

WAI MĀORI



5.3 WAI MĀORI

Ko te wai te oranga o ngā mea katoa

Water is the life giver of all things

Water is a significant cultural resource that connects Ngāi Tahu to the landscape and the culture and traditions of the tūpuna. All water originated from the separation of Rangī and Papatūānuku and their continuing tears for one another. Rain is Rangī's tears for his beloved Papatūānuku and mist is regarded as Papatūānuku's tears for Rangī.

For tāngata whenua, the current state of cultural health of the waterways and groundwater is evidence that water management and governance in the takiwā has failed to protect freshwater resources. Surface and groundwater resources are over-allocated in many catchments and water quality is degraded as a result of urban and rural land use. This has significant effects on the relationship of Ngāi Tahu to water, particularly with regard to mauri, mahinga kai, cultural well-being and indigenous biodiversity.

The policies in this section are intended to guide freshwater management in a manner consistent with Ngāi Tahu cultural values and interests. They provide a general policy statement to sit alongside catchment specific issues and policy identified in Part 6 of this IMP. The anticipated outcome is the restoration of the cultural health of freshwater resources of the region, *mō tātou, ā, mō kā uri ā muri ake nei*.

A significant kaupapa that emerges from this policy section is the need to rethink the way water is valued and used, including the kind of land use that water is supporting, and the use of water as a receiving environment for contaminants such as sediment and nutrients. Fundamental to tāngata whenua perspectives on freshwater is that water is a taonga, and water management and land use should reflect this importance.

“Because of the fundamental importance of water to all life and human activity, Kai Tahu maintain that the integrity of all waterways must be jealously protected.... This does not preclude the responsible use of water, but merely states the parameters which Kai Tahu believe any such use should remain within. The utilisation of any resource for the benefit of the wider community is encouraged, providing that it is done with the long-term welfare of both the community and the resource in mind.”

Ngā Paetae Objectives

- (1) Water management effectively provides for the taonga status of water, the Treaty partner status of Ngāi Tahu, the importance of water to cultural well-being, and the specific rights and interests of tāngata whenua in water.
- (2) Water quality and quantity in groundwater and surface water resources in the takiwā enables customary use *mō tātou, ā, mō kā uri ā muri ake nei*.
- (3) Water and land are managed as interrelated resources embracing the practice of Ki Uta Ki Tai, which recognises the connection between land, groundwater, surface water and coastal waters.
- (4) Mauri and mahinga kai are recognised as key cultural and environmental indicators of the cultural health of waterways and the relationship of Ngāi Tahu to water.
- (5) Land and water use in the takiwā respects catchment boundaries, and the limits of our land and freshwater resources.
- (6) Wetlands and waipuna are recognised and protected as wāhi taonga, and there is an overall net gain of wetlands in the takiwā as wetlands are restored.
- (7) All waterways have healthy, functioning riparian zones and are protected from inappropriate activities, including stock access.
- (8) The practice of using water as a receiving environment for the discharge of contaminants is discontinued, and all existing direct discharges of contaminants to water are eliminated.
- (9) Water quality is such that future generations will not have to drink treated water.

NGĀ TAKE – ISSUES OF SIGNIFICANCE

WAI MĀORI: ISSUES OF SIGNIFICANCE

Issue WM1: Rights and interests	Tāngata whenua have specific rights and interests associated with freshwater.
Issue WM2: Value of water	Changing the way water is valued.
Issue WM3: Priorities for use	Priorities for use based on Ngāi Tahu values.
Issue WM4: Management of water	Appropriate management scale, principles, tools and processes to deliver Ngāi Tahu cultural outcomes.
Issue WM5: Statutory Acknowledgements	Recognition of freshwater statutory acknowledgement sites.
Issue WM6: Water quality	The decline in water quality in the region as a result of point and non-point source pollution, low flows and loss of wetlands and riparian areas.
Issue WM7: Rural land use	Intensive rural land use is having unacceptable effects on water quality and quantity, and Ngāi Tahu values.
Issue WM8: Water quantity	Freshwater resources in the takiwā are over-allocated or under increasing pressure from abstractive use.
Issue WM9: Regional infrastructure	The need for a robust cultural framework to assess proposals for in-stream water storage, irrigation and hydro-generation.
Issue WM10: Mixing of water	There are cultural issues associated with the unnatural mixing of water between and within catchments.
Issue WM11: Transfer of permits	The transfer of water permits is inconsistent with tāngata whenua perspectives on how to achieve the sustainable management of water.
Issue WM12: Beds and margins	Activities occurring within the beds and margins of rivers and lakes can adversely affect Ngāi Tahu values.
Issue WM13: Wetlands, waipuna and riparian margins	Loss of wetlands, waipuna and riparian margins, and the cultural and environmental values associated with them.
Issue WM14: Drain management	Drain management can have adverse effects on Ngāi Tahu values, particularly mahinga kai.
Issue WM15: Invasive weeds	The spread of invasive woody weeds and standing trees in the beds and margins of rivers.
Issue WM16: Coastal marine area	The freshwater-saltwater interface is an important feature of freshwater management.



It is time for a new way of managing water

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| <ul style="list-style-type: none"> ▶ There are now ten red zones in Canterbury where water has been fully allocated, and four “yellow zones” where allocation exceeds 80% of the allocation limit. ▶ Run-of-river takes are near the limit of what can be safely abstracted while maintaining environmental flows. ▶ Less than 10% of the region’s previously extensive wetlands remain. | <ul style="list-style-type: none"> ▶ Increasing land use change and intensification threatens what remains of indigenous habitats – including mahinga kai species and wāhi taonga. ▶ Urban growth is driving an increasing demand for the use of natural waterways for the discharge of contaminants (e.g. stormwater). |
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Source: Canterbury Water Management Strategy (CWMS); Te Rūnanga o Ngāi Tahu submissions, and the Mahaanui IMP Working Group.

TĀNGATA WHENUA RIGHTS AND INTERESTS IN FRESHWATER

Issue WM1: Recognising and providing for Ngāi Tahu rights and interests associated with freshwater resources.

Ngā Kaupapa / Policy

- WM1.1 Ngāi Tahu, as tāngata whenua, have specific rights and interests in how freshwater resources should be managed and utilised in the takiwā.
- WM1.2 Te Tiriti o Waitangi is the basis for the relationship between Ngāi Tahu and local authorities (and water governance bodies) with regard to freshwater management and governance in the takiwā.
- WM1.3 Papatipu Rūnanga may have their own policy positions on the commercial use and ownership of water, from that of Te Rūnanga o Ngāi Tahu as the iwi authority, and from other Papatipu Rūnanga.
- WM1.4 To require that local authorities and water governance bodies recognise that:
- The relationship of tāngata whenua to freshwater is longstanding;
 - The relationship of tāngata whenua to freshwater is fundamental to Ngāi Tahu culture and cultural well-being;
 - Tāngata whenua rights and responsibilities associated with freshwater are intergenerational; and
 - Tāngata whenua interests in freshwater resources in the region are cultural, customary and economic in nature.
- WM1.5 To support the development of a *Te Rūnanga o Ngāi Tahu Freshwater Strategy Statement*, to further protect, enhance, utilise and develop freshwater resources within the Ngāi Tahu rohe for the benefit and achievement of Ngāi Tahu whānui cultural, environmental, social and economic aspirations and outcomes.

He Kupu Whakamāhukihuki / Explanation

Ngāi Tahu, as tāngata whenua, have customary rights and responsibilities associated with freshwater resources in the region, as expressed through the exercise of manawhenua, rangatiratanga, kaitiakitanga and manaakitanga, and as guaranteed by Te Tiriti o Waitangi. Ensuring that freshwater management recognises and provides for these rights and interests is critical to enabling tāngata whenua to protect water as a taonga for future generations.

Te Tiriti o Waitangi and the sale and purchase agreements for Canterbury and Te Pātaka o Rākaihautū guarantee the protection of tāngata whenua interests in water. The RMA recognises the relationship of Māori to freshwater as a matter of national importance.

“The value we place on water may not be economic in a dollar sense. For us, it is about having enough water in a river to support mahinga kai, and therefore enable us to manaaki our manuhiri.” Clare Williams, Ngāi Tūāhuriri.

CHANGING THE WAY WATER IS VALUED

Issue WM2: There is a need to change the way water is valued.

Ngā Kaupapa -Policy:

- WM2.1 To consistently and effectively advocate for a change in perception and treatment of freshwater resources: from public utility and unlimited resource to wāhi taonga.
- WM2.2 To require that water is recognised as essential to all life and is respected for its taonga value ahead of all other values.
- WM2.3 To require that decision making is based on inter-generational interests and outcomes, *mō tātou, ā, mō kā uri ā muri ake nei*.
- WM2.4 To continue to assert that the responsibility to protect and enhance mauri is collective, and is held by all those who benefit from the use of water; and that the right to take and use water is premised on the responsibility to safeguard and enhance the mauri of that the water.

He Kupu Whakamāhukihuki / Explanation

Changing the way water resources are valued must underpin and drive the changes needed in the way freshwater resources are managed and used. Water is a taonga, and the collective responsibility for protecting the mauri of this taonga is a fundamental principle of Ngāi Tahu freshwater policy. The right to use water must be premised on a responsibility to care for water.

“It will take a fundamental shift of mindset to think about what we can do for the river (and therefore ensure the health of our rivers is sustained), rather than what the river can do for us. This is the challenge.”²

“Water is a life resource, not an economic resource.”

IMP Working Group, 2012.

“When you are brought up to love and respect a river, there is nothing else that compares.”

Aunty Joan Burgman, Ngāi Tūāhuriri Rūnanga.

PRIORITIES FOR USE

Issue WM3: Priorities for the use of freshwater resources.

Ngā Kaupapa / Policy

WM3.1 To advocate for the following order of priority for freshwater resource use, consistent with the *Te Rūnanga o Ngāi Tahu Freshwater Policy Statement (1999)*:

- (1) That the mauri of fresh water resources (ground and surface) is protected and sustained in order to:
 - (a) Protect instream values and uses (including indigenous flora and fauna);
 - (b) Meet the basic health and safety needs of humans, specifically the provision of an untreated and reliable supply of drinking water to marae and other communities; and
 - (c) Ensure the continuation of customary in-stream values and uses.
- (2) That water is equitably allocated for the sustainable production of food, including stock water, and the generation of energy; and
- (3) That water is equitably allocated for other abstractive uses (e.g. development aspirations).

He Kupu Whakamāhukihuki / Explanation

The *Te Rūnanga o Ngāi Tahu Freshwater Policy Statement (1999)* sets out priorities for freshwater water use. The priorities recognise mauri as a first order principle given its fundamental importance to sustaining the cultural and environmental health and well-being of waterways. Ngāi Tahu also recognise that sustainable economic development is fundamentally dependent on sustaining healthy waterways.

“We don’t want to have to treat our drinking water. When drinking water becomes unsafe, we need to address the source of the problem and not just dig a deeper well or further treat the water. We need to think about water over the long term. We don’t want our mokopuna to be drinking treated water.” Clare Williams, Ngāi Tūāhuriri.

MANAGEMENT OF WATER

Issue WM4: The need for appropriate management scales, principles, tools and processes to deliver cultural outcomes.

Ngā Kaupapa / Policy

WM4.1 To require that water governance and management structures, plans, policies and processes are culturally relevant and deliver clear and reliable cultural and environmental outcomes. This means:

- (a) Ngāi Tahu involvement in ongoing management of freshwater resources reflects the spirit of Te Tiriti o Waitangi and the principle of kaitiakitanga (as per Policies WM1.1 to WM1.4);
- (b) Policies and rules on taking, use, damming, diversion and discharge of water are designed to protect the relationship of Ngāi Tahu values with freshwater as a matter of national importance;
- (c) Integrated catchment and sub-catchment management plans are developed and implemented, recognising and providing for:
 - (i) Mauri and customary use as first order priorities;
 - (ii) Kaitiakitanga;
 - (iii) The principle of Ki Uta Ki Tai;
 - (iv) The relationship between groundwater and surface water;
 - (v) The relationship between water quality and water quantity;
 - (vi) The effects of land use on water quality and quantity;
 - (vii) Assimilative capacity of catchments, and associated limits; and
 - (viii) Cumulative effects.
- (d) Recognition and use of Ngāi Tahu monitoring and assessment tools to compile base line information and assess the state of freshwater resources, including but not limited to:
 - (i) Cultural Opportunity Mapping, Analysis, and Response (COMAR) projects;
 - (ii) Cultural Health Index; and
 - (iii) State of the Takiwā monitoring.
- (e) Recognition and use of customary management tools for protecting freshwater values of importance to Ngāi Tahu, including but not limited to:
 - (i) Rāhui; and
 - (ii) Freshwater mātaimai.
- (f) An appropriate and effective regulatory framework (e.g. rules) to control the effects of

land use on water quality and quantity, alongside incentives and opportunities to improve existing practices.

- (g) Recognising and providing for nohoanga, and Fenton reserves and entitlements.

He Kupu Whakamāhukihuki / Explanation

For tāngata whenua, the current state of cultural health of the freshwater resources in the takiwā is evidence that freshwater management has failed to protect the mauri of waterways, lakes and the coastal marine area and to sustain their potential for future generations (s.5 RMA). It has also failed to recognise and provide for the relationship of Ngāi Tahu and their culture and traditions with ancestral waters, as a matter of national importance (s.6(e) RMA).

The Canterbury Water Management Strategy (CWMS) has the potential to change the way water is managed in the takiwā. The Strategy clearly identifies the environment and customary use as first order priorities, ahead of irrigation and other abstractive use, and provides a framework for catchment based integrated surface and groundwater (and lake-water) management plans.

Policy WM4.1 is a high level general policy pertaining to water governance and management in the takiwā, setting out a framework to ensure that existing and future structures, plans and processes deliver clear and reliable cultural outcomes. An important aspect of the policy is the need to bridge the gap between mainstream science based techniques and mātauranga Māori. A range of tools are now available to convey tāngata whenua perspectives of river management and health in a tangible and accessible manner, including the Cultural Health Index, State of the Takiwā and COMAR (see Part 4 of this plan for an explanation on these, and Box - COMAR).

Tāngata whenua values associated with water can enhance overall water management. For example, the protection of mauri as a fundamental value can instill a dimension to policy and practice in the management of water resources that is often lacking.

Cultural Opportunity Mapping, Assessment and Responses (COMAR)

COMAR (Cultural Opportunity Mapping, Analysis, and Response) is a tool developed by Gail Tipa (Tipa & Associates) to assist in identifying key attributes required to protect tāngata whenua values.

COMAR provides a methodology for identifying flow and water quality that would enable the protection of tāngata whenua values.

COMAR is a tool used to apply and assess the extent to which different environmental conditions afford Māori opportunities to engage in a range of cultural experiences, particularly in geographic locations. This process can assist in the preparation of responsive resource management strategies and plans that deliver cultural outcomes.

Source: Tipa, G. & Nelson, K. 2008. Introducing Cultural Opportunities: a Framework for Incorporating Cultural Perspectives in Contemporary Resource Management. *Journal of Environmental Policy and Planning* 10 (4).

STATUTORY ACKNOWLEDGEMENTS

Issue WM5: Recognition of Statutory Acknowledgements beyond their expiry dates.

Ngā Kaupapa / Policy

WM5.1 To advocate for local authorities to recognise the mana and intent of Statutory Acknowledgements (SAs) beyond the expiry of the Ngāi Tahu Claims Settlement (Resource Management Consent Notification) Regulations 1999. This means:

- (a) The existence and location of the SAs will continue to be shown on district and regional plans and policy statements;
- (b) Councils will continue to provide Ngāi Tahu with summaries of resource consent applications for activities relating to or impacting on SA areas (reflecting the information needs set out in this IMP);
- (c) Councils will continue to have regard to SAs in forming an opinion on affected party status; and
- (d) Ngāi Tahu will continue to use SAs in submissions to consent authorities, the Environment Court and the Historic Places Trust, as evidence of the relationship of the iwi with a particular area.

WM5.2 To work with Te Rūnanga o Ngāi Tahu to:

- (a) Extend the expiry date of the Statutory Acknowledgement provisions; and
- (b) Advocate for increasing weighting and statutory recognition of IMP in the RMA 1991, so as to reduce the need for provisions such as Statutory Acknowledgements.

He Kupu Whakamāhukihuki / Explanation

Statutory Acknowledgements were created in the Ngāi Tahu Deed of Settlement as a part of suite of instruments designed to recognise the mana of Ngāi Tahu in relation to a range of sites and areas, and to improve the effectiveness of Ngāi Tahu participation in RMA 1991 processes. Statutory Acknowledgements are given effect by recorded statements of the cultural, spiritual, historical, and traditional association of Ngāi Tahu with a particular area. These are included as schedules in the NTCSA 1998, and in Appendix 7 of this plan.

There are 11 Statutory Acknowledgements in the takiwā covered by this IMP, and 8 of these are rivers and lakes (see map in Appendix 1). These designations highlight the immense significance of freshwater to Ngāi Tahu.

Statutory Acknowledgments have their own set of regulations that implement Deed of Settlement provisions such as resource consent notification. The *Ngāi Tahu Claims Settlement (Resource Management Consent Notification) Regulations 1999* have a 20 year life span and therefore expire in 2019.

Statutory Acknowledgements continue to be relevant and necessary to the effective participation of tāngata whenua in RMA 1991 processes. The purpose of Policy WM5.1 is to ensure that plans, policy statements and resource consents relevant to a SA area continue to recognise the significance of the area to Ngāi Tahu.

Cross reference:

- » *General policy on coastal Statutory Acknowledgments (Section 5.6 Issue TAN1).*

WATER QUALITY

Issue WM6: The decline in water quality in the takiwā as a result of:

- (a) **The continuation of direct discharges of contaminants to water, including treated sewage, stormwater and industrial waste;**
- (b) **Point and non-point source pollution associated**

with unsustainable intensive rural land use;

- (c) **Prolonged low flows in waterways as a result of over-allocation for abstraction, and unmetered water takes;**
- (d) **Over-allocation of groundwater; and**
- (e) **Drainage of wetlands and degradation of riparian areas, and the resultant loss of eco-cultural values.**

Ngā Kaupapa / Policy

WM6.1 To require that the improvement of water quality in the takiwā is recognised as a matter of regional and immediate importance.

WM6.2 To require that water quality in the takiwā is of a standard that protects and provides for the relationship of Ngāi Tahu to freshwater. This means that:

- (a) The protection of the eco-cultural system (see Box - *Eco-cultural systems*) is the priority, and land or resource use, or land use change, cannot impact on that system; and
- (b) Marae and communities have access to safe, reliable, and untreated drinking water; and
- (c) Ngāi Tahu and the wider community can engage with waterways for cultural and social well-being; and
- (d) Ngāi Tahu and the wider community can participate in mahinga kai/food gathering activities without risks to human health.

WM6.3 To require that clear and effective targets are established for restoring water quality in the takiwā, with immediate attention to:

- (a) Lowland and coastal streams; and
- (b) Groundwater.

WM6.4 To support the development of national standards for mahinga kai, including freshwater food gathering.

WM6.5 To require that water quality standards in the takiwā are set based on “*where we want to be*” rather than “*this is the point that we can pollute to*”. This means restoring waterways and working toward a higher standard of water quality, rather than establishing lower standards that reflect existing degraded conditions.

Addressing the source of the problem

WM6.6 Where there are water quality issues, we need to address the source of the problem, and not just dig deeper wells or find new ways to treat water.

Relationship between water quality and water quantity

WM6.7 To ensure that the relationship between water quality and quantity is recognised and provided for in all processes and policy aimed at protecting and restoring water quality. There must be sufficient water to protect water quality.

Discharges

WM6.8 To continue to oppose the discharge of contaminants to water, and to land where contaminants may enter water.

WM6.9 To require that local authorities work to eliminate existing discharges of contaminants to waterways, wetlands and springs in the takiwā, including treated sewage, stormwater and industrial waste, as a matter of priority.

WM6.10 To require that the regional council classify the following discharge activities as prohibited due to significant effects on water quality:

- (a) Activities that may result in the discharge of sewage (treated or untreated), stormwater, industrial waste, animal effluent or other contaminants to water, or onto land where contaminants may enter water; and
- (b) Stock access to waterways and waterbodies (including drains and stock races), regardless of the size of the waterway and type of stock.

WM6.11 Consented discharge to land activities must be subject to appropriate consent conditions to protect ground and surface water, including but not limited to:

- (a) Application rates that avoid over saturation and nutrient loading;
- (b) Set backs or buffers from waterways, wetlands and springs;
- (c) Use of native plant species to absorb and filter contaminants; including riparian and wetland establishment and the use of planted swales; and
- (d) Monitoring requirements to enable assessment of the effects of the activity.

Catchment nutrient budgets and limits

WM6.12 To address the decline in water quality in the takiwā by requiring, supporting and contributing to:

- (a) The development of catchment nutrient budgets (using the best available modelling software) as a tool to manage the cumulative effects of land use on water quality and create

rules and incentives to improve on land and water management;

- (b) The setting of effective limits for nitrogen, phosphorus, sediment and *Escherichia coli* in waterways and groundwater; and
- (c) The setting of effective discharge limits for nutrients and sediment on site, whether 'at the farm gate', on an industrial site, or within a residential property development, as a tool to improve on site management of nutrients and contaminants.

WM6.13 To require that catchment nutrient budgets and limits protect eco-cultural systems and values as a matter of priority.

WM6.14 Contaminant and nutrient limit and target setting must be based on the best available information and modeling, and draw from both western science and mātauranga Māori.

Incentives and controls

WM6.15 To support an effective and strong regulatory and non-regulatory framework to address the effects of rural and urban land use to protect water quality. This framework to include:

- (a) Incentives to do things right;
- (b) Controls (i.e. rules) on land use, including prohibiting those activities that will have significant effects on water quality;
- (c) Compliance monitoring, including a role for tāngata whenua in auditing and as enforcement officers; and
- (d) Effective and enforceable penalties for non-compliance, including revoking resource consents and enforced environmental remediation.

Controls on land use activities to protect water quality

WM6.16 To require, in the first instance, that all potential contaminants that may enter water (e.g. nutrients, sediments and chemicals) are managed on site and at source rather than discharged off site. This applies to both rural and urban activities.

WM6.17 To require the development of stringent and enforceable controls on the following activities given the risk to water quality:

- (a) Intensive rural land use (see Issue WM.7);
- (b) Subdivision and development adjacent to waterways;
- (c) Discharge to land activities associated with industry;

- (d) Activities in the bed and margins of waterways, including gravel extraction; and
- (e) Upper catchment activities such as forestry and vegetation clearance.

WM6.18 To oppose the use of global consents for activities that pose a significant threat to water quality, and where the location of the activity is critical for assessing effects.

Environmental infrastructure

WM6.19 To promote the restoration of wetlands and riparian areas as part of maintaining and improving water quality, due to the natural pollution abatement (treatment) functions of these taonga.

WM6.20 To require that the regional council prohibit any further drainage, destruction or modification of remnant wetlands or existing native riparian vegetation, particularly given the function of these taonga in mitigating the effects of land use on water quality.

Measuring and monitoring our progress

WM6.21 To promote the monitoring of water quality and cultural health at hāpua, coastal lakes and river mouth environments, to monitor the health of catchments and assess progress towards water quality objectives and standards (see Section 5.6, Issue TAN3).

Costs and benefits

WM6.22 To require that local authorities afford appropriate weight to tāngata whenua values when assessing the costs and benefits of activities that may have adverse effects on water quality.

WM6.23 To ensure that economic costs do not take precedence over the cultural, environmental and intergenerational costs of poor water quality.

He Kupu Whakamāhukihuki / Explanation

The decline in water quality in the takiwā as a result of the continuing practice of using water as a receiving environment for the discharge of contaminants and waste, and unsustainable rural and urban land use is one of the most significant natural resource issue for tāngata whenua. Cultural health assessments undertaken by Ngāi Tahu in the last ten years indicate that many waterways are in a poor state of cultural health and do not meet basic standards for cultural use.

“The measure of success of this IMP will be the outcomes in terms of water quality. Environmental sustainability and mahinga kai depend on water quality.” Rei Simon, Wairewa Rūnanga.

For much of the takiwā the story is the same: high water quality in upper catchments deteriorates significantly on the plains and in coastal regions. Lowland streams are highly enriched, reflecting the pressure put on freshwater resources by rural and urban land use on the plains.

Intensive pastoral grazing is the land use with the greatest impact on water quality, in terms of land area and the volume of water affected.³ High stocking rates, over-grazing and unrestricted stock access to waterways are significant contributors of nutrients, sediment and faecal micro-biota to water. Other activities such as cropping, horticulture and plantation forestry can also have local impacts on water quality in terms of sedimentation and nutrient run off, and nitrate leaching into groundwater, particularly when there are no riparian buffers between planting (and therefore harvesting) and a waterway.

Rural or urban, the cultural bottom line is the same. The discharge of contaminants such as wastewater, stormwater or sediment to water, or to land where they may enter water, is culturally unacceptable. The effects of an activity on tāngata whenua values may be significant despite the activity having been assessed as having only minor ecological effects e.g. the discharge of treated human waste to water. It is critical that local authorities recognise that Ngāi Tahu concerns with discharges of contaminants to water extend beyond the existence of silent files or areas of cultural significance. Rather, these concerns are based on protecting the mauri of waterways, and the relationship of Ngāi Tahu to them.

“The discharge of contaminants to water is culturally unacceptable. Dilution to pollution is not the solution.” Terrianna Smith, Te Taumutu Rūnanga.

“The Ngāi Tahu Policy position of discharge to land still means that the soil and groundwater must be protected.” IMP Working Group, 2010.

Clear limits are required for reducing and managing contaminants at source, whether at the farm gate or within the urban subdivision, and for controlling those land use activities which pose the highest risk to water quality. Addressing non-point source pollution is paramount, and requires a targeted effort at addressing the effects of intensive rural land use. While the direct discharges can more easily be avoided, addressing non-point source pollution requires changing the way land use occurs.

For Ngāi Tahu, water quality is a measure of how well we are doing with regard to land and water management and hāpua, coastal lakes and river mouth environments are the indicators. At the bottom of the catchment, the health of these environments reflects our progress in the wider catchment (see Section 4.6 Issue TAN3 for a discussion).

Cross reference:

- » *Issue WM7: Effects of intensive land use on water resources*
- » *General policy on coastal water quality (Section 5.6 Issue TAN2)*
- » *General policy on coastal wetlands and hāpua (Section 5.6 Issue TAN3)*
- » *General policy on stormwater (Section 5.4 Issue P6)*
- » *General policy on waste management (Section 5.4 Issue P7)*
- » *Water quality issues in catchment sections of Part 6*

The protection of eco-cultural systems

The term 'eco-cultural system' acknowledges that there are ecological and cultural values associated with water, that these are related, and that both are integral to the relationship between tāngata whenua and land and water. For example, aquatic ecosystems are not separate from mahinga kai. A waterway with good flows, riparian margins and water quality enhances cultural well-being. The use of the term overcomes the division of culture and nature.

The starting point when managing an ecosystem must be developing an understanding of the relationship of tāngata whenua with the land and water. The protection of the eco-cultural system must be the priority for land and water management. As Tudge (2006) explains "integral to the survival of indigenous culture is restoring the ecological communities that are central to their traditional life-ways and that are woven into stories, ceremonies, songs and practices".

Source: Personal Communication, Gail Tipa (Tipa and Associates); Tudge, C. (2006). *The tree: a natural history of what trees are, how they live, and why they matter*. New York: Crown Publishers.

Improving water quality in the region

For tāngata whenua, improving water quality in the region means:

- » Eliminating existing unnatural discharges to water;
- » Avoiding any new discharges of contaminants to water;
- » Establishing native vegetated riparian buffer zones along all waterways and drains;
- » Protecting existing and restoring degraded springs and wetlands;
- » Appropriate controls on rural and urban land use to eliminate non-point source pollution;
- » Flow and allocation regimes that enable sufficient flow to safeguard water quality; and
- » Prohibiting activities that have significant adverse effects on water quality.

EFFECTS OF INTENSIVE RURAL LAND USE ON FRESHWATER RESOURCES

Issue WM7: Intensive rural land use is having unacceptable effects on water quality, water quantity, and the relationship of Ngāi Tahu with freshwater.

Ngā Kaupapa / Policy

Matching land use with land capability and water availability

- WM7.1 To require that rural land and water planning, management and use recognises and provides for:
- (a) Catchment boundaries and water availability;
 - (b) Water quality and quantity thresholds and limits;
 - (c) Land capability, including soil type and topography;
 - (d) The protection of eco-cultural systems and resources; and
 - (e) The capacity of a catchment to assimilate land use effects.
- WM7.2 To require a precautionary approach to the land use conversion and intensification in the takiwā that recognises and provides for:

- (a) Existing and future effects of diffuse source pollution on surface and groundwater resources from land use;
- (b) The cumulative effects of land use on the health of soil and water resources; and
- (c) The cultural and environmental costs of land conversion and intensification, in addition to economic return per hectare.

WM7.3 To work with local authorities to develop land use and water quality assessment tools to evaluate the suitability of particular areas for certain activities (e.g. dairy), including but not limited to:

- (a) The use of zoning as a method to enable land use that matches local conditions (e.g. soil, climate, water availability, assimilative capacity), as opposed to best economic return per hectare (i.e. when you add enough water and nutrients) and that protect waterways from particular land use activities that are likely to threaten water quality.

Resource consents for irrigated and other forms of intensive land use

WM7.4 All new land conversions for irrigated and other forms of intensive land use (e.g. dairy and cropping) should require resource consent, and be assessed on the following matters:

- (a) Appropriateness of the activity to the environment based on:
 - (i) Soil type and topography;
 - (ii) Proximity to surface water (waterways, wetlands, waipuna, lakes and drains);
 - (iii) Depth to groundwater, and nature of the aquifer (confined or unconfined); and
 - (iv) Water quantity required and limits of available water supply.
- (b) Actual and potential effects on the environment and associated Ngāi Tahu values, including the relationship of Ngāi Tahu to land, water and sites; and
- (c) Cumulative effects of existing irrigated and other forms of intensive land use in the catchment.

WM7.5 To require that resource consents granted for irrigated and other forms of intensive land use are subject to the following conditions of consent:

- (a) The development, implementation and monitoring of farm management plans that cover such matters as effluent, irrigation, soil and environmental infrastructure management, stocking rates, and associated reporting requirements and monitoring provisions; and

- (b) Provision to protect and enhance cultural and environmental values, including indigenous biodiversity (e.g. the establishment of shelter belts using native species).

WM7.6 To require that land use and water abstraction consents associated with intensive rural land use are assessed and evaluated together as joint consents.

Catchment nutrient management

WM7.7 The development of catchment nutrient budgets as a tool to manage the cumulative effects of land use on water quality and create rules and incentives to improve on land and water management.

WM7.8 To oppose the trading of nutrient limits. Limits must be attached to land and location.

WM7.9 To support the concept of creating 'headroom', through improved nutrient management, to enable land use change or intensification, but only when:

- (a) Water quality load limits reflect the need to improve water quality and general cultural health of the catchment, particularly lower catchments, and not just maintain the existing state;
- (b) Improving water quality and the cultural health of rivers is given priority over enabling development; and
- (c) Headroom is not created using nutrient trading.

Internalisation of environmental costs

WM7.10 To promote on-farm measures that maximise water use efficiencies and reduce nutrient loss, and that enable landowners undertaking intensive rural farming activities to be responsible for the cultural and environmental costs of their activities, including but not limited to:

- (a) The treatment of effluent before disposal;
- (b) On-farm nutrient management;
- (c) Appropriate stocking rates, that avoid soil loss and nutrient leaching;
- (d) Soil and foliage testing to optimise and minimise fertiliser use;
- (e) Best practice irrigation management;
- (f) The protection, construction or restoration of environmental infrastructure such as wetlands and riparian margins; and
- (g) Fencing off surface waterways.

WM7.11 To require effective and enforceable penalties for non-compliance, including revoking resource consents and enforced environmental remediation.

Incentives

WM7.12 To recognise and support those land users and managers that are demonstrating sustainable land use and protecting and enhancing the environment and cultural values.

WM7.13 To support the use of incentives to encourage landowners to practice stewardship of freshwater resources. Incentives can be a more powerful tool than regulatory measures such as fines or rules.

Cumulative effects

WM7.14 To require that the effects of land use activities on water quality and quantity are assessed with due regard to the cumulative effects of all land use in the catchment and as well as of individual consents.

is valued and how land is used and managed, rather than simply mitigating the effects of farming. This approach requires an assessment of how we are using land and water as a *prerequisite* to looking for ways to securing more water and increase production.

“You can grow grass anywhere if you add enough water and nutrients, but in some places we need to consider whether it is the best place to grow grass if we need to add that much water and nutrient.”

IMP Working Group, 2011.

Cross reference:

- » *Issue WM11: Transfer of water permits*
- » *Issue WM6: Water quality*
- » *Issue WM8: Water quantity*
- » *Issue WM9: Regional infrastructure*

He Kupu Whakamāhukihuki / Explanation

The effects of intensive rural land use on water quality and quantity is one of the most significant issues for tāngata whenua. Increased pastoral and agricultural production across Ngā Pākihi Whakatekateka o Waitaha has come with a high environmental and cultural cost (see Table 2). Many waterways are not safe to swim in or catch fish from, and many community groundwater supplies are at risk of nitrate and *E.coli* contamination. While tāngata whenua recognise the need for agriculture production, development must be sustainable for the very long term and not driven purely by economics and short-term gains. The right to take and use water must be premised on the responsibility to protect water as a taonga resource.

Intensive pastoral grazing is the land use with the greatest impact on water quality, in terms of land area and the volume of water affected, and waterways in and adjacent to dairy farms are among the most polluted in the country (Issue WM6). Controlling the effects of land use on water quality is critical to recognising and providing for the ancestral relationship of Ngāi Tahu with water.

Tāngata whenua support greater regulation of land use that adversely affect waterways. Appropriate controls are required to avoid unlimited land intensification and conversions, particularly with proposed irrigation schemes providing new supplies of water. One method to address this issue is to require resource consents for all new and existing high impact intensive and irrigated rural land use activities, and to ensure that effects on cultural values and the environment are a key component of assessing the sustainability and appropriateness of these activities. Tāngata whenua want to see changes in the way water

Table 2: Examples of adverse effects associated with intensive rural land use

Activity	Adverse effects
Stock access to waterways	<ul style="list-style-type: none"> ❖ Sedimentation ❖ Trampling of river bed and riparian margins, reducing bank stability and inducing erosion ❖ Degradation of mahinga kai habitat ❖ Impacts on wāhi tapu and wāhi taonga values ❖ Effluent degrades water quality
Drainage and riparian modification	<ul style="list-style-type: none"> ❖ Can impede fish passage and reduce quality of aquatic habitat ❖ Changes to natural character of waterways ❖ Loss of mahinga kai resources ❖ Degradation of water quality ❖ Reduced filtration of contaminants
Water abstraction	<ul style="list-style-type: none"> ❖ Low flows affect water quality and overall cultural health ❖ Lack of water affects mahinga kai habitat, and customary use opportunities ❖ Surface water abstractions can affect groundwater quality and quantity ❖ Spring fed streams particularly vulnerable to over-abstraction
Irrigation bywash	<ul style="list-style-type: none"> ❖ Direct discharges of nutrients and sediment to surface water ❖ Can alter stream flows ❖ Seepage of irrigation water back to surface waters leads to increased organic loading and discoloration. ❖ Mixing of waters and adverse effects on mauri
Intensive irrigation	<ul style="list-style-type: none"> ❖ Run off and leaching of contaminants and nutrients into surface and groundwater ❖ Changes soil character ❖ Adverse effects on mauri of soil resources
Stocking rates	<ul style="list-style-type: none"> ❖ High stocking rates leads to nitrate contamination from urine patches and effluent ❖ Increased risk of run off and leaching to water ❖ Degradation of soil resources ❖ Nitrate leaching to groundwater
Discharge of dairy shed effluent to land	<ul style="list-style-type: none"> ❖ Concentrated contaminants released to soil and risk of oversaturation and contamination of groundwater ❖ Potential for run off to waterways
Shelter belt removal	<ul style="list-style-type: none"> ❖ Loss of habitat and diversity ❖ Loss of protection for soil resources; increased soil erosion
Fertiliser use	<ul style="list-style-type: none"> ❖ High fertiliser use results in high levels of nitrates and phosphates in soil that can leach into groundwater and run off to surface water.



WATER QUANTITY

Issue WM8: Freshwater resources in the takiwā are over-allocated or under increasing pressure from abstractive use, and this has resulted in significant effects on:

- (a) **Mauri;**
- (b) **Mahinga kai habitat, abundance and diversity;**
- (c) **The relationship of tāngata whenua with freshwater, including cultural well-being and the loss of customary use opportunities;**
- (d) **The flows of lowland spring fed streams;**
- (e) **The ability of groundwater resources to replenish and recharge for ongoing use and future generations;**
- (f) **Resilience of waterways, or the ability to withstand stress or disturbance;**
- (g) **Natural variability and character of waterways, including floods and freshes;**
- (h) **Cultural health of hāpua, including duration and frequency of openings; and**
- (i) **Connectivity between waterways and their tributaries, associated wetlands and the sea.**

Ngā Kaupapa / Policy

Flow and water allocation regimes

WM8.1 Environmental flow and allocation limits must be set on all waterways, including tributaries.

WM8.2 Environmental flow and water allocation regimes must recognise and provide for Ngāi Tahu values and interests, and therefore deliver cultural and environmental outcomes. This means flows and limits recognise and provide for:

- (a) Mauri and mahinga kai as first order priorities, over abstractive use: *'how much water does the river need to be healthy'* rather than *'what is the lowest possible flow that the river can sustain'*;
- (b) Flow and limits that restore *what a river should be*, as opposed maintaining the existing degraded condition or value (particularly lowland streams);
- (c) Flows and limits reflect seasonal flows and flow variability, including floods and freshes;
- (d) Continuous and reliable flow of water through the river *Ki Uta Ki Tai*, from the headwaters to the estuarine and coastal environments, noting that in some waterways this may include both

surface and underground flow;

- (e) There is sufficient water to sustain the wetlands and waipuna associated with waterways;
- (f) River mouth and hāpua dynamics and ecological processes are protected, including duration and frequency of openings;
- (g) The interconnectedness of groundwater and surface water is recognised and provided for, and certainty of supply for groundwater recharge is ensured;
- (h) Sufficient water depth and flow for indigenous fish passage, recognising that species such as tuna require a specific ecological flows (floods and freshes) to trigger and enable safe and successful passage;
- (i) The quality and quantity of water on tribal properties and NTCSA 1998 sites is enhanced;
- (j) Flows are consistent with protecting and enhancing mahinga kai and indigenous biodiversity values;
- (k) Shingle movement does not lead to unnatural or exacerbated aggradation and erosion; and
- (l) Weed and periphyton growth and algal blooms are avoided.

WM8.3 To require the use of a range of tools and initiatives to achieve Policy WM8.2, including but not limited to:

- (a) The mātauranga held by whānau and hapū about waterways and the flows required to sustain specific cultural values is recognised equally alongside mainstream methods;
- (b) Cultural monitoring tools, such as COMAR to identify flow and water quality that would enable the protection of tāngata whenua values (see Issue WM4);
- (c) Stock water not be exempt from flow and allocation plans (see Box – *Stockwater Issues*);
- (d) Water permits are attached to land not to consent holders (See Issue WM11);
- (e) Mandatory water metering on all water takes, as a condition of consent;
- (f) Continuous recording of flow at appropriate locations;
- (g) Requiring efficient use of water as a condition of consent;
- (h) User levies on abstractions to fund resource studies and realise protection and restoration measures; and
- (i) Common consent expiry dates within catchments.

WM8.4 To require that specific values important to local waterways and catchments as identified in Part 6 of this IMP (Catchment Policy) are recognised and provided for when establishing flow and allocation limits.

Ngāi Tahu restoration initiatives

WM8.5 To ensure that environmental flow and water allocation regimes are consistent with supporting and furthering Ngāi Tahu initiatives to restore waterways and their mahinga kai values.

Aquifers

WM8.6 To require that aquifers are recognised and protected as wāhi taonga. This means:

- (a) The protection of groundwater quality and quantity, including shallow aquifers;
- (b) The protection of aquifer recharge;
- (c) Ensuring a higher rate of recharge than abstraction, over the long term;
- (d) Continuing to improve our understandings of the groundwater resource, and the relationship between groundwater and surface water.

Over-allocated catchments

WM8.7 To require the implementation of an immediate solution to addressing the over-allocation of water in particular catchments, based on a staged approach designed to enable an improved understanding of the local environment and natural resource requirements:

- (1) Firstly:
 - (i) Do not grant any new abstraction or water permit, and place a moratorium on all new land conversions requiring water;
 - (ii) Do not allow the trading of existing permits;
 - (iii) Review all existing consents for actual use, using metering; and
 - (iv) Require the cancellation of consents of not being given effect to, and the surrender of unused allocations (i.e. no transfers of unused water).
- (2) Secondly:
 - (i) Assess the state of the resource (groundwater, waterway);
 - (ii) Monitor how the resource responds to these measures; and
 - (iii) Adapt management plans and practices accordingly, acknowledging the principle of matching land use with natural resource

limits and availability. If the resource is still degraded, then address issue through a community process, including assessing whether land use (water demand) needs to change.

WM8.8 To address allocation issues in those catchments that are currently identified as nearing over-allocation (e.g. at 80%) as a matter of priority.

Controls on land use to protect water quantity

WM8.9 To require controls on specific land use activities that are associated with high water demand, through policies and rules in district and regional plans, to protect surface water flows and groundwater recharge, particularly in water sensitive catchments where the demand for water can be inconsistent with water availability.

WM8.10 To support a requirement for water permit applicants to demonstrate the need for the quantity of the proposed water take, including providing information on crop type, productive area, acreage, proposed water use per hectare, estimated water losses, and efficiency measures. This information will guide the assessment of the appropriateness of the proposed water take and land use with regard to the effects on soil and water resources.

Efficiencies

WM8.11 To support activities and strategies to improve the efficiency of water use in urban and rural situations, including:

- (a) Water efficiency technology in residential, commercial, industrial and urban environments:
 - (i) rainwater storage tanks;
 - (ii) greywater reuse;
 - (iii) reduced or low flow devices (e.g. low flush toilets and efficient showerheads); and
 - (iv) water efficient appliances.
- (b) Water efficiency technology on the farm:
 - (i) metering of use;
 - (ii) soil moisture monitoring;
 - (iii) efficient irrigation technology;
 - (iv) wise irrigation practices, such as irrigating at night; and
 - (v) collecting and storing rainwater for on farm use.

WM8.12 To ensure that water use efficiency criteria is to apply to all users of water - new and existing permit holders.

WM8.13 To require that any water saved through efficiency gains is returned to the river to restore river health as a first priority, rather than made available for re-allocation.

Resource consents to take and use water

WM8.14 To advocate for a maximum of a 15 year duration on water permits, and consent terms to reflect the:

- (a) Level of existing knowledge about the resource;
- (b) Risk to the resource;
- (c) Nature of the activity supported by the take and use of water, and justification for amount applied for; and
- (d) Need for common expiry dates in the catchment.

WM8.15 To oppose the granting of water permits to take and use water from waterways where there is insufficient information about flows, including flow volume and variability (e.g. small tributaries).

WM8.16 To advocate for monitoring, reporting and effective and enforceable penalties for non-compliance, including revoking resource consents and enforced environmental remediation.

“The status quo is that when water gets scarce or polluted, we just look for ways to find more water, or we just go deeper. We devise out-of-catchment water transfers and we dig deeper wells, rather than address the source of the problem.” Terrianna Smith, Te Taumutu Rūnanga.

Ngāi Tahu values such as mauri and mahinga kai are flow dependent. Sufficient water quantity, along with suitable flow conditions are key elements of safeguarding the mauri or life supporting capacity of waterways and their value as mahinga kai. Environmental flow and allocation regimes must be designed to protect the mauri of the waterway, rather than simply ensure water is there for abstraction. The minimum flow process is often viewed as prioritising abstraction and assessing a waterway in terms of the lowest acceptable flow (i.e. determining ‘where the bottom of the bucket is’) rather than what is needed to ensure river health.

Ngāi Tahu have consistently advocated for measures to improve certainty for instream life and users, in the same way that is provided for out-of-stream users such as irrigators. The policies in this IMP set out the values, tools and processes to enable environmental flow and water allocation regimes to protect eco-cultural systems, and therefore deliver cultural outcomes.

He Kupu Whakamāhukihuki / Explanation

Freshwater resources in the takiwā are over-allocated or under increasing pressure from abstractive use and this is having a significant effect on the mauri of these resources and the relationship of tāngata whenua to them. In 2012 there are ten red zones in Canterbury where water has been fully allocated, and four yellow zones where allocation exceeds 80% of the allocation limit.

The prevailing approach to water management has been to prioritise abstractive use over the mauri of the resource, and to commodify and compartmentalise water rather than manage it as a life sustaining taonga. Freshwater management has more often than not been driven by economic considerations to the detriment of the environment and cultural values associated with that environment. Over-allocation is a reflection of the lack of understanding of the freshwater resource, including the relationship between surface and groundwater, and of the lack of value given to the resource. Resolving over-allocation requires a fundamental shift of mindset: from maintaining reliability of supply for abstractors to recognising the value of water as essential to all life and respecting it for its taonga value ahead of all other values.

Stock water issues

Why does the RMA specifically provide for stock water but not water for native fish? The taking and using of water for stock drinking purposes is allowed under the Resource Management Act 1991 (RMA) without the need for a resource consent (s.14 3 (b)). Yet stock water demands can be significant, whether from a bore, river or stock water race that derives its water from a river. A lactating dairy cow can require up to 70 litres of water per day.

Without specific recognition and provision for stock water demands within the water allocation regime, river flows can potentially be reduced below minimum flows for extended periods to a point where the life cycles of native fish are adversely and disproportionately affected.

To be effective, water allocation regimes will have to explicitly recognise and provide for stock water demands. A fair balance must be found whereby the needs of native freshwater fish, particularly mahinga kai species, can be provided for without being adversely affected by the increased demands for water, including stock water, through intensified land use.

Transfers of unused allocations

A landowner may hold a consent for 100l/s but is only using half that amount. For Papatipu Rūnanga, an important step to addressing over-allocation is to require the surrender of unused allocations and the cancellation of consents that have not been given effect to, and to prevent the transfer of water permits. Not just some of it - *all of it*. Then we can assess the state of the waterways and adjust accordingly. Once we have established how much water the river needs, then we can determine how much can be allocated.

REGIONAL WATER INFRASTRUCTURE

Issue WM9: The need for a robust cultural framework to assess regional water infrastructure proposals, based on sound cultural and environmental bottom lines.

Ngā Kaupapa / Policy

WM9.1 To advocate for a takiwā-wide robust evaluation and assessment of the land uses that our freshwater resources are supporting, including the assimilative capacity of the land and the long-term cumulative effects of land use, *prior to* looking for ways to provide more water.

WM9.2 To promote co-operative and constructive relationships between the irrigation and energy sectors and Ngāi Tahu, over and above RMA 1991 consultation, to facilitate consideration of effects of regional water infrastructure options on tāngata whenua values and interests.

WM9.3 To support in principle the storage of water through local and regional infrastructure development, provided that:

- (a) Land use or land use change enabled by the provision of water is managed to avoid compromising cultural and environmental values, including water quality.
- (b) The location of storage does not compromise places or sites with outstanding cultural characteristics and values;
- (c) Storage will relieve pressure on groundwater resources;
- (d) Water is harvested on the receding flows of floods and freshes;

- (e) The role of floods and freshes in channel formation and the maintenance of river processes and health is not compromised; and
- (f) There is a robust and critical assessment of effects on Ngāi Tahu values (see Policies WM9.4 and WM9.5).

Evaluating cultural effects and benefits

WM9.4 To critically evaluate the cultural implications of any damming, on-farm storage, community water enhancement schemes, or water storage proposal that may have adverse effects on resources and values of importance to tāngata whenua, with particular regard to:

- (a) How the proposal aligns with Ngāi Tahu priorities for water use, as per Policy WM3.1;
- (b) Consistency with Ngāi Tahu initiatives to restore waterways and their mahinga kai values;
- (c) The nature and extent of transfer and mixing of waters between and within catchments;
- (d) The effects of increased water availability and subsequent land use change on surface and groundwater;
- (e) Measures to avoid non-point source pollution;
- (f) The effects on cultural landscapes sites, features and values;
- (g) The effects on coastal ecosystems and processes, including hāpua;
- (h) The potential for loss of mahinga kai resources and opportunities (e.g. disruption of fish passage);
- (i) Interruption of continuity of flow Ki Uta Ki Tai; and
- (j) The cultural imperative to leave the natural environment, including waterways, in a better state for future generations than its current or inherited state.

WM9.5 To critically evaluate the potential for damming, diversion or water storage proposal to have positive effects on Ngāi Tahu values, with particular regard to:

- (a) Objectives to re-establish and restore indigenous biodiversity on the landscape, including biodiversity/habitat corridors;
- (b) Alleviating pressure on groundwater resources and opportunities for groundwater consents to be surrendered as a condition of the provision of new water infrastructure; and
- (c) Increased controls and consistency for land use activities benefiting from water infrastructure, including:
 - (i) Imposition of environmental levies (user

levies) as a condition of water supply, to encourage efficiency and provide funds for research and monitoring, and protection and enhancement initiatives; and

- (ii) Requirement for farm management plans as a condition of water supply, to minimise the effects of land use on the farm site and wider environment.

WM9.6 To ensure that the effects of any proposed regional water infrastructure scheme are assessed with reference to the objectives for ecological and cultural health of waterways in the takiwā (i.e. *what should be there*), rather than the existing degraded state of the resource. The existing degraded condition of a waterbody cannot be used as a basis for allowing further adverse effects to occur.

WM9.7 To require that any proposed regional water infrastructure scheme includes provisions for a contingency fund, to be used for remediation and to remedy unanticipated effects on the environment (e.g. dam failure) and unforeseen cumulative effects on water quality.

He Kupu Whakamāhukihuki / Explanation

Regional infrastructure proposals such as community water enhancement schemes and hydro-generation proposals are an ongoing issue of importance to tāngata whenua, given the cultural importance of, and increasing demand for, water in the takiwā.

Tāngata whenua are not opposed to regional infrastructure proposals involving water resources. Hydroelectric generation is important to the country's power supply and economy. The considered provision of community water enhancement schemes can potentially ease pressure on over-allocated groundwater resources and improve on-farm management of environmental effects.

However, in the midst of the increasing demand for the region's water resources there are fundamental issues that need to be addressed. For example, community water enhancement schemes are by no means a comprehensive solution to water quality and water quantity issues in the takiwā (see Box – *Is more water to lowland streams a benefit?*). Intensive land use in the region, particularly dairying, is having a significant impact on groundwater and waterways, and the values associated with those resources (Issue WM6). Tāngata whenua firmly believe that, as a prerequisite to providing more water, we need to assess and evaluate the types of land use that water is supporting, and whether these are sustainable *mō tātou, ā, mō kā uri ā*

muri ake nei. Importantly, concerns relate to the effects of water use and the ability of the region to assimilate land use effects, rather than to the scale of scheme (i.e. 100 small schemes could have more effects than one large scheme).

“Tāngata whenua realise that better land management including irrigation efficiencies, will likely reduce run-off of contaminants to adjacent surface waters which they accept should be viewed as a positive. However the reality is that these same options will result in more lands being irrigated. Tāngata whenua fear that any gains from increased flows will be offset by the effects of land use.”⁴

An issue of particular significance concerning regional infrastructure proposals is the unnatural mixing of water (Issue WM10). The transfer of water between and within catchments are often key features of hydro-generation and irrigation proposals. For Ngāi Tahu there are cultural and environment risks associated with the unnatural mixing of waters from different environments.

Policies WM9.1 to WM9.7 provide a framework of cultural and environmental considerations against which regional infrastructure proposals can be assessed. The approach sets out the cultural parameters or thresholds against which activities such as damming and diversions should be assessed, rather than establishing opposition or support. Cultural thresholds are desired states or levels of acceptability that are determined through the need to protect, maintain, and in some cases enhance, tāngata whenua values. They reflect the relationship between values and activities that may affect those values, and of the sensitivity of certain values to change.

Cross reference:

- » *Issue WM6: Water quality*
- » *Issue WM7: Effects of intensive rural land use on water resources*
- » *Issue WM8: Water quantity*

Information resources:

- » *Cultural Impact Assessment for the Central Plains Water Enhancement Scheme (2005). Prepared by D. Jolly on behalf of Te Taumutu Rūnanga, Ngāi Tūāhuriri Rūnanga and Te Rūnanga o Ngāi Tahu.*
- » *Cultural Impact Assessment - Rakaia Water Conservation Order. Prepared by M. Home and C. Severne for TrustPower Ltd.*
- » *Tāngata Whenua Values Report for the Waiau, Hurunui, Waipara and Kowai River catchments, as part of the Hurunui Community Water Development Project. Prepared by D. Jolly on behalf of Te Rūnanga o Kaikōura and Ngāi Tūāhuriri Rūnanga, for the Hurunui Community Water Development Project Working Group.*

» *Preliminary Cultural Impact Assessment for the Hurunui Water Project Waitohi Irrigation and Hydro Scheme (2011). Prepared by KTKO Ltd.*

Is more water to lowland streams a benefit?

While increased water availability as result of community water enhancement schemes *may* result in increased flow in lowland streams, it *will* result in more intensive land use, which *will* inevitably increase the likelihood that surface and groundwater will continue to be degraded. Ngā Rūnanga identify a real risk that the water in lowland streams, lakes and hāpua will be of a lesser quality due to the proliferation of non-point source pollution presently associated with intensive land use. Flow augmentation via irrigation schemes is not seen as a way to address the issue of low flows and poor water quality in lowland streams, lakes and hāpua, and the 'benefit' of more water to lowland streams is therefore not necessarily seen as an environmental or cultural benefit.

As a 2005 Environment Court decision (Lynton Dairies Ltd vs. Canterbury Regional Council, C108/05) concluded: "Any excess water that might be surfacing in the lowland streams is not going to provide any natural benefit at the current time because of the woeful condition of these waterways and their riparian margins."

UNNATURAL MIXING OF WATER

Issue WM10: There can be significant cultural issues associated with the unnatural mixing of water between and within catchments.

Ngā Kaupapa / Policy

WM10.1 In principle, the unnatural mixing of water from different sources between or within catchments is culturally inappropriate.

WM10.2 Water infrastructure proposals that will result in the unnatural mixing of waters will be assessed by Papatipu Rūnanga on a case by case basis, allowing for consideration of:

- The varying perspectives of different hapū to the unnatural mixing of waters in their takiwā;
- The current state of water quality, water quantity, indigenous biodiversity and other cultural values within particular waterways; and

- Different mixing scenarios, including provisions to avoid or mitigate cultural issues and/or provide cultural benefit.

WM10.3 The cultural acceptability of proposals that will result in the unnatural mixing of waters will be assessed using the following framework:

- The unnatural mixing of water is likely to be culturally unacceptable where it involves:
 - direct mixing between glacial, rain or spring fed waters,
 - direct mixing of waters used for different purposes;
 - direct mixing of water between different catchments; or
 - direct mixing of water from different aquifers.
- The unnatural mixing of waters may be acceptable where it involves:
 - Waters that already mix naturally within the same catchment;
 - Waters that are of same type (e.g. rainfed to rainfed); or
 - Waters that are filtered through natural processes, such as natural or constructed wetlands and riparian margins.

He Kupu Whakamāhukihuki / Explanation

For tāngata whenua, avoiding the unnatural mixing of waters is fundamental to the protection of mauri in waterways. Transferring water from one catchment to another or mixing different types of water through flow augmentation, tributary transfers and out-of-catchment transfers means that the life supporting potential of the receiving water is potentially compromised (i.e. it may no longer have the same life giving potential as it would if it were left in its original state).

What makes water types incompatible? Ngāi Tahu have traditionally opposed mixing waters from different environments. The mixing of waters from different environments is generally considered unacceptable when waterways are associated with mutually exclusive uses (e.g. cleansing the dead and collecting food). The unnatural mixing of waterways may also be unacceptable to Ngāi Tahu if the distinctive characteristics of each waterway (e.g. source, topography, temperature, pH and flow) contribute to specific ecosystems that would be compromised as a result of mixing with other waters.

On either occasion, the transfer of water may ultimately affect the relationship of tāngata whenua with that waterway, including a reduction in the abundance and health of mahinga kai, the diversity and distribution of

species, and the overall ecological balance of the waterway.

“The river’s whakapapa is what we must protect when we are talking about the potential mixing of waters from different rivers.” Te Taumutu Rūnanga kaumatua.

Mixing of different waters occurs naturally. However, where natural mixing occurs, the mixing is almost always facilitated by the presence of a wetland, estuary or similar environment that provides a natural buffer or transition zone. An example is hāpua and estuaries, where salt and freshwater mix.

A case by case approach is required to assess proposals involving the mixing of waters, recognising the potential for different views between hapū, and the relative acceptability or non-acceptability of individual scenarios.

Cross reference:

» *Issue WM9: Regional water infrastructure proposals*

Information source:

- » *Cultural Impact Assessment for the Central Plains Water Enhancement Scheme (2005). Prepared by D. Jolly on behalf of Te Taumutu Rūnanga, Ngāi Tūāhuriri Rūnanga and Te Rūnanga o Ngāi Tahu.*
- » *Tāngata Whenua Values Report for the Waiau, Hurunui, Waipara and Kowai River catchments, as part of the Hurunui Community Water Development Project. Prepared by D. Jolly on behalf of Te Rūnanga o Kaikōura and Ngāi Tūāhuriri Rūnanga, for the Hurunui Community Water Development Project Working Group.*

TRANSFER OF WATER PERMITS

Issue WM11: The ability to transfer water permits and treat water as a tradeable commodity is inconsistent with tāngata whenua perspectives on how to achieve the sustainable management of water.

Ngā Kaupapa / Policy

WM11.1 To require that water permits are connected to the property they were allocated to, and herefore to a specific waterway or aquifer, and not to a permit holder; and that when land is sold the new owner must re-apply for consent to take water if there is a proposed change to land use.

WM11.2 To oppose the transfer of water permits in catchments that are over-allocated.

WM11.3 To oppose the transfer of unused allocations

associated with a water permit to another use or user different from that which it was originally allocated/permitted for. Unused water must remain in the river and a new permit should be required for any new land use.

He Kupu Whakamāhukihuki / Explanation

The transfer of water permits is a significant issue of concern for tāngata whenua. If, as the Crown asserts, water is not owned by anyone, then individuals should not be able to trade it as a commodity. The use of water should be location specific; tied to the flow and allocation regimes of a specific waterway or groundwater resource.

ACTIVITIES IN THE BEDS AND MARGINS OF RIVERS AND LAKES

Issue WM12: Activities occurring within the beds of rivers and lakes and their riparian zones can adversely affect Ngāi Tahu values associated with these areas.

Ngā Kaupapa / Policy

Cultural use

WM12.1 To require that local authorities recognise Ngāi Tahu cultural use as an activity that occurs in beds of rivers and lakes and their riparian zones, and provide for this as a permitted activity (including any structures that may be required to enable cultural use).

Riparian areas

WM12.2 To require the protection and restoration of native riparian vegetation along waterways and lakes in the takiwā as a matter of priority, and to ensure that this can occur as a permitted activity.

Access

WM12.3 To require that local authorities recognise and provide for the following cultural matters associated with access and use of the beds and margins of rivers and lakes:

- (a) The need to protect sites of cultural significance to tāngata whenua when considering public access; and
- (b) The need to protect and maintain Ngāi Tahu

access to sites associated with wāhi tapu, wāhi taonga, mahinga kai and other cultural resources, including Fenton reserves, Fenton Entitlements and Nohoanga.

Use and enhancement of river margins in the built/urban environment

WM12.4 All waterways in the urban and built environment must have indigenous vegetated healthy, functioning riparian margins.

WM12.5 To require that all waterways in the urban and built environment have buffers or set back areas from residential, commercial or other urban activity that are:

- (a) At least 10 metres, and up to 30 metres; and
- (b) Up to 50 metres where there is the space, such as towards river mouths and in greenfield areas.

WM12.6 In the urban environment, it is accepted that waterways may have existing exotic vegetation along margins (e.g. exotic specimen trees in waterside reserves). However the objective is still to promote native riparian vegetation, as taonga valued for flood control, the maintenance of water quality, mahinga kai and cultural well-being.

WM12.7 To require all esplanade reserves and esplanade strips established on subdivisions to incorporate native riparian planting.

Riverworks

WM12.8 To require that all river works activity, including vegetation clearance and silt removal, are undertaken in a manner that protects the bed and margins of the waterway from disturbance, and that mahinga kai values are not compromised as a result of the activity.

WM12.9 To require that any river works activity that results in the loss or damage of riparian vegetation includes measures to replace or restore vegetation, with appropriate indigenous species.

WM12.10 To require the appropriate disposal of spoil (silt or weed), with a preference for the use of spoil as compost.

WM12.11 To oppose the use of global consents for earthworks activities in the beds and margins of waterways.

WM12.12 To require that any plantings associated with flood protection works is undertaken using indigenous species.

Structures in the beds and margins of waterways

WM12.13 To require that any structure, essential or otherwise, in the bed or margin of a waterway (e.g. floodgate) supports and enables passage for migratory indigenous fish species and does not compromise any associated kōhanga.

Rural activities along and in the beds and margins of rivers

WM12.14 To protect the beds and margins of foothill, lowland, and coastal waterways from effects associated with rural land use by requiring a 20 metre buffer or set back area from the waterway, or whatever distance is appropriate to ensure:

- (a) Capture of run-off and protection of water quality;
- (b) Protection of eco-cultural attributes such as mahinga kai; and
- (c) Prevention of stock access to waterways.

WM12.15 Recognising that a 5 metre well-planted buffer along a healthy stream may be as effective as a 20 metre buffer along a degraded waterway, the appropriate size of buffers or set back areas along waterways as per Policy WM12.14 should be based on an assessment of:

- (a) The nature of the adjacent land use and therefore risk to waterway health;
- (b) The existing state of cultural health of the waterway; and
- (c) The existing pressures on the waterway.

WM12.16 To advocate for buffer zones on braided river margins that are least the width of the river itself, as a buffer against land use and development.

WM12.17 To oppose the use of river and lake beds and their margins for farming activities, including the conversion to pasture, grazing of stock and growing of winter feed crops.

Gravel extraction

WM12.18 To support sustainable gravel extraction as part of floodplain and river management in the takiwā provided that:

- (a) It is undertaken in areas where there is no surface or groundwater flow, while recognising the need to ensure that there are still gravels available to be transported downstream in floods;
- (b) Methods are used to avoid or minimise sedimentation; and

- (c) The location of extractions sites does not compromise wāhi tapu, wāhi taonga or mahinga kai values.

WM12.19 To limit the duration of resource consents for gravel extraction to 10 years, and to maintain the ability to require consent durations of 2-5 years on some waterways.

WM12.20 To require that gravel extraction activities maintain the natural character of the waterway, including but not limited to returning the site of extraction to its original shape and character following gravel extraction.

WM12.21 To require that gravel extraction consent applications assess actual and potential effects on cultural values including but not limited to effects on:

- (a) Mahinga kai, including bird nesting sites, native fish habitat, nohoanga and fishing easements;
- (b) Wāhi tapu, wāhi taonga and other sites of cultural significance;
- (c) The natural character of the river;
- (d) Hāpua and river mouth environments; and
- (e) Potential for positive effects on cultural values through improvements to river environments (e.g. willow removal).

WM12.20 To recognise the ability of gravel extraction to address issues associated with the unnatural aggradation of gravel in the lower reaches of some waterways, but to advocate for solutions that identify and address the source of the aggradation (e.g. low flows and upper catchment erosion).

He Kupu Whakamāhukihuki / Explanation

Tāngata whenua have a particular interest in the beds of lakes and rivers and their margins. River and lake beds and their margins may be significant for cultural use (e.g. mahinga kai) or for the presence of significant sites (e.g. wāhi tapu). Nohoanga sites established under the NTCSA are located in a number of the beds or margins of rivers and lakes in the takiwā. The beds of Te Waihora and Muriwai were vested in Te Rūnanga o Ngāi Tahu as an outcome of the Ngāi Tahu Claim. For Ngāi Tahu, the beds and margins of lakes and rivers are part of the waterbody, and not separate from it.

A range of activities occur in the beds and margins of lakes and rivers. Some of these have the potential to compromise waterway health and other Ngāi Tahu values. Activities of particular concern are:

- Gravel extraction, given that extraction is near or

at sustainable limits in many rivers (e.g. Rakahuri, Waimakariri and Waipara) and there will be increased demand for this resource during the rebuild of Christchurch;

- Use of waterways in the urban environment for stormwater treatment and disposal;
- Encroachment of the urban built environment on waterways;
- Riverworks activities such as weed cleaning, vegetation clearance and silt removal;
- Physical modification of beds of rivers and their margins (e.g. channalisation);
- Effects of structures in riverbeds on fish passage (e.g. floodgates);
- Farming activities in riverbeds and in the margins of rivers and lakes, including the conversion of braided riverbeds and margins to pasture;
- The planting of exotic vegetation on river margins; and
- Access to sites of cultural significance.

“We have seen the effects on sedimentation on our fish, when gravel extraction is done in areas of flowing water.” Clare Williams, Ngāi Tūāhuriri Rūnanga.

Cross reference:

- » *Issue WM13: Riparian margins*
- » *Issue WM14: Drain management*
- » *General policy on earthworks (Section 5.4 Issue P11)*

WETLANDS, WAIPUNA AND RIPARIAN MARGINS

Issue WM13: Loss of wetlands, waipuna and riparian margins, and the cultural and environmental values associated with them.

Ngā Kaupapa / Policy

WM13.1 To recognise and protect all wetlands, waipuna and riparian areas as wāhi taonga that provide important cultural and environment benefits, including but not limited to:

- (a) Mahinga kai habitat;
- (b) The provision of resources for cultural use;
- (c) Cultural well-being;
- (d) The maintenance and improvement of water quality; and
- (e) Natural flood protection.

- WM13.2 To protect, restore and enhance remaining wetlands, waipuna and riparian areas by:
- (a) Maintaining accurate maps of existing wetlands, waipuna and riparian margins;
 - (b) Requiring that the drainage of existing wetlands or waipuna or the destruction or modification of existing native riparian areas be a prohibited activity;
 - (c) Requiring the use of appropriate fencing, buffers and set back areas to protect wetlands, waipuna and riparian areas from intensive land use, including stock access and irrigation;
 - (d) Supporting initiatives to restore wetlands, waipuna and riparian areas; and
 - (e) Continuing to educate the wider community and landowners of the taonga value of these ecosystems.

WM13.3 To support the establishment, enhancement and restoration of wetlands, riparian areas and waipuna as a measure to avoid, remedy or mitigate any actual or potential adverse effects of land use and development activities on cultural and environmental values.

Wetlands

WM13.4 To advocate for resource management plans, policies and rules that lead to a *net gain* in wetlands throughout the takiwā as well as no loss of remaining natural wetlands.

WM13.5 To advocate, where appropriate, for the creation of wetland areas to assist with the management of onsite/site sourced stormwater and other wastewater, to utilise the natural capacity of these ecosystems to filter contaminants. These wetlands must be constructed wetlands; natural wetlands are not be used to treat or dispose of wastewater. However, they may be adjacent to natural wetlands, to mitigate the impacts on natural systems.

WM13.6 The cultural value of wetlands must be included in any regional or local assessments of wetland significance.

Riparian margins

WM13.7 To recognise the protection, establishment and enhancement of riparian areas along waterways and lakes as a matter of regional importance, and a priority for Ngāi Tahu.

Waipuna

- WM13.8 To require that waipuna are recognised as wāhi taonga in district and regional plans. This means:
- (a) Explicit recognition of the value of waipuna to tāngata whenua;
 - (b) Effective policies, rules and methods to protect waipuna from abstraction, stock access, drainage and run-off, including prohibiting any direct discharges and requiring riparian margins to buffer adjacent land use; and
 - (c) Explicit objectives to restore degraded waipuna.

He Kupu Whakamāhukihuki / Explanation

Wetlands, waipuna and riparian areas are all considered to be wāhi taonga by Ngāi Tahu, treasured for their role in protecting and enhancing mauri, as providing habitat for mahinga kai. They are considered together in this IMP as they are all fundamental to the cultural health of freshwater resources.

The *Canterbury Water Management Strategy* highlights that less than 10% of the region's previously extensive wetlands remain. Moreover, cultural health assessments in the takiwā highlight that one of the greatest issues facing waterways is the absence of sufficient riparian margins to buffer those waterways from intensive land use and provide habitat for mahinga kai and indigenous species.

It is critical that existing wetlands, waipuna and riparian areas are protected, maintained or enhanced, degraded areas are restored, and opportunities taken to re-establish wāhi taonga across the landscape.

Cross reference:

- » *General policy on coastal wetlands, hāpua and estuaries (Section 5.6 Issue TAN3).*
- » *Local issues and policy on wetlands (Sections 6.1 Hurunui, 6.3 Rakahuri, and 6.11 Te Waihora).*

DRAIN MANAGEMENT

Issue WM14: Drain management can have effects on Ngāi Tahu values, particularly mahinga kai.

Ngā Kaupapa / Policy

- WM14.1 To require that drains are managed as natural waterways and are subject to the same policies, objectives, rules and methods that protect Ngāi Tahu values associated with freshwater, including:
- (a) Inclusion of drains within catchment management plans and farm management plans;

- (b) Riparian margins are protected and planted;
- (c) Stock access is prohibited;
- (d) Maintenance methods are appropriate to maintaining riparian edges and fish passage; and
- (e) Drain cleaning requires a resource consent.

WM14.2 To require and uphold agreements with local authorities to ensure that the timing and techniques of drain management are designed to avoid adverse effects on mahinga kai and water quality, including:

- (a) Identifying drains that are or can be used for mahinga kai;
- (b) Returning any fish that are removed from drains during the cleaning process to the waterway;
- (c) Riparian planting along drains to provide habitat and shade for mahinga kai and bank stability while reducing the frequency and costs of maintenance by reducing aquatic plant growth;
- (d) Ensuring drain management/cleaning does not breach the confining layers;
- (e) Use of low impact cleaning methods such as mechanical 'finger buckets', as opposed to chemical methods such as spraying, to minimise effects on aquatic life;
- (f) Notification to tāngata whenua of any chemical spraying of drains used for mahinga kai or connected to waterways used as mahinga kai; and
- (g) Involvement of tāngata whenua in drain maintenance activities where there is a need to return native fish back to the drain (e.g. tuna, kekewai and kanakana).

He Kupu Whakamāhukihuki / Explanation

Drains are a common feature across Ngā Pākihi Whakatekata o Waitaha, given that much of the land in lower catchment areas was originally swamp. An extensive network of drains provides flood protection for settlement and land use. Some of these drains are modified natural waterways, and many connect or empty into existing waterways and waterbodies. For this reason drain management is an important kaupapa for tāngata whenua. While drains may not be highly valued in the wider community, drains that function as mahinga kai habitat and where mahinga kai resources are gathered may be identified as wāhi taonga by Ngāi Tahu.

"You can't tell a fish what the difference is between a drain, river, stream or spring." David Perenara O'Connell, Te Taumutu Rūnanga Natural Resource Management Plan 2002.

"Spraying is a quick fix technique, with a very long recovery time." Uncle Waitai Tikao, Ōnuku Rūnanga.

INVASIVE WEEDS IN RIVERBEDS AND MARGINS

Issue WM15: The spread of invasive woody weeds and standing trees in the bed and margins of rivers.

Ngā Kaupapa / Policy

WM15.1 To oppose the planting of willows and poplars along waterways, for erosion control or otherwise.

WM15.2 To promote the adoption of a long term objective in the region to phase out existing willows and poplars in river margins, and re-establish native species.

WM15.2 To promote healthy riparian margins along waterways, vegetated with native species, as a means to protect waterway health and prevent the establishment of weedy species in riverbeds and margins.

WM15.3 Where river rating districts are established to contribute to the costs of clearing and maintaining willows along rivers for flood protection, such schemes should also provide for the planting of riparian margins with native species that further the flood protection goals and enhance cultural and environmental values.

WM15.4 To require that environmental flow regimes recognise and provide for the role of the flood flows in preventing the establishment of willow and other weeds in river beds.

WM15.5 To support the use of regional catchment management plans to promote the use of suitable native plants and trees as riparian margins instead of willow, so that these species are progressively returned to our landscape.

WM15.6 To work with relevant agencies to eliminate woody weeds such as broom and gorse that are invading braided rivers.

He Kupu Whakamāhukihuki / Explanation

Willows and poplars are well established along many waterways in the takiwā and have a significant effect on natural character and the cultural health of waterways by disrupting, confining and reducing flow, and reducing

native biodiversity. Planted along rivers for shelter and bank stability purposes, species such as grey and crack willow are now a significant weed issue. Grey willow (*Salix cinerea*) and crack willow (*Salix fragilis*) are currently listed in the National Pest Plant Accord.

“There is no need to use willows for erosion or flood control. Native species can fulfill the same purpose.” IMP Working Group, 2012.

COASTAL MARINE AREA

Issue WM16: The freshwater-saltwater interface at hāpua and river mouth environments is an important value to protect in freshwater management.

Ngā Kaupapa / Policy

See General Policy Section 5.6 Issue TAN2 *Coastal Water Quality*, and Issue TAN3 *Coastal wetlands, estuaries and hāpua*.

ENDNOTES

- 1 Goodall, A. 1992. *Ko Waitaki Te Awa, Ka Roimata Na Aoraki I Riringi*. Aoraki Press, p. 54.
- 2 Solomon, R., as quoted in Jolly, D. 2010. *Waiau River Tributaries Assessment Report*. Prepared on behalf of Te Rūnanga o Kaikōura and Environment Canterbury.
- 3 NIWA, 2003. *Effects of rural land use on water quality*. Report HAM2003-057.
- 4 Tipa and Associates, 2011. *Kaitiaki synthesis report*. Prepared for Environment Canterbury, p. 59.