be continued, a final list of water bodies will be determined through subsequent phases of the Water Programme of Action. A candidate list of nationally important water bodies may be presented to Cabinet with options for their appropriate management.

Work is also required to address the following:

- resolve any inconsistencies among methods and potential lists
- establish a process to decide how competing values will be reconciled
- explore different mechanisms to secure the values.

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Appendices

Appendix 1: Biodiversity dimension of natural heritage

Table 1: Potential water bodies of national importance for aquatic biodiversity values

Biogeographic zone	Catchment name	NIWA ID#	Type**
Auckland	Huia Streams	902	1
	Karekare Stream	1071	1
	Tapapakanga Stream	1117	1
	Waitakere River	1186	1
	Nihotupi Streams	1790	1
	Te Matuku Bay west	1872	1
	Nukumea Stream	2298	1
	Pareoha Bay	2541	1
	Motatapu Stream 1	3632	1
	Motatapu Stream 2	4673	1
	Okura River	1189	2
Banks Peninsula	Okuti River	408	1
	Le Bons Bay	850	1
	Narbey Stream	1288	1
	Wainui Bay	1306	1
	Lyttelton Basin	2525	1
	Charteris Bay	2929	1
Bay of Plenty	Whirinaki River	173	1
	Wairoa River and tributaries	198	1
	Mangorewa River	308	1
	Tuapiro Creek	569	1
	Ngututuru/Rereatukahia	728	1
	Rangitaiki River	29	2
	Tarawera Stream	116	2
Canterbury	Waimakariri River	17	1
	Rakaia and tributaries	30	1
	Upper Waimakariri catchment	50	1
	Lake Sumner Catchment	67	1
	Rangitata headwaters	151	1
	Hapuku River	379	1
	Kowhai River	463	1
	Hurunui River	31	2
	Opihi River	35	2
	Rangitata River	47	2
	Ashley River	77	2
	Opihi River headwaters	85	2
	South Branch Ashburton	94	2
	Selwyn River	95	2
	Orari River	135	2

Biogeographic zone	Catchment name	NIWA ID#	Type**
Clutha	Manuherikia River	28	1
	Lake Wanaka tributaries (NE)	32	1
	Lindas River	90	1
	Makarora River	132	1
	Dart River	148	1
	Hunter River	209	1
	Greenstone River	235	1
	Teviot River	241	2
	Pomahaka River	40	2
Coromandel	Tairua River	296	1
	Kaueranga River	389	1
	Wangamaroro River	484	1
	Waiharakeke Stream	500	1
	Manaia River	599	1
	Kaitoke Creek	790	1
	Stony Bay catchment	1135	1
	Mangatu-Mataiterangi streams	1445	1
	Tuateawa Creek	1449	1
	Okanutahi Stream	1454	1
	West Tataweka	1963	1
	East Tataweka	2970	1
	North East Tutaweka	3649	1
East Cape	Haparapara Stream	339	1
	Raukokore River	229	1
	Motu River	63	2
	Waioeka River	112	2
	Ruakituni River	171	2
	Karakatuwhero River	474	2
	Waiau River (Hawke Bay)	60	2
	Whakatane River	48	2
	Waiapu River	53	2
Fiordland	Waihaurahiri River	136	1
	Waitutu River	191	1
	Seaforth River	279	1
	Arthur River	280	1
	Stillwater River	334	1
	Long Burn	342	1
	Big River	355	1
Grey-Buller	Grey River headwaters	49	1
	Maruia River	87	1
	Ahaura River	101	1
	Upper Buller River	154	1
	Gowen River	208	1
	Buller River	6	2

Biogeographic zone	Catchment name	NIWA ID#	Type**
Hawkes Bay	Mohaka headwaters	80	1
	Mohaka River	34	2
	Taruarau River	182	2
	Ngarururo River tributaries	183	2
	Tutaekuri River	206	2
	Ngaruroro River	43	2
Manawatu-Wairarapa	Waipawa River	137	1
	Pohongina River	162	1
	Raumahanga/Waingawa River	217	1
	Otaki River	231	1
	Mangahao River	244	1
	Waikanae – Ngatiawa	354	1
	Mangatainoka River	361	1
	Turanganui River	496	1
	Waiorua Stream	2897	1
	South Wairarapa basin	22	2
Marlborough	Mill Arm Creek, D'Urville Island	1070	1
	Castor Stream	1242	1
	Umungata Bay	2269	1
	Pouowhariki Steam	2398	1
	Southern Stm, South Arm, D'Urville	2481	1
	Kawauiti Stream	3527	1
	Wairau River	18	2
	Clarence River	24	2
	Pelorus River	106	2
Mokau	Waitara River	78	1
	Tongapurutu River	270	1
	Mohakatino River	393	1
	Awaroa River	412	1
	Waikawau River	468	1
	Waiharakeke Stream	545	1
	Stream SW of peak 501	2736	1
	Te Karo Stream	3380	1
	Te Toto Stream	3494	1
	Stream W of peak 294	3839	1
Motueka-Nelson	Wairoa – Wai-iti River	126	1
	Whangapeka River	188	1
	Baton River	303	1
	Riwaka River	462	1
	Awaroa River	677	1
	Motueka River	41	2

Biogeographic zone	Catchment name	NIWA ID#	Type**
Northland – eastern	Ngunguru River	566	1
	Kohumaru Stream	691	1
	Punaruku Stream	778	1
	Central Tokerau Beach wetland	1115	1
	Wairakau Stream	1375	1
	Te Rewa Stream	1634	1
	Taupo Creek	1959	1
	Kopuaparore Stream	2716	1
	Te Waiorakau Creek	2852	1
	Catchment south of Koware 142 m	3045	1
	Catchment south of pt 67	3126	1
	Waipokara Stream	3515	1
	Omaruhanga Stream	3540	1
	Waitapu Bay Stream	3979	1
	Awanui River	220	2
	Oruaiti River	332	2
	Oruru River	433	2
Northland – northern	Te Werahi Stream	638	1
	Waitahora Stream	795	1
	Tupotupotu Bay	1169	1
	Kaumaumau	1210	1
	Tom Bowling Bay	1269	1
	Rangiora Beach	1292	1
	Kauaeparaoa Stream (Te Paki Stream)	1298	1
	Waimaharu Stream	1542	1
	Waihakari Stream	2431	1
	Te Kanakana Stream	3129	1
	Middle, Tom Bowling Bay	3506	1
Northland – western	Rotokakahi River	317	1
	Mangamuka River	362	1
	Waimamaku River	383	1
	Waipoua River	411	1
	Waitokitoki Stream	526	1
	Mokeno-Whakaneke	661	1
	Wairau River	780	1
	Tanutanu Stream	1079	1
	Waitaha Stream	1201	1
	Mokorau Stream	4194	1
	Manganui River	123	2
	Kaihu River	227	2
	Waipapa River	268	2

Biogeographic zone	Catchment name	NIWA ID#	Type**
NW Nelson-Paparoa	Karamea River	71	1
	Takaka River	109	1
	Mokihinui River	130	1
	Aorere River	222	1
	Heaphy River	258	1
	Fox River	418	1
	Sandhills Creek	674	1
	Mangarakau Flat	1154	1
Otago Peninsula	Orokonui Creek	2011	1
	Robertsons Creek	2096	1
	Deborah Bay Tunnel Creek	2942	1
	Sandymount	3399	1
	Blue Skin Bay North	3840	1
	Broad Bay	4105	1
	Okia Flat	1873	2
	Tomahawk Lagoon streams	1964	2
	Sawyers Bay	2343	2
	Lathen Bay	3841	1
	Purakinui Stream	2044	1
	Leith River	590	3
Palliser-Kidnappers	Whawanui River	808	1
	Makotukutuku Stream	924	1
	Mangatoetoe Stream	1099	1
	Waitatuna Stream	1180	1
	Okau Stream	1185	1
	Stream North of Homewood	1343	1
	Purangirua Stream	1684	1
	Little Mangatoeroe Stream	1902	1
	Te Ika Pakake Stream	3221	1
	Porangahau River	110	2
	Pahaoa River	142	2
	Akitto River	157	2
	Whareama River	167	2
Southland	Tahakopa River	253	1
	Monowai River	267	1
	Lill Burn	278	1
	Pourakino River	281	1
	Waituna Creek	375	1
	Currans Creek	491	1
	Muddy Creek	672	1
	Longbeach Creek	871	1
	Upper Waiau River	13	2
	Aparima River	55	2
	Waiau River	4	2
Stewart Island	Freshwater River	249	1
	Toitoi River	396	1
	Rakeahua River	430	1
	Doughboy River	472	1

Biogeographic zone	Catchment name	NIWA ID#	Type**
Taieri	Lake Waihola catchment	139	1
	Shag River	163	1
	Waikouaiti River	203	1
	Deep Stream	210	1
	Tokomairiro River	214	1
	Kye Burn	237	1
	Akatore Creek	507	1
	Big Creek	1170	1
	Upper Taieri River	46	2
	Lower Taeri River	9	2
Taranaki	Manganui River	259	1
	Kaupokonui Stream	368	1
	Waiwhakaiho River	377	1
	Oakura River	623	1
	Punehu Stream	634	1
	Taungatara Stream	682	1
	Te Henui Stream	775	1
	Katikara Stream	894	1
	Wairau Stream	1899	1
Waikato	Waipa River	52	1
	Tongariro River	120	1
	Tauranga Taupo River	299	1
	Waipapa River	302	1
	Kuratau River	316	1
	Waihaha River	356	1
	Waihou River	45	2
	Piako River	57	2
	Whangamarino River	122	2
	Waikato River	2	3
Waitaki	Ahuriri River	68	1
	Kakanui River	105	1
	Tasman River	115	1
	Godley River	146	1
	Ohau River	176	1
	Twizel River	230	1
	Huxley River	238	1
	Cass River	288	1
	Tekapo River	56	2
	Lower Waitaki	3	3
Wanganui-Rangitikei	Whanganui River Headwaters	97	1
	Tangarakau River	150	1
	Whangamomona River	289	1
	Whanganui River upper	12	2
	Waitotora River	75	2
	Rangitikei River Headwaters	88	2
	Rangitikei River	15	2
	Whangaehu River	44	2
	Whanganui River	5	3

Biogeographic zone	Catchment name	NIWA ID#	Type**
Wellington	Wainuiomata River	381	1
	Orongorongo River	445	1
	Karori Stream	760	1
	Gollans Stream	946	1
	Stream west of Happy Valley Stream	3577	1
	Stream SE Mt Porirua 261 m	3860	1
	Hutt River	147	2
Westland	Haast River	64	1
	Hollyford River	79	1
	Hokitika River	84	1
	Arawhata River	100	1
	Waiatoto River	168	1
	Turnbull / Okura rivers	192	1
	Cascade River	201	1
	Karangarua River	211	1
	Paringa River	221	1
	Cook River	247	1
	Okarito River	255	1
	Cockabulla Creek	825	1

Type 1: Whole catchments considered to be nationally important for biodiversity.

Type 2/3: These contain sections or sites of national importance for biodiversity.

NIWA ID # refers to the catchment numbering system used by NIWA, with the longest river numbered as # 1.

Appendix 2: Geodiversity and geothermal features

Table 2: Water dependent geodiversity and geothermal features of national importance

Region	Name of feature
Northland	Titoki natural bridge Kai iwi dune dammed lakes Ngawha Springs and hydrothermal field Lake Omapere
Gisborne	Waipaoa River braid channel
Bay of Plenty	Rotorua Geothermal Field (including Whakarewarewa, Government Gardens) White Island Geothermal Field Waimangu Geothermal Field Tikitere Geothermal Field Waiotapu Geothermal Field Motu Gorge Lake Rotomahana explosion craters
Hawke's Bay	Lake Poukawa Holocene swamp Lake Waikaremoana Ahuriri Lagoon
Chatham Islands	Te Pukaha Quaternary moorland peat North Chatham peat swamp
Waikato	Mangawhitikau Cave System Ruakuri Cave Waitomo Glow worm Cave Waitomo Stream headwaters cave system Mangapu cave system (incl Lost World) Gardners Gut Cave Troopers Road cave system Waikite/Puakohurea Geothermal Field Ketetahi Geothermal Field Orakeikorako Geothermal Field Tokaanu/Waihi/Hipaua Geothermal Field Te Kopia Geothermal Field Rotokawa Geothermal Field Ohaaki Pool Kopouatai peat bog Tongariro River delta Aratiatia rapids Waikato River delta Tree Trunk Gorge Huka Falls

Region	Name of feature
Manawatu-Whanganui	Manawatu Gorge Ruapehu Crater Lake Atene oxbow Ohingaiti cut-off meander Rangitikei Gorge Whangaehu lahar fan
Nelson	Mount Arthur karst to Pearse Resurgence Riwaka North and South Branch karst systems Waikoropupu Springs and catchment Mount Owen karst system (NE Owen, Bulmer Caverns)
Marlborough	Wairau boulder barrier, lagoon and delta Tarndale flats
Canterbury	Pyramid Valley (Holocene swamp) Rakaia River braids Opihi Lagoon and Harakeke Tautoro Island Hurunui Lakes (Sumner, Katrine, Mason, Sheppard, Taylor) Vagabonds Inn (Kettle Lake) Okana River delta Rakaia Gorge and terraces
West Coast	Babylon Cave Bullock Creek – Cave Creek south – Xanadu Cave Fox River Cave (incl Armageddon Cave) Honeycomb Hill Holocene cave system Nile River Cave (Aranui or Metro cave) Oparara Arch Hapuka Estuary Callery Gorge Buller Gorge
Otago	Kawarau Gorge Crucible Lake Hawkdun cirque Motatapu Gorge Taieri River mouth gorge Taieri River meanders (scroll plain)
Southland	Aurora Cave Stirling Falls, Milford Sound Mavora Lakes (glacial swamp and lake) Lake Quill cirque and Sutherland Falls Humboldt Falls Eglinton River delta, Lake Te Anau Hidden Lake (Milford Track)

Appendix 3: Recreation

Table 3: Potential water bodies of national importance for recreation

Region	Water body
Northland region	Kai Iwi Lakes Kaimaumau Block
Auckland region	Lake Pupuke Mangaparo/Clarkes wetland Mangatawhiri wetland
Waikato region	Mokau Tauranga Taupo River Tongariro River Waikato River (includes Huka Falls) Lake Taupo Lake Karapiro
Bay of Plenty region	Ngongotaha Stream Wairoa River and Tributaries Lake Tarawera Lake Rotorua Lake Rotoiti Lake Rotoma Lake Tikitapu (Blue Lake) Lake Rotokakahi (Green Lake)[10] Motu River (includes gorge) Hororata River
Hawke's Bay region	Pekapeka wetland Mohaka Lake Waikaremoana Ngaruroro River Tukituki/Ruataniwha Plains Tukituki River Ahuriri Esturary/Westshore Lagoons
Manawatu-Whanganui region	Dune Lakes Whanganui River Rangitikei River Manawatu River Lake Aniwhenua Otaki River Manganuioteau River
Taranaki region	Aniwhenua Lake

[10] No water activity allowed.

Region	Water body
Wellington region	Kohangatera and Kohangapiripiri lakes and wetlands Hutt River
Marlborough region	Vernon Lagoons Wairau
Tasman region	Aorere Motueka Nelson Lakes (Lakes Rotoroa and Rotoiti)
West Coast region	Wanganui River Ahaura River Buller River Karamea Cascade Turnbull/Okura/Hapuku Lagoon Waiatoto Arawhata Haast-Landsborough Paringa Awarua River and Waiuna Lagoon Big Bay Birchfield wetland Hermitage wetland Hokitika Lake Okarito Lake Brunner Perth River Owowaiti Wetlands Tawharekiri Lakes Complex Waiata River mouth and Pakihi Saltwater Lagoon Mikohinui River Moeraki River Grey River

Region	Water body
Canterbury region	George Lake and Henderson extension Lake Ellesmere and wetlands Rakaia and tributaries Rangitata River and headwaters Lake Benmore Lake Coleridge Ashley River Opihi River Waimakariri River Hurunui River Waiau Avon River Ahuriri River Clarence River Lake Tekapo Waitaki River (includes Lower Waitaki) Wolds wetland Lake Aviemore Hikarangi wetland Aparima River Oreti River Pourakino River
Otago region	Taieri River (includes Lower Taieri) Lake Wanaka Clutha River Lake Wakatipu Kawerau River Lake Hawea Lake Dunstan Blue Skin Bay
Southland region	Lake Manapouri Lake Te Anau Hollyford River Mataura River Waituna Creek, and wetlands Titiroa River

Appendix 4: Irrigation

Table 4: Contribution to farmgate GDP[11] from the supply of irrigation water

Region	Water body	Current irrigated area (ha)	Farmgate GDP generated ($ million per annum)	Farmgate GDP generated ($/ha per annum)
Hawkes Bay	Heretaunga Plains	13,000	79	6,065
Marlborough	Wairau catchment	15,075	72	4,802
Canterbury	Rangitata River	57,474	63	1,103
Canterbury/Otago	Waitaki River	46,060	57	1,238
Canterbury	Central Canterbury ground water	56,900	55	963
Canterbury	Mid Canty ground water	50,015	39	779
Northland	Waipapa catchment	1,450	25	17,110
Canterbury	Waimakariri River	11,000	22	1,996
Canterbury	Waiau River	16,500	21	1,297
Hawkes Bay	Tukituki/Ruataniwha Plains	3,500	18	5,258
Canterbury	Opihi River	23,510	17	705
Tasman	Waimea catchment	4,798	16	3,294
Otago	Manuherikia River	17,320	15	842
Tasman	Moutere catchment	1,909	13	6,748
Otago	Clutha River	9,520	11	1,185
Hawkes Bay	Ngaruroro catchment	4,800	11	2,303
Otago	Taieri River	10,000	8	781
Canterbury	Rakaia River	4,100	8	1,834
Canterbury	Ashburton River	6,386	7	1,103
Canterbury	Hurunui River	4,000	7	1,655
Tasman	Motueka catchment	2,160	5	2,529

Table 5: Potential net contribution to gross domestic product at the farmgate from new irrigation development

Region	Water body	Potential irrigated area (ha)	Farmgate GDP generated ($ million per annum)	Farmgate GDP generated ($/ha per annum)
Hawkes Bay	Tukituki/Ruataniwha Plains	31,500	116	3,676
Canterbury/Otago	Waitaki River	136,400	115	843
Canterbury	Rakaia River	107,200	74	688
Canterbury	Hurunui River	80,000	68	850
Marlborough	Wairau catchment	13,000	53	4,094
Canterbury	Rangitata River	18,000	22	1,203
Tasman	Waimea catchment	3,400	19	5,525
Canterbury	Waimakariri River	16,800	14	841
Wellington	Ruamahanga catchment	6,000	11	1,821
Tasman	Motueka catchment	1,600	7	4,673
Otago	Taieri River	5,000	4	860
Otago	Manuherikia River	3,500	4	1,054
Canterbury	Opihi River	3,200	2	599
Total		**425,600**	**509**	**1,195**

[11] In 2003/04 dollars, only water bodies with an irrigation value of *greater than $5 million* are included.

Appendix 5: Energy

Table 6: Existing hydro generation by catchment

Rank	Catchment name	Existing (GWh per annum)	% of GWh per annum
1	Waitaki	7,612	33.0%
2	Waikato	6,349	27.5%
3	Clutha	3,378	14.6%
4	Waiau (Southland)	3,180	13.8%
5	Wairoa (Hawke's Bay)	625	2.7%
6	Rangitaiki	540	2.3%
7	Taieri	425	1.8%
8	Rakaia	197	0.9%
9	Manawatu	166	0.7%
10	Takaka	140	0.6%
11	Patea	134	0.6%
12	Rangitata	118	0.5%
13	Wairau	59	0.3%
14	Taramakau	46	0.2%
15	Mokau	28	0.1%
16	Waitara	21	< 0.1%
17	Waiwhakaiho	20	< 0.1%
18	Wairoa (Northland)	13	< 0.1%
19	Whanganui	7	< 0.1%
20	Ruamahanga	4	< 0.1%
21	Mataura	4	< 0.1%
	Total	**23,066**	**100%**

Table 7: Potentially nationally important water bodies for existing energy generation

Rank	Catchment name	Existing (GWh per annum)
1	Waitaki	7612
2	Waikato	6349
3	Clutha	3378
4	Waiau (Southland)	3180
5	Wairoa (Hawkes Bay)	625
6	Rangitaiki	540
7	Taieri	425

Table 8: Potentially nationally important water bodies for potential energy generation with a medium probability of proceeding by 2025

Rank	Catchment name	Potential (GWh per annum)
1	Waitaki	3208
2	Clutha	1950
3	Grey	1546
4	Waiau (Canterbury)	1030
5	Ngaruroro	585
6	Wairau	526
7	Whanganui	476
8	Waiau (Southland)	350
9	Hurunui	350
10	Mohaka	330

Table 9: *Existing* energy generation by geothermal field

Rank	Catchment name	Existing GWh per annum	Exceeds 230 GWh per annum
1	Wairakei	1,734	Yes
2	Ohaaki	820	Yes
3	Mokai	434	Yes
4	Rotokawa	221	No
5	Kawerau	118	No
6	Ngawha	71	No

Table 10: *Potential* energy generation by geothermal field with a medium probability of proceeding by 2025

Rank	Geothermal field name	Potential GWh per annum	Exceeds 230 GWh per annum
1	Kawerau	2,810	Yes
2	Rotokawa	2,390	Yes
3	Wairakei	1,430	Yes
4	Ngatamariki	1,104	Yes
5	Mokai	770	Yes
6	Tauhara	550	Yes
7	Mangakino	512	Yes
8	Ngawha	500	Yes
9	Rotoma	280	Yes
10	Tikitere-Taheke	80	No
11	Horohoro	70	No

Appendix 6: Industry and domestic

Table 11: Water bodies of highest economic value for existing domestic use

Rank	Region	Water body
		Surface water:
1	Waikato +Auckland	Waikato
2	Otago	Clutha
3	Auckland	Wairoa (Auckland)
4	Wellington	Hutt
5	Northland	Waipapa
6	Auckland	Huia
7	Auckland	Nihotupu
8	Otago	Taieri
9	Canterbury	Rakaia
10	Bay of Plenty	Kaituna
		Groundwater:
1	Canterbury	Christchurch – West Melton
2	Hawkes Bay	Heretaunga Plains
3	Wellington	Hutt
4	Canterbury	Ashley Downs (Canterbury)
5	Canterbury	Central Plains
6	Auckland	Auckland volcanics
7	Canterbury	Rangitata-Levels plains
8	Otago	Central Otago
9	Manawatu-Whanganui	Manawatu
10	Otago	Lower Taieri Plain – East and West

Table 12: Water bodies identified for *potential* domestic use

Rank	Region	Water body
		Surface water:
1	Waikato	Waikato
2	Auckland	Wairoa (Auckland)
3	Canterbury	Clutha
4	Wellington	Hutt
5	Northland	Waipapa
6	Auckland	Huia
7	Auckland	Nihotupu
8	Bay of Plenty	Kaituna
9	Canterbury	Rakaia
10	Bay of Plenty	Waimapu
		Groundwater:
1	Canterbury	Christchurch – West Melton
2	Hawkes Bay	Heretaunga Plains
3	Wellington	Hutt
4	Auckland	Auckland volcanics
5	Canterbury	Ashley Downs
6	Canterbury	Central Plains
7	Canterbury	Rangitata-Levels Plains
8	Otago	Central Otago
9	Manawatu-Whanganui	Manawatu
10	Bay of Plenty	Mamaku Plateau

Table 13: Water bodies with highest economic value for existing industrial use

Rank	Region	Water body
		Surface water:
1	Otago	Clutha
2	Waikato/Auckland	Waikato
3	Canterbury	Waitaki
4	West Coast	Grey
5	Canterbury	Rakaia
6	West Coast	Mikonui
7	West Coast	Manakaiaua
8	Bay of Plenty	Kaituna
9	Otago	Taieri
10	West Coast/Tasman	Buller
		Groundwater:
1	Canterbury	Christchurch – West Melton
2	Hawkes Bay	Heretaunga Plains
3	Marlborough	Upper Wairau Valley
4	Canterbury	Central Plains
5	Wellington	Hutt
6	Waikato	Coromandel volcanic
7	Waikato	Tauranga Group sediments
8	Manawatu-Whanganui	Manawatu
9	Waikato	Hinuera Formation
10	Canterbury	Rangitata-Levels plains

Appendix 7: Tourism

Table 14: Potential water bodies of tourism/scenic value

Region	Water body
Auckland region	Lake Pupuke Western Springs Lake Waiamu Puhoi River Waiwera Hot Pools Waitakere Falls Dam lakes in Waitakere and Hunua Ranges (Upper and Lower Nihotupu, Huia and Waitakere) Kitekite Falls Mahurangi River Mangaparo/Clarkes wetland Lake Arapuni Lake Rotorua (Hamilton Lake)
Waikato region	Tongariro River Waipa (includes Waitomo Stream) Waikato River (includes Huka Falls) Okohua stream Mangawhitakau stream Mangapu stream Mangarama stream Lake Taupo Ngaawapurua Lake Rotoaira Taupo Hot Springs Waitomo Stream Ngaawapurua Waipahihi Spring Lake Rotopounamu Lake Karapiro Lake Arapuni
Hawke's Bay region	Lake Waikaremoana*

Region	Water body
Bay of Plenty region	Wairoa River and tributaries Lake Okataina Rangitaiki River Tarawera River Lake Tarawera Kaituna River Tongariro River Lake Rotorua Lake Rotoiti Lake Rotoehu Te Waireka Spring (Paradise Valley Spring) Rachel Spring Radium Spring Priest Spring Fairy Spring Kerosene Spring Hamurana Spring Pohutu Spring* Lake Rotoma Lake Rotomahana* Lake Rerewhakaaitu Lake Okareka Lake Tikitapu (Blue Lake) Lake Rotokakahi (Green Lake)* ** Motu River (includes gorge)
Tasman region	Nelson Lakes (Lakes Rotoroa and Rotoiti)*
West Coast region	Lake Okarito* Lake Kaniere* Lake Brunner* Lake Matheson*

Region	Water body
Canterbury region	Rakaia and tributaries Rangitata River and headwaters Lake Sumner Lake Sheppard Lake Taylor Lake Katrine Lake Mason Waimakariri River Hurunui River Waiau Avon River Hanmer River Percival River Pahau River Clarence River Lake Coleridge* Lake Pearson* Lake Tekapo* Lake Pukaki* Ohau*
Otago region	Lake Wanaka Clutha River Lake Wakatipu Shotover River Kawerau River Lake Hawea* Lake Dunstan* Lake Hayes
Southland region	Wairarahiri River Arthur River Lake Te Anau Tunnelburn River Clinton River Hollyford River Lake Hauroko Waiau River Mavora Lakes Lake Manapouri

* Identified for scenic value.

** No water activity allowed.