Ministry for the Environment
Manatū Mō Te Taiao

Ministry for Primary Industries
Manatū Ahu Matua

To: Hon Amy Adams, Minister for the Environment
Hon Nathan Guy, Minister for Primary Industries

Freshwater Reform: Economic Impact Studies – The potential impacts of water quality limits on non-economic values (Southland Case Study)

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Executive Summary

1. This Briefing Note provides preliminary findings of a study that seeks to identify the non-economic values of water, and the potential impacts of water quality limits on those values. The findings presented are based on a case study assessing the marginal impact[1] of maintaining or improving water quality on non-economic values in Southland.

2. Non-economic values of water are those are not readily valued in monetary terms. These values include recreational values, cultural and spiritual values, existence values (value from knowledge of continuous existence) such as ecosystem health; option values (future use); and bequest values (environmental integrity for future generations).

3. This study is a first step in assessing the marginal impact of maintaining or improving water quality on non-economic values and provides an indication of the overall marginal changes. The total marginal impact on non-economic values is unknown. Preliminary results indicate that the non-economic values of the recreational values of fishing, swimming and kayaking and existence values aggregate to a marginal benefit ranging from $0.3m to $2.1m per annum in 2037 (in 2012 dollars).

4. Whilst the marginal benefit appears to be relatively small, it does not include the marginal impact on a number of significant non-economic values, including aesthetics and amenity, ecosystem health and diversity and cultural and spiritual values that have not been quantified due to data limitations. As the latter values are greater in scope

[1] A positive or negative change compared to the status quo.

than the small proportion of values quantified, and as they are likely to be positively correlated with improved water quality[2], it can reasonably be expected that these values would have marginal benefits that significantly exceed those quantified. Therefore, the total marginal benefit of maintaining or improving water quality would be significantly greater than the preliminary results presented in this Briefing Note.

5. It is important to recognise non-economic values as a significant influencing factor in community based decision making on the trade-offs between environmental and economic impacts of freshwater management. However, communities may face challenges in quantifying the marginal impact of maintaining or improving water quality on non-economic values as it is technically difficult and resource intensive. It is also difficult to quantify and assess marginal impacts on unique Māori values such as reciprocity, knowledge and cultural identity. While the approach could be used to support community based decision making, communities will require subjective assessments of values that cannot be quantified.

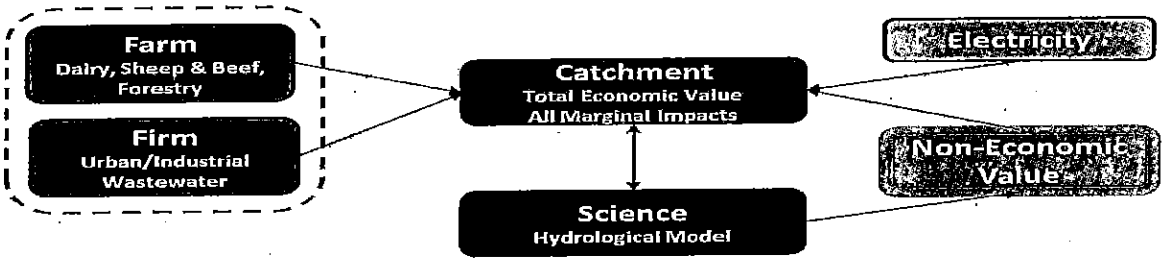
6. This is the second of four Briefing Notes that Ministers will receive on the economic impact studies. The outputs will inform advice to Ministers on policy proposals for a National Objectives Framework in May 2013. We propose that this Briefing Note is not circulated more widely to other Ministers, until material presenting more comprehensive results of all the economic impact studies for Southland is provided for discussion by Ministers in May.

Situation Analysis

Economic Impact Studies

7. Ministry for the Environment, Ministry for Primary Industries and Department of Conservation have jointly funded a series of scientific and economic studies, which are being carried out in conjunction with regional councils. Figure 1 shows where the non-economic value study fits within the economic impact studies.

Figure 1: Southland studies assess impacts of potential water quality bottom lines across all economic sectors and non-economic values



Overview of non-economic values associated with water

8. Fresh water is recognised as one of New Zealand's key economic assets. However, water quality is declining in some catchments, which could result in potential environmental and public health impacts (see Appendix 1), and potential risks for future direct economic uses of water (e.g. agriculture, electricity), as well as non-economic values of water. Non-economic value is a 'catch-all concept' that captures all water values that are not associated with the direct economic use of water, i.e. the values of water that are not traded in a market and are not readily valued in monetary terms.

[2] Aesthetics, ecosystem health and cultural uses are likely to increase as water becomes cleaner

Table 1: Non-economic values (Appendix 2 provides an overview of total economic value)

Non-economic value of water	Description
Recreational use values	Swimming, fishing, canoeing, kayaking, hiking and picnicking along a waterway
Option values	Potential for future economic uses (e.g. manufacturing) and recreational uses
Existence values	Value from knowledge of continued existence (e.g. aesthetic values, ecosystem health and biodiversity (water purification and soil cycling))
Bequest values	Value in environmental integrity for future generations (e.g. cultural values)

9. Māori values include both economic use and non-economic values. This study focuses on non-economic Māori values associated with water in order to provide a complete picture of the non-economic values of water in New Zealand. Māori have strong associations with water bodies based on social, cultural, economic and spiritual world-views. This relationship gives rise to distinct interests in respect of fresh water. Māori values related to water such as whakapapa (genealogy), mauri (life supporting capacity of water), and mahinga kai (food and resource gathering) may be valued differently by individual iwi. Values expressed by Southland Ngāi Tahu are outlined in Appendix 3.

10. There are challenges in integrating Māori values, cultural and spiritual values into microeconomic frameworks that assess the impact of changes in water quality. While there is some overlap between Māori values and non-economic values captured by the Total Economic Value framework used, there are unique Māori non-economic values of water which are not reflected and are difficult to quantify. These were identified by a review of iwi and runanga case studies and consultation with Te Ao Marama Inc in Southland, and are outlined in the results section.

Approach to analysing impacts of water quality limits on non-economic values

11. The approach used to estimate the marginal impacts of maintaining or improving water quality on non-economic values is a novel approach which attempts to link a change in water quality outcomes to non-economic values. This has not previously been carried out in New Zealand with the following inputs and analyses:

    a. **Water quality outcomes** determined by hydrological modelling. These are based on aggregated farm-level and point source contaminant discharges, influenced by a series of increasingly stringent nutrient discharge caps on farms, leading to water quality scenarios for 73 sites.

    b. The impact of a change in water quality on the **attributes of water** that enable it to be used or valued, based on previous research, e.g. the effect of total phosphorus on water clarity.

    c. **Baseline data** on water bodies in Southland and their most common uses was collated where possible, e.g. data on current levels of recreational use.

    d. A **benefit transfer** approach applied non-economic values estimated at other water bodies in New Zealand to water bodies in Southland, provided that there were sufficient similarities between them, in terms of location, resource and affected population.

    e. The **marginal impact analysis** estimated the impact of a change in attributes of water on non-economic water values, e.g. the value of one more metre of water visibility to a recreational visitor's day spent fishing.

Key preliminary findings of the non-economic value study

12. The analysis undertaken for Southland estimated the marginal impacts of maintaining or improving water quality for a limited number of non-economic values, including recreational values of fishing, swimming, kayaking and existence value, as baseline information on these activities was available. Other significant non-economic values including aesthetics and amenity, ecosystem health and diversity and cultural and spiritual values have not been individually analysed due to data limitations, but these are partly covered in existence value.

13. Preliminary results are presented in Table 2. The results shown are based on water quality outcomes predicted though the parallel aggregate farm-level analysis that models the impact of less stringent to very stringent uniform nutrient discharge caps scenarios (see Briefing Note 13-B-00470). The ***total*** marginal impact of maintained or improved water quality on non-economic values is unknown. Preliminary results indicate that the recreational values of fishing, swimming and kayaking and existence values aggregate to a marginal benefit ranging from $0.3m to $2.1m per annum in 2037 (in 2012 dollars). The findings indicate that non-economic values of water generally increase (for all except fish numbers[3]) as water quality improves with the implementation of nutrient discharge caps.

14. Whilst the marginal benefit appears to be relatively small, it does not include the marginal impact of maintained or improved water quality for a number of significant non-economic values that have not been quantified due to data limitations. As the these values are greater in scope than the small proportion of values quantified, and as they are likely to be positively correlated with water quality (e.g. aesthetics, ecosystem health and cultural uses are likely to improve as water becomes cleaner), it can reasonably be expected that these values would have marginal benefits that significantly exceed those quantified. Therefore, the total marginal benefit of maintaining or improving water quality would be significantly greater than the preliminary results presented in Table 2. Work is on-going to source additional information that would allow further quantification of marginal impacts for the remaining values.

[3] At low levels of periphyton, increased periphyton can result in increased trout density. The tipping point is currently unknown.

Table 2: Key preliminary results of the non-economic value study

Non economic value		Marginal Impacts of Improved Water Quality due to Uniform Nutrient Discharge Caps Increasing Stringency of Nutrient Discharge Cap Scenarios			
		Policy Set B ($m)	Policy Set C ($m)	Policy Set D ($m)	Policy Set E ($m)
Recreation	Benefit to Water Clarity for Fishing	$0.1 to $0.2	$0.3 to $0.7	$0.3 to $0.7	$0.5 to $1.1
	(Potential) cost in terms of Fish Numbers	-$0.1 to $0.0	-$1.2 to -$1.0	-$1.4 to -$1.2	-$2.4 to -$2.2
	Benefit to Swimming Visits	$0.1 to $0.4	$0.0	$0.0 to $0.1	$0.1 to $0.3
	Benefit to Kayaking Visits	$0.1	-$0.1 to $0.0	-$0.1 to $0.0	$0.0 to $0.1
	Benefit to Other recreation	*Not assessed quantitatively*			
Existence values	Benefit to Existence Value (includes some option value)	$0.4 to $0.6	$1.1 to $1.7	$1.2 to $1.8	$1.9 to $3.0
	Benefit to aesthetics and amenity values	*Not assessed quantitatively but may be included partially in Existence Value*			
	Benefits to current ecosystem health and biodiversity	*Not assessed quantitatively but may be included partially in Existence Value*			
Culture	Benefits to current cultural and spiritual activities, including unique Maori values	*Not assessed quantitatively*			
Bequest value	Benefits to future ecosystem health and biodiversity	*Not assessed quantitatively but may be included partially in Existence Value*			
	Benefits to future cultural and spiritual values, including unique Maori values	*Not assessed quantitatively*			
	Sub-total of marginal change *(incomplete – as only some marginal impacts assessed quantitatively)*	$0.6 to $1.2	$0.4 - $1.1	$0.3 - $1.1	$0.4 - $2.1
	Total Marginal Change to Non-Economic Value of Water	Unknown and likely to be far greater than estimates of this study			

Key Findings

Non-economic values aggregate to a sub-total of marginal benefit in 2037 (2012 dollars) ranging from $0.3m to $2.1m per annum.

Of the values assessed, the most significant contributor to value is existence value that ranges from $0.4m to $3.0m per annum.

The number of fish decreases when water quality improves (using nutrient concentration as a proxy for water quality) resulting in fewer angler days. This is the only non-economic value quantified which has a negative correlation with water quality.

If fishing values are excluded, the range of measured non-direct values is $0.7 to $4.5 million per annum.

Source: Covec, 2013

Note: The results shown are annual and expressed in actual 2012 values (not 2037 values discounted to 2012 dollars)

15. There are three unique Māori values related to water[4], which have been identified as additional to the non-economic values captured the overall theoretical framework. Although these are not quantified, it can reasonably be expected that these values increase with improved water quality. The three additional values are:

    a. **reciprocity** in which the act of taking anything from the environment needs to be balanced by restoring the environment to ensure its functioning and wholeness. The failure to restore the environment is a source of loss of mana (prestige or power).

    b. **knowledge** (maatauranga) where management and use of water and the relationship with the water body provide resources, builds knowledge and provides education that can be passed to future generations. An increase in water quality results in a marginal increase in knowledge as there is an increase in the opportunities for use of a resource.

    c. **cultural identity** as whānau and hapū are often defined with respect to the environment and resources that they use. The loss of the ability to use a resource reduces their identity as a group.

Advice

16. This study is a first step in assessing the marginal impact of maintaining or improving water quality and provides an indication of the overall marginal changes. Preliminary results indicate that the marginal benefits for a subset of non-economic values range from $0.3m to $2.1m per annum in 2037 (in 2012 dollars). As a number of significant non-economic values have not been quantified, and as these values are likely to be positively correlated with improved water quality, it can reasonably be expected that the total marginal benefit would be significantly greater than the preliminary results.

[4] Based on Southland Ngāi Tahu perspective, caution required in generalising for all iwi, hapū or whānau.

17. For example, anecdotal evidence on the compensation required to remove water from the Waiau River for the Manapouri Power Scheme indicates the monetary value of restricting the flow of the Waiau River was $9m to $10m twenty years ago. Also, in an attempt to maintain the values of the Waituna Lagoon, Environment Southland and Department of Conservation have spent between $300,000 and $500,000 per annum over the past two to three years. The government has also spent $785,000 in Waituna.

18. It is important to recognise non-economic values as a significant influencing factor in community based decision making on the trade-offs between environmental and economic impacts of freshwater management. However, communities may face challenges in quantifying non-economic values as it is technically difficult and resource intensive. It is also difficult to quantify and assess marginal impacts on unique Māori values such as reciprocity, knowledge and cultural identity. While the approach could be used to support community based decision making, communities will require subjective assessments of values that cannot be quantified.

Risks and Mitigations

19. A risk with any modelling exercise is that models are by definition a simplification of reality. The results are not intended to be specific predictions of exact benefits and costs, but provide an indication of the magnitude of impacts on non-economic values of water. Preliminary results will be peer reviewed by sector and independent subject experts prior to finalisation and a copy of the revised report will be provided to the Ministers' Offices once it has been updated.

20. Not all non-economic values are quantified due to significant gaps in the data. These include: other recreational uses; aesthetics and amenity; ecosystem health and biodiversity; and cultural and spiritual values (including unique Māori values). Option and bequest use values are partly addressed in existence value, but are not separately estimated. The impact on New Zealand's reputation for its pristine environment and the impact on commercial tourism providers using water have not been analysed. A non-economic value study will be carried out in the Waikato Region, which will add to the development of a more complete view of non-economic values over time.

Consultation

21. Environment Southland has been consulted in the development of the non-economic value analysis. Te Ao Marama Inc provided input on the incorporation of Māori values in the study, and will be consulted further in advance to the submission of the final report. Department of Conservation co-funded this work and has been consulted.

Next steps

22. Further assessment of the impact of water quality limits on non-economic values is underway and will be reported in the fourth Briefing Note in this series. Upcoming Briefing Notes will cover: the potential impacts of water quality limits on Canterbury's agricultural sector and a summary of the potential impacts of water quality limits on the economic use and non-economic use values of water (Southland Region).

23. The preliminary findings of these studies will inform advice to Ministers on policy proposals for a National Objectives Framework in May 2013. Final results and findings will feed into the detailed section 32 analysis of the proposed National Objectives Framework in mid 2013.

Recommended Action

We recommend that you:

a) **Note** that preliminary results indicate that the marginal benefits of maintaining or improving water quality for a subset of non-economic values range from $0.3m to $2.1m per annum in 2037 (in 2012 dollars). As a number of significant non-economic values have not been quantified, it can reasonably be expected that the total marginal benefit would be significantly greater than the preliminary results.

b) **Note** that while the approach to assessing the marginal impact could be used to support community based decision making, communities will require subjective assessments of values that cannot be quantified.

c) **Note** that the findings in this Briefing Note are preliminary and will be reviewed by the Independent Quality Assurance process before the final report is submitted.

d) **Note** that a copy of the revised report will be provided to the Ministers' offices once it has been updated.

e) **Note** that the findings of the economic impact studies will inform advice to Ministers on policy proposals for a National Objectives Framework in May 2013.

f) **Agree** that this Briefing Note is not circulated more widely to other Ministers, until material presenting more comprehensive results of all the economic impact studies for Southland is provided for discussion by Ministers in May.

Yes / No

g) **Refer** this Briefing Note to Hon Nick Smith for his information, as the Department of Conservation co-funded this work.

Yes / No

Kay Harrison
Director, Water Reform Directorate

Date

Hon Amy Adams
Minister for the Environment

Date

Hon Nathan Guy
Minister for Primary Industries

Date

Minister's feedback on quality of briefing note:	**1**	**2**	**3**	**4**	**5**
1 = Was not satisfactory 2 = Fell short of my expectations in some respects 3 = Met my expectations 4 = Met and sometimes exceeded my expectations 5 = Greatly exceeded my expectations					

Appendix 1: Impacts on of contaminant discharges on water quality

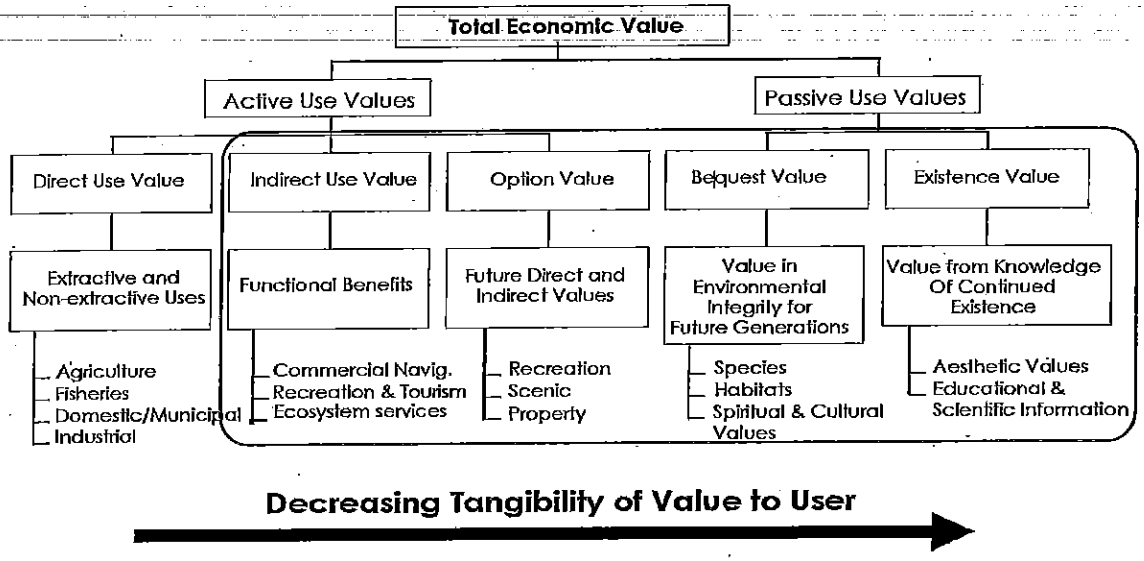
A recent report by the Parliamentary Commissioner for the Environment presented the impacts of discharges of nutrients, sediment and pathogens on water quality including on algal blooms, habitats for fish and other organisms, water clarity of the water and its suitability for recreational use. Those impacted are those who use the water bodies and those who value them more widely. Internationally there are impacts on the perception of New Zealand's reputation for its pristine environment:

Cause	Effects
Nutrients (nitrogen and phosphorus)	Nitrates can make water unsafe to drink and kill sensitive organisms (eg young trout and salmon);
	Ammonia is highly toxic to fish
	Excessive growth of large plants (macrophytes), periphyton and phytoplankton. Periphyton can carpet the bottom of waterways, with impacts on habitats and degrading water recreation and fishing.
	Algal blooms that can be toxic, including through organisms that eat it (eels, shellfish)
	Oxygen depletion as a result of excessive plant growth
Sediment	Damage to plants when suspended in moving water;
	Damage to gills and delicate body parts of invertebrates and fish;
	Increasing turbidity, reducing visibility (for people and animals) and reducing light for plants
	Smothering beds of water bodies, reducing habitat for plants, invertebrates and fish
	Changing water flows
Pathogens	Health risks for people and animals

Source: Parliamentary Commissioner for the Environment (2012) Water quality in New Zealand: Understanding the Science

Appendix 2: Total economic value framework

The total economic value framework identifies and quantifies (where possible) the impacts of water quality limits across economic, environmental, social and cultural water values. The categories considered in the non-economic study are highlighted in the green rectangle and include all values but the direct economic use values.



Appendix 3: Core Ngāi Tahu whānui values and uses relating to the freshwater environment

Core Value	Description	Relationship to Cultural Use of freshwater environment
Whakapapa	Whakapapa (genealogy) is about the relationships of all life forms to each other as well as the atua (gods). Whakapapa describes bonds, relationships, and connections. All things are linked by whakapapa.	Water has its own whakapapa and Māori link to this whakapapa. Whakapapa is also central to passing on kai gathering knowledge through the generations.
Te Ao Māori	The environment is viewed as a whole -- not as divided parts.	This holistic view of the freshwater environment requires consideration of the whole catchment. A catchment constitutes soils, water, flora, fauna and the relationships between them.
Mauri	Mauri is a central component of the Māori perspective on the environment. It can be defined as the life principle, life supporting capacity, or life force present in all things.	Protecting the mauri of a resource is the fundamental management principle for Māori. Māori treasure the mauri of freshwater and may experience cultural offence and distress when the mauri is degraded.
Wairua	Spiritual connection/wellbeing.	Ngāi Tahu, like other Māori, use different ways to feel spiritually connected with their takiwā. This spiritual connection can occur by gathering kai with whānau at a traditional fishing place that they know have been named by their tūpuna, and utilised by successive generations of their whānau; being able to contribute the kai that their takiwā is renowned for, to ceremonies. Being denied these opportunities can impact on spiritual wellbeing.
Kaitiakitanga	The exercise of guardianship by manawhenua of an area and resources in accordance to tikanga Māori (customs and rules).	Kaitiakitanga governs the way humans interact with the environment. The notions of sharing and maintaining balance with nature underpin cultu uses and practices. Balance requires respect to be shown when interacting with the environment; and use of the resource (within limits) afforded by healthy ecosystems. Māori have a duty to protect nature.
Tino Rangatiratanga	Tino Rangatiratanga is the right to make decisions for your own people concerning the resources within your takiwā.	This means determining what, from a cultural perspective, represents satisfactory aquatic conditions and appropriate use.
Mahinga kai	Mahinga kai encompasses the resource harvested, the ability to access the resource, the site where gathering occurs, the act of gathering and using the resource, and the good health of the resource.	Mahinga kai is considered to be the principle 'environmental indicator' in natural systems. If mahinga kai is not present, or is unsafe to harvest, then, that natural system is under stress and requires remedial action. The state of freshwater is important as a medium for sustaining and accessing mahinga kai. Ideally streams will sustain healthy and diverse koiora/life.
Manaakitanga	The support, caring and hospitality shown to guests.	The ability to manaaki (welcome) visitors by supplying kai sourced locally means that the activities of fishing, eeling and gathering foods creates and maintains whānau and hapū ties and reinforces identity. Conversely the inability to manaaki guests and sustain whāungatanga can lead to cultural loss.
Tino Rangatiratanga	Tino Rangatiratanga is the right to make decisions for your own people concerning the resources within your takiwā (tribal boundaries).	This means determining what, from a cultural perspective, represents satisfactory aquatic conditions and appropriate use.
Mahinga kai	Mahinga kai encompasses the resource harvested, the ability to access the resource, the site where gathering occurs, the act of gathering and using the resource, and the health of the resource.	Mahinga kai is considered to be the principle 'environmental indicator' in natural systems. If mahinga kai is not present, or is unsafe to harvest, then, that natural system is under stress and requires remedial action. The state of freshwater is important as a medium for sustaining and accessing mahinga kai. Ideally streams will sustain healthy koiora/life.
Manaakitanga	The support, caring and hospitality shown to guests.	The ability to manaaki visitors by supplying kai sourced locally means that the activities of fishing, eeling and gathering foods creates and maintains whānau and hapū ties and reinforces identity. Conversely the inability to manaaki guests and sustain whāungatanga can lead to cultural loss.
Mātauranga Māori	Māori knowledge.	Interacting with waterways serves the functions of passing on traditional knowledge from one generation to the next. Mātauranga Māori is developed and transmitted through the use of natural resources, such as the practices of food management, harvesting and preparation. E.g if populations of fish decline, knowledge of the techniques of gathering these foods along with the associated ecological and cultural knowledge will likely also begin to disappear.
Te Reo	Language. Te Reo contains knowledge and is another expression of culture and identity.	Stories, waiata and Te Reo that pertain to particular uses, and these uses sustain the culture. When a valued species disappears from a local ecosystem or the activities associated with a species decrease, the associated Te Reo drops away.
Whānaungatanga	The interrelationship of Māori with their ancestors, their whānau, hapū and iwi as well as the natural resources within their tribal boundaries. This genealogical relationship is one of the foundations upon which the Māori culture is based.	Sustainable management seeks to sustain the health, wealth and well-being of the natural environment while sustaining communities dependent upon it. In a catchment it is water that makes and maintains connections between different waterbodies and entities within a catchment.

Source: Tipa G, 2011. Our Uses: Cultural Uses in Murihiku. Report prepared for Environment Southland.
Note: The study focuses on values from a Southland Ngāi Tahu perspective. Caution is required in generalising for all iwi, hapū or whānau.