The River Values Assessment System:

Volume 2: Application to cultural, production and environmental values

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Preamble

Application of a method developed for individual values to tangata whenua river values was always going to be challenging. There were three main challenges:

1. The need, primarily, to encompass the holistic Maori world view of resources, rather than to compartmentalise as the method does;
2. The need to translate a method and set of defined terms into a terminology and set of concepts and rules relevant and useful to tangata whenua;
3. The time needed to thoroughly work through, with local Maori, the complexities of the approach and how it might assist in terms of Maori resource management expectations and aspirations.

All of these challenges have been addressed and the chapter below, while different to others, is fundamentally consistent and certainly complementary and helpful in articulating priorities and ways of working with these priorities.

Consideration of a significance assessment method for tangata whenua river values

Gail Tipa (Gail Tipa and Associates)

Peer reviewed by:
Dean Walker and Keriana Wilcox

8.1 Description of the Overall Project

8.1.1 *Introduction*

This chapter provides guidance for parties (iwi, councils) wanting to apply the RiVAS method **in order to assess tangata whenua river values**[1]. The chapter's purpose is to outline the results of one case study, to develop a framework and apply the method in Murihiku. However, rather than simply defining significance thresholds for application within national and regional planning under the RMA, the challenges of according significance from a cultural perspective are also introduced (albeit briefly) in section 5.

To this end, the modified method outlined in this chapter:

- Establishes criteria to assess the **total river value** from a tangata whenua perspective[2].

It does not:

- Identify thresholds for **individual taonga or individual sites** to rate their individual significance within a river system.
- Outline a means to determine whether a river is nationally, regionally or locally significant.

The final section of this chapter comments on the results of the case study. At present its construction reflects the structure and content of the *Te Tangi a Tauira*, the Iwi Resource

1 Although the project can be supported by Council only tangata whenua can assess significance to tangata whenua.
2 The method for use by tangata whenua to assess total river value will provide for subjective assessments.

Management Plan in Murihiku, and only incorporates comments from nga papatipu runanga o Murihiku (see Photo 8-1 – example of the Oreti, a river important to local iwi).

Photo 8-1
The Oreti River – one of the rivers assessed by representatives of Kai Tahu Ki Otago

8.1.2 *Outline of the generic method*

The generic method comprises three parts, and is outlined here in order to provide a context for tangata whenua modification:

- In Part 1 assessment criteria are defined;
- In Part 2 significance is to be assessed but as noted in the introduction to this chapter the challenge of according significance from a cultural perspective is discussed; and
- In Part 3 future data needs are considered.

Each part is divided into a series of steps (Table 8-1).

Table 8-1
Summary Method

	Step	Purpose
PART 1: ASSESSMENT CRITERIA		
1	Identify attributes	Listing all attributes ensures that decision-makers are cognisant of full scope of the river value
2	Select and describe primary attributes	A subset of attributes is selected to ensure the method is practical and implementable A synopsis is provided for each primary attribute, to inform decision-makers about its validity and reliability
3	Identify and apply indicators	SMARTA-criteria selected indicator(s) are identified for each primary attribute. Where quantitative data are not available, Expert Panel advice is used
PART 2: DETERMINATION OF SIGNIFICANCE		
4	Apply significance threshold	Thresholds are applied to combined indicator scores to facilitate recognition of significance at national or regional levels for the value
5	Determine significance	The significance of the river for the value in question is determined from the combined indicator scores for primary attributes. National significance is defined as combined indicator score ranking for the value in the top 10% of rivers nationally. Regional significance is

	Step	Purpose
		defined as a combined indicator score ranking for the value in the top 10% of rivers within the region, exclusive of nationally important rivers.
6	Outline other factors relevant to assessment of significance	Factors which cannot be quantified are outlined to inform decision-making
PART 3: METHOD REVIEW		
7	Identify information requirements	Following from 6, data desirable for assessment purposes (but not currently available) are listed, to inform a river research strategy and to determine future information requirements

In addition to trialling a particular process for identifying tangata whenua river values and assessing significance, this particular project may be of value to nga runanga o Murihiku as it is also a trial of how parts of their newly developed iwi resource management plan can be operationalised. In other words, although the project was initiated on the premise that the process would be of value to resource managers, there is potential for it to be of value to tangata whenua.

8.1.3 *Limitations of the method*

This whole chapter is premised on tangata whenua supporting an assessment of their rivers – in particular a significance assessment. This may be problematic. Many whanau, hapu and iwi choose not to assign numerical scores to values or attributes, arguing that such an approach is reductionist and in conflict with their worldview. While that perspective can be readily supported, there are many examples where tangata whenua willing reduce their arguments to one or a few key points that are then supported by some form of quantitative analysis.

Rather than debate a reductionist versus holistic perspective, it is sufficient to state that the approach we have adopted is to proffer a method then leave it for tangata whenua to choose whether or not they want to utilise the methodology.

8.2 Considering tangata whenua River Values

Without water no living thing, plant, fish or animal can survive. Water is a taonga and this taonga value refers to values associated with the water itself, the resources living in the water and the sites, resources and uses of in the wider environs that are sustained by the water. Further, water is a holistic resource. As a taonga it is the responsibility of tangata whenua as Tangata Tiaki to ensure that water is available for future generations in as good as, if not better quality. Water has the spiritual qualities of mauri and wairua. The continued well-being of these qualities is dependent on the physical health of the water.

8.2.1 *Adaptation of the method as a starting point with tangata whenua*

At the commencement of the project it was envisaged that the project with tangata whenua would involve the steps outlined in Table 8-2.

Table 8-2
Method summary for use with tangata whenua

	Step	Purpose
PART 1: ASSESSMENT CRITERIA		
1	Identify attributes	Listing all values and attributes to ensure that decision-makers are cognisant of full scope of the value of the river to tangata whenua
2	Select and describe primary attributes	A subset of attributes is selected to ensure the method is practical and implementable A synopsis is provided for each primary attribute, to inform decision-makers about its validity and reliability
3	Identify and apply indicators	SMARTA criteria selected indicator(s) are identified for each primary attribute. Where quantitative data are not available, Expert Panel advice (comprised of mandated members of mana whenua) would be used. At this stage links to other assessments can be identified (e.g., wildlife and native fisheries)
PART 2: DISCUSSION OF SIGNIFICANCE		
4	Outline other factors relevant to a consideration of significance	Factors distinct to tangata whenua which make it difficult to assign significance values.
PART 3: METHOD REVIEW		
5	Identify information requirements	Following from 3, data desirable for assessment purposes (but not currently available) are listed, to inform a river research strategy and to determine future information requirements

Please note: The method that we propose in the next section is for tangata whenua to apply to assess catchments within their takiwa.

8.3 Overarching principles and concepts - Te Tangi a Tauira[3]

There are many principles that collectively describe the worldview of Maori. Many iwi throughout New Zealand have articulated their values from their perspective. The proposed significance assessment method is being applied in Murihiku. A key part of the method is accessing available (and mandated) planning frameworks – in this case – the plans of relevance with Murihiku. This means the operative Iwi Resource Management Plan for the Murihiku region, *Te Tangi a Tauira*, is the starting point.

Within Te Tangi a Tauira, the four overarching principles and concepts are:
a. Te Wairua (Spiritual);
b. Maoritanga (Cultural);
c. Kaitiakitanga; and
d. Mahinga kai.

These four overarching principles are the starting point and each is discussed below, along with the attributes that are listed under each in the iwi plan.

8.3.1 *Te Wairua*

The cultural identity of Ngai Tahu stems from their relationship with maunga, roto and awa. Ngai Tahu identifies with the surrounding mountains and their awa as evidenced by their mihi. The

3 Because the intent of the method is to use readily accessible data, all the interpretations found in this section are extracted from the iwi plan.

spiritual health and wellbeing of Ngai Tahu whanui is dependent on the continued health and wellbeing of these mountains, the waterways of Murihiku and the resources supported by the waterways, ki uta ki tai. Adverse impacts represent a loss in the culture and identity of Ngai Tahu.

8.3.2 ***Maoritanga***

Maoritanga is a general concept to describe the actions associated with being Maori and living according to Maori customs, values and cultural practices within modern New Zealand. These practices evolved over generations as Maori learned to live sustainably within the lands and waters within their natural environment - tikanga, kawa, and specialist matauranga have been passed down through the centuries.

- Kawa can be defined as the right way of doing things. It is usually specific to a whanau, hapu, or marae;
- Tikanga – are rights, customs, accepted protocol and rules. They encompass Maori traditions, lore, law, the Maori way; and
- Matauranga – knowledge held by tangata whenua, a blend of local, historical and indigenous knowledge.

8.3.3 ***Kaitiakitanga***

The term “kaitiakitanga” derives from the verb tiaki. In a natural resource context, the term incorporates notions of guarding, keeping, preserving, fostering, sheltering and watching over resources. The responsibilities of kaitiaki can only be discharged by outcomes which sustain the spiritual and physical integrity of the resources and their relationship with the people, so that the resources and the cultural values they support are passed down to future generations. Given that objective, Maori are likely to measure the effectiveness of opportunities provided for the exercise of kaitiakitanga against the environmental outcomes that are achieved. Those outcomes will be represented by physical resource health and opportunities for continuing cultural usage according to customary preferences and priorities.

8.3.4 ***Mahinga Kai***

Ngai Tahu had an intimate knowledge of the resources available to them, and utilised this knowledge to develop a seasonal cycle of harvesting of mahinga kai (see Photo 8-2). Ngai Tahu relied on extensive area of land and a myriad of water based food resources. Because of the way in which food was collected from different areas at different times, Ngai Tahu ensured the continued availability of the resource.

Ngai Tahu have lost a lot of their traditional food gathering places in the Murihiku region due to a variety of reasons including the introduction of pests, domestic animals, pastoral farming and modification to waterways most notably through damming, abstractions for irrigation and gravel extractions and draining of wetlands that would once have been a natural habitat to many plants and animals valued by Ngai Tahu.

Photo 8-2
Examples of kai available from Murihiku

8.4 Sorting attributes, primary attributes and indicators

The significance assessment method seeks to ensure a holistic understanding of the river value by comprehensively describing its attributes. Again, attributes are to be identified on the basis of an accepted planning framework. In this section, we describe how steps 1-3 of the process (as shown in Table 8-3) were implemented.

Table 8-3
Applying the method – Steps 1-3

Step 1: Identify values and attributes
8.5 **Output:** Attributes which attach to the river value are listed comprehensively. Wherever possible, an accepted planning framework should be used to
8.6 **Rationale**: Attributes are identified (including where possible at least one for each of the four 'well-beings') in order to describe the nature of the river value. The list should be as comprehensive as possible to provide a holistic 'picture' of the river value.
Step2: Select and describe primary attributes
Output: Attributes which will be used to represent the river value are selected and described (validity and reliability outlined).
Rationale: The method used to select the primary attributes must be practical, be able to be implemented, be explicit and therefore be defensible. Pragmatically, all attributes cannot be considered, therefore a subset of attributes is chosen.
Action: From the list of attributes outlined in Step 1, select those "primary" attributes considered most important. These will be used to best *represent* the river value within the assessment. Note the basis for selection (see the salmonid angling chapter for guidance). For each selected primary attribute, discuss its validity and reliability, in other words, its strengths and weaknesses as a means to represent the river value.
Step 3: Identify and apply indicators
Output: Indicators which will be used to measure each primary attribute are listed. Data are applied to each indicator
Rationale: This step responds to the question: How can the primary attributes be measured in a cost effective manner? A key component of this step is the assessment of available data. An alternative approach (an Expert Panel) is used where data are deficient.
Action: Choose the most relevant indicator(s) for each primary attribute. Some primary attributes may be best represented by several indicators. Decisions must be based on the availability of data and relevance to the site. If available data are deficient, use the best available information and/or an Expert Panel (see Appendix). Use SMARTA criteria to select the indicator.

Within the Iwi Resource Management Plan, Te Tangi a Tauira, the four overarching principles and concepts are accompanied by a series of "attributes".

8.6.1 *Step 1: Identify attributes*

The iwi plan uses the terms "principles, values and concepts". Consistent with the proposed method we have chosen to use as the attributes for each of the four overarching values[4]. These are presented in Table 8-4.

4 We note that other iwi may define these slightly differently.

Table 8-4
List of all attributes

MAORITANGA attributes	WAIRUA Attributes	KAITIAKITANGA attributes	MAHINGA KAI attributes
Ahi ka	Karakia	Kaumatua	Hapua
Kai hau kai	Ki uta ki tau	Kawanatanga	Kaimoana
Kawa	Kotahitanga	Manawhenua	Kainga nohoanga
Koha	Mana	Manamoana	Mahinga kai
Manaakitanga	Mauri	Manuhiri	Nohoanga
Marae	Maoritanga	Mo tatou a mo nga uri a muri ake nei	Taiapure
Rahui	Noa	Murihiku	Tauranga ika
Take raupatu	Rangatiratanga	Runanga papatipu	Waimataitai
Take tuku	Tangaroa	Tangata whenua	
Take tupuna	Tapu	Uri	
Takiwa	Wairua	Waiora	
Taonga	Whakanoa	Whenua	
Taonga pounamu	Waitapu	Waipuna	
Tauranga waka	Wai whakaheke tupapaku	Waitohi	
Tikanga	Whakapapa	Waiwera ngawha	
Topuni			
Turangawaewae			
Wahi ingoa			
Wahi tapu			
Wahi taonga			
Wahi taonga classes			
Wananga			
Whanau			
Whakatauki			
Whanaungatanga			
Wakawaka			

This level of specificity in the iwi plan is of value as it provides the “building blocks” from which a method can be developed, in consultation with tangata whenua.

8.6.2 *Step 2: Select and describe values and primary attributes*

The next step is to identify the primary attributes. These are a subset of the total list of attributes, and it is this subset that is to be to be used to represent the river value. The selected primary attributes are then measured using quantitative indicators wherever possible.

Table 8-4 listed the initial 63 attributes. The two questions when determining the final list of primary attributes are:

a. Why are some not counted; and
b. How was the final list of primary attributes defined?

In order to progress to a subset, each of the 63 attributes was assessed against four criteria:

1 The attribute can be used to distinguish between different catchments and different reaches of the catchment;
2 The attribute can be described by physical features of a catchment, in particular the waterway;
3 The attribute can be assessed by a quantifiable indicator or by an Expert Panel; and
4 The attribute relates to something tangible measured by a quantifiable indicator that can be aggregated with other primary attributes to enable assessment of values often dismissed as intangible.

Attributes that meet all four criteria are maintained as primary attributes unless they are discounted for any <u>one</u> of the following reasons.

- Attributes were discounted if they relate more to **implementation of the method** rather than being representative of the river. For example, *tangata whenua* with rights of *mana whenua*, *mana moana* (who are often represented within the rohe of Ngai Tahu by *papatipu runanga*) may see application of this method as an expression of their *rangatiratanga* and a tangible means of upholding their *ahi ka.* Within their *takiwa*, they are likely to seek a catchment approach to any assessment consistent with *ki uta ki tai.* By responsibly participating in activities (such as applying this method), they are protecting the waterways for *whanau*, *manuhiri*, *kaumatua* – consistent with the vision of *Mo tatou a mo nga uri a muri ake nei.*

- Attributes were discounted if they relate to a general practice or an activity (karakia, rahui, topuni, tikanga, kawa, wananga) rather than a water related or water dependent activity.

- Attributes that alone do not represent a measurable attribute but when considered collectively with other attributes are likely to lead to the protection of a tangata whenua value.

The final list of primary attributes is:

Hapua	*Taonga pounamu*
Kaimoana	*Waitapu*
Kainga nohoanga	*Waipuna*
Mahinga kai	*Tauranga waka*
Nohoanga	*Wai whakaheke tupapaku*
Marae	*Waitohi*
Tauranga ika	*Waiwera ngawha*
Waimataitai	*Wahi ingoa*
Waiora	*Wahi tapu*
Taonga	*Wahi taonga classes*
Whenua	*Whakatauki*

Although we assessed each attribute in order to reduce the list to those that can be considered primary attributes, we need to consider how we move from narrative – i.e., descriptions of values – to categories that can meaningfully incorporated in a method. At our third hui with representatives of the papatipu runanga they provided guidance as to how the primary attributes were to be ordered in an assessment of river values.

Categories within our framework

We were still left with 22 primary attributes that we grouped into a number of categories each of which is discussed below.

Wai

Traditional water classifications, which draw on the classifications proposed by Douglas (1984: 1), Tau et al., (1990) Rochford (2003), and Williams (2003), offer another understanding the distinctive characteristics and values associated with different water bodies. Within this category we also include “wai tapu” which refers to waters that are tapu or sacred because of their special properties in relation to other waters, places, or objects. Other water bodies may be accorded taonga status, because of particular uses the waterway supports, which unlike wai tapu, are not prohibited by tapu. The framework needs to enable identification of distinct water bodies and reaches within a catchment.

This category captures the following primary attributes: waimataitai, waiora, waitapu, waipuna, waitohi, wai whakaheke tupapaku, waiwera ngawha. Wai is explicitly included in the assessment of attributes (Part C of the spreadsheet).

1. Wahi ingoa & Whakatauki

- The value attached to catchments is evident from the fact that every part of a landscape was known and named. Not only were the larger mountains, rivers and plains named but every hillock, stream and valley. Some place names are of particular value to this project as they describe the state, features, or relationships in a catchment.
- Whakatauki are of value with some also describing the state, features, or relationships in the environment.

This category, which captures the primary attributes wahi taonga and whakatauki is explicitly included in the assessment of attributes (Part C of the spreadsheet).

2. Mahinga kai

Ngai Tahu often distinguishes between kai awa, kai roto and kai moana. Foods and resources sourced from rivers, lakes and coastal waters respectively. Within Murihiku the koiora (diversity of life) assured always that somewhere, something was available to eat. As a result food gathering in the south saw the sequential utilisation of a great variety of natural resources as they occurred in widely scattered localities.

This category is accorded the status of being a primary attribute. It includes kai awa, kai roto, kai moana and tauranga ika. Mahinga kai is explicitly included in the assessment of attributes (Part C of the spreadsheet).

3. Settlements

Along river valleys of Murihiku are remains of camp sites, some permanent other seasonal. Many are believed to have been seasonal food gathering camps as it was only possible for people to live in permanent settlements, often on the coast, if there were sufficient resources available from the surrounding environment to sustain a resident population. Permanent settlements were supported by a number of seasonal food gathering sites, many of which are found along the sides of mainstem, near wetlands, or at the confluence of tributaries with the mainstem of rivers. Three types of settlements are distinguished in the iwi plan:

Traditionally:
- Kainga nohoanga,
- Nohoanga

And in a modern context:
- Marae

This category, which captures the following primary attributes: kainga nohoanga, marae, nohoanga is part of the assessment of attributes in Part C of the assessment

4. Nga Takiwa o Nga Awa (the catchment)

Different types of water bodies valued by Ngai Tahu and recognized as constituting the whole "catchment system" are described in the iwi resource management plan

Te Upoko o Nga Awa – refers to the source of the awa and includes -

- Roto (lakes) - Inland lakes are valued as receiving bodies collecting high quality waters sourced from maunga, and feeding downstream streams and rivers. They are also linked to the deeds of Rakaihautu who is credited with forming the great lakes of Canterbury, Otago and Southland. The good health of inland lakes seen as a prerequisite for the good health of the heavily utilized downstream waters.

- Maunga – with many streams being sourced from maunga including from the Takitimu (no nga maunga tapu).

Whenua (lands) and awa (rivers): *Catchments comprise lands that are linked by a series of rivers and streams that vary in character and support a range of ecosystems. Stream differences are reflected in their koiora or their biodiversity. The species present, their abundance and their condition are one of the measures of the health of waterways.*

Repo raupo (wetlands): Wetlands vary with the seasons – sometimes wet, sometimes dry, sometimes land, sometimes dominated by freshwater, sometimes brackish. To Ngai Tahu their wealth is represented by their koiora and their functioning providing flow regulation and sediment control (with fertile silts suspended in their waters).

Te Tai (the sea): Flowing rivers flow find their way to the sea. The coastal waters represent the end of the cycle – they were fed from the maunga, used by humans along the way, being degraded as a consequence, but are finally returned to Tangaroa.

Hapua refers to a type of lagoon, dominated by freshwater, that are shaped by river mouth and coastal processes that can be distinguished from other types of lagoons and estuaries.

Waipuna are natural springs, especially at the source, that are usually valued because of the high water quality.

Waiwera ngawha refers to the sources of hot water, highly valued and often used for healing purposes, bathing or recreation.

Takiwa captures the primary attributes of hapua, whenua (plus links to "Wai" above) and is explicitly included in the assessment of attributes (Part C of the spreadsheet).

5. Wahi tapu[5]

It is important to consider the location of wahi tapu in the catchment, specifically their proximity and dependence on the character and condition of the river.

This category is accorded the status of being a primary attribute. Tangata whenua are asked at the beginning of the assessment to identify wahi tapu and wahi taonga.

5 It is important to acknowledge that it is for tangata whenua to identify what is wahi tapu and similarly it is their role to manage information pertaining to wahi tapu.

6. Wahi taonga classes (listed in Te Tangi a Tauira)[6]

- Wahi tapuketia – buried taonga
- Wahi ana – important cave areas
- Tuhituhi nehera – rock drawing areas
- Wahi tohu – locators and their names within landscapes
- Wahi paripari – cliff areas
- Tuahu – sacred place for spiritual purposes
- Wahi rakau – area of important trees
- Pa tawhito – ancient pa sites
- Wahi raranga – sources of weaving materials
- Maunga
- Wahi rua – food storage areas
- Wahi kaitiaki – resource indicators from the environment
- Wahi kohatu – rock formations
- Wahi mahi kohatu – quarries
- Wahi pounamu – greenstone, jade sources

Within this grouping we have added
- Tauranga waka
- Ara tawhito

This category is accorded the status of being a primary attribute. It picks up taonga pounamu, tauranga waka. To reiterate, tangata whenua are asked at the beginning of the assessment to identify wahi tapu and wahi taonga.

7. Nga mahi (ahua o te awa)

This classification was introduced at the hui. It encompasses the functions that collectively represent the working ability of a river, including:
- Carrying nutrients and gravels to the coast;
- Providing homes (habitats);
- Building the coastline;
- Building plains; and
- Providing floods to cleanse and rejuvenate the system.

This category links to "wai" and "takiwa" above.

8. Management mechanisms

There are now a number of legislative mechanisms that accord "value" to waterways. These were not reflected in the framework.

8.6.3 ***Step 3: Identify and apply indicators***

By drawing on the narrative found in the Iwi Management Plan, the statements by manawhenua that have been included in statutory plans, CIAs and other documents prepared for whanau in Murihiku, discussion at the first two hui, and a paper prepared by Te Ao Marama a number of indicators were developed. These are shown in Table 8-5. Indicators used by tangata whenua in other processes, especially monitoring, are shaded blue.

6 It is for tangata whenua to distinguish between wahi tapu and wahi taonga.

Table 8-5
Categories, Attributes and Indicators

Takiwa	Variable flow
	Source protected
	• Connections – groundwater/surface water • Continuous flow source to sea
	Natural river mouth
	Ecosystem integrity
	Passage / movement of sediment
	Mostly native / little or no invasive species
Wai	Character of different water bodies protected
	Continued utility of different water bodies
	Connections – riparian to water
	Quality of waters in different water bodies protected
Settlements	Nohoanga, kaika, marae have a safe water supply
Mahinga kai	Presence of mahinga kai species – known sites
	Healthy condition of target species and fit for use,
	Passage throughout catchment
	Abundance populations of target species,
Wahi ingoa	Place names as indicators of condition of awa
Access	Satisfactory physical access for tangata whenua

Having identified the pieces that we were to work with, the next stage was to structure them within a framework and present in a spreadsheet.

8.7 Constructing the Framework

Having come up with a list of attributes and indicators we had to think how these were to be structured within the overall framework. The challenges and concerns expressed by tangata whenua are summarised in Table 8-6 along with a description of our response.

Table 8-6
A summary of concerns

<table>
<tr><th colspan="3">Mauri, whakapapa, whanaungatanga, maanakitanga</th></tr>
<tr><th>Categories in the assessment method</th><th>Concerns with respect to quantitative measurement</th><th>How incorporated in the assessment method</th></tr>
<tr><td>Part A:
ASSESSMENT OF WAHI TAONGA / WAHI TAPU</td><td>This was seen as the crux of the significance challenge. We need to recognise wahi tapu and wahi taonga in a catchment.
However it may not be appropriate to rate the significance of individual wahi tapu/ wahi taonga
How could we recognise but not rate individually?
Also we had to incorporate a historical perspective alongside contemporary reality. For example a kaika for a rangatira could be found at a river mouth but the site is now modified and no trace is evident. It is still of historical significance however.
Also increasingly sites are being restored. A degraded condition need not be permanent.
However, the converse is also true; a site may still be at risk.</td><td>Identifying wahi taonga and wahi tapu in the framework is the first part of the assessment. This identification process accommodates historic values.

But the assessment for Part A also contains:
An initial overall score for significance based on the total range of wahi taonga present
An assessment of current condition. This brings cotemporary realities into the discussion of values and ratings.
an assessment of the ability to restore is undertaken.
An assessment of risk is also included.</td></tr>
<tr><td>PART B:
ASSESSMENT OF CULTURAL USE</td><td>Wahi taonga and wahi tapu are important for cultural identity – as is the continuity of use at a particular site which may be renown for certain resources</td><td>As a second assessment (Part B), tangata whenua rate their ability to use the river as they aspire to. This also captures economic use. It also can include historic as well as contemporary uses.</td></tr>
<tr><td>PART C:
ATTRIBUTE ASSESSMENT

1. Wai
2. Mahinga kai
3. Settlements
4. Takiwa o Nga Awa</td><td>We need to consider the working ability of a river – in others words the processes and functions associated with a healthy river.
But we need to consider the cultural dimensions</td><td>The final assessment (Part C) asks tangata whenua to assess indicators for the characteristics of the river / water that tangata whenua believe reflect a healthy working river.</td></tr>
</table>

The steps that fall under each Part of the assessment process are as follows:

Preparation – Identify wahi tapu and taonga (Steps 1 and 2)

Step 1: Define river segments	Step 2: Identify wahi tapu / wahi taonga

Part A – Assessment of taonga (Steps 4, 5 and 6)

Step 4: Assess condition	Step 5 Assess reversibility / potential for restoration	Step 6: Assess risk based on known threats

Part B - (Step 7) Assessment of use

Step 7: Assess as being fit for cultural use

Part C – (Step 8) – Assessment of indictors of attributes

Step 8: Apply indicators to assess health of river system

It is the scores from each part of this 3 part assessment (A, B and C) that are used to assess overall significance.

The spreadsheet that contains all the parts of the framework that we propose is shown in Table 8-7.

Table 8-7
Decision Support System for deciding tangata whenua priorities

Part A: Assessment of taonga (Steps 2 - 6)									
Step 1: Define river segments			Step 2: Identify wahi tapu / wahi taonga		Step 3: Assign significance of river / reach	Step 4: Assess condition	Step 5 Assess reversibility / potential for restoration	Step 6: Assess risk based on known threats	SIGNIFICANCE OF CULTURAL VALUES COMPRISING RIVERSCAPE
River code	Reach	River	Wahi tapuketia Wahi ana Tuhituhi nehera Wahi tohu Wahi paripari Tuahu Wahi rakau Pa tawhito Wahi raranga Maunga Wahi rua Wahi kaitiaki Wahi kohatu Wahi mahi kohatu Wahi pounamu Tauranga waka Ara tawhito		Tangata whenua assess level of significance for total catchment based on range of wahi taonga	Level of modification - for unit being assessed (catchment or reach)	Tangata whenua assess the opportunity to restore wahi taonga and / or reverse level of modification	Tangata whenua assess the current risk to wahi taonga	Average the scores from Step 3 to 6 to get an overall score between 1 - 3
			1= few wahi taonga present in catchment/ reach ; 2= moderate representation of taonga in catchment; 3= extensive range of taonga in catchment,		1= minor significance ; 2= moderate significance; 3= high significance	1= highly modified; 2= some modification; 3= substantially unmodified	1= irreversible, no chance to restore; 2= some opportunity to restore; 3= substantially unmodified, can fully restore	1= high level of risk; 2= moderate level of risk; 3= no or minimal risk	
		Scores for the assessment of wahi taonga can range from a total of 5 - 15							
		River							
		River							
		River							

Part B: Sustains cultural use	Part C: Assessment of indicators of attributes							Part D: Significance				
Step 7: Assess as being fit for cultural use	Step 8: Apply indicators to assess health of river system							Step 9: Component scores				Step 10: Assessing overall significance
Assign a 1 - 3 score as to whether or not the river sustains uses as desired by tangata whenua - including economic use	Takiwa	Wai	Mahinga kai	Settlement	Wahi ingoa	Access	Divide the total scores for the assessment of indicators by 19 to get an overall score between 1 - 3	A. Significance	A. Presence and condition of wahi taonga in the catchment	B: Ability to sustain cultural uses	C: A healthy functioning river system	Add the three thresholds scores and divide by 3
	Score 1 (No) or 3 (YES) for eight indicators - source waters protected, integrity of whenua and awa, connections maintained ground-surface, connections riparian to surface, movement sediment throughout system, natural river mouth, mostly native plants - few introduced, variable flow.	Score 1 - 3 for four indicators - continuity of flow source to sea, character of different water bodies protected, quality of waters in different water bodies protect, and continued utility of different water bodies	Score 1 -3 for four indicators - presence / absence of key kai species, abundance of key kai species, condition of key kai species & fit for use, access to gather and use	Score 1 (No) or 3 (YES) for one indicator - marae, kaika or nohoanga in catchment have access to safe water supply	Score 1 (No) or 3 (YES) for one indicator - wahi ingoa in catchment still relevant to condition of awa	Score 1 - 3 for one indicator - satisfactory physical access to wahi taonga		1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1.0 - 1.50 lesser significance 1.51 - 2.50 moderate significance 2.51 - 3.0 higher significance
	TOTAL SCORE CAN VARY FROM 19 - 57							TOTAL SCORE VARIES FROM 1 - 12				

In response to the discussions with tangata whenua we have added restoration after a participant noted that most sites, reaches or indeed catchments could be restored. Similarly we added in a risk assessment after another participant commented that sites in a healthy state may be at risk of degradation.

8.8 Applying the Framework to Rivers in Murihiku

The assessment panel of experts involved representatives from

- Hokonui Runanga;
- Waihopai Runanga;
- Oraka Aparima Runaka;
- Awarua Runanga;
- Te Ao Marama[7]; and
- Environment Southland[8].

The location of each runanga is shown in Figure 8-1.

Figure 8-1
Papatipu runanga

Te Ao Marama and Environment Southland helped facilitate the hui.

7 Participating staff members are mana whenua.
8 The participating staff member is mana whenua.

As this project seeks to develop a relatively efficient method for assessment, the time commitment of our tangata whenua "Expert Panel" was as follows:

- The purpose of the first hui was to meet with staff of Te Ao Marama and Environment Southland to discuss the project;
- The next hui with representatives of nga runanga was to discuss to how rivers are valued and used by Ngai Tahu whanui and how we might accord significance.
- The third hui, again with representatives of nga runanga, was to present a draft of a framework that had been developed in response to the conversations and the provisions of the Iwi Management Plan. At this hui the rivers that could be assessed were also identified.
- The results of the first three hui that led to development of the framework are described in Sections 2-3.

It is the results of the final hui – applying the framework in Murihiku - that are now presented and discussed. Each participant had a worksheet for the river that was to be assessed (an example is appended). As a collective the panel worked through the worksheet. Each river assessment, because of the discussion that accompanies each indicator, is expected to take 2.5–3 hours.

With respect to wahi taonga, it was a case of the panel members identifying – via a simple yes / no – accompanied by a discussion – the wahi taonga within a catchment. Given the list of wahi taonga identified, at this early stage they were asked to accord a significance rating to the catchment solely on the basis of presence or absence of taonga. This also has the effect of according a significance value to historic or traditional value. **This is the first rating that informs our overall assessment – as Part A.**

However, the need to incorporate contemporary realities meant that panel members were then asked to collectively score the

- The current condition of these wahi taonga;
- The potential for their restoration / rehabilitation; and
- The risk of further degradation to wahi taonga.

The ratings for these criteria were averaged to give an overall rating. **This is the second score that informs our overall assessment – as Part B.**

As the relationship of tangata whenua with catchment is usually an active one, tangata whenua then were asked whether or not they could use the catchment as they aspired to. This can include an assessment of economic aspirations. **This is the third score that informs our overall assessment – as Part C.**

The next step was to assess the indicators of attributes that tangata whenua believed represent a healthy functioning system. Again scores were determined as a collective and where there was disagreement for the rating to be accorded an indicator, the ratings were averaged. **This is the final score that informs our overall assessment as Part D.**

The results of the assessment in Murihiku are shown in Table 8-8.

Ultimately, however it is the right of manawhenua to determine every waterway within their takiwa to be of the highest significance.

Table 8-8
Decision Support System applied in Murihiku

Part A: Assessment of taonga									
Step 1: Define river segments			Step 2: Identify wahi tapu / wahi taonga		Step 3: Assign significance of river / reach	Step 4: Assess condition	Step 5 Assess reversibility / potential for restoration	Step 6: Assess risk based on known threats	SIGNIFICANCE OF CULTURAL VALUES COMPRISING RIVERSCAPE
River code	Reach	River	Wahi tapuketia Wahi ana Tuhituhi nehera Wahi tohu Wahi paripari Tuahu Wahi rakau Pa tawhito Wahi raranga Maunga Wahi rua Wahi kaitiaki Wahi kohatu Wahi mahi kohatu Wahi pounamu Tauranga waka Ara tawhito		Tangata whenua assess level of significance for total catchment based on range of wahi taonga	Level of modification - for unit being assessed (catchment or reach)	Tangata whenua assess the opportunity to restore wahi taonga and / or reverse level of modification	Tangata whenua assess the current risk to wahi taonga	Average the scores from Step 3 to 6 to get an overall score between 1 - 3
			1= few wahi taonga present in catchment/ reach ; 2= moderate representation of taonga in catchment; 3= extensive range of taonga in catchment,		1= minor significance ; 2= moderate significance; 3= high significance	1= highly modified; 2= some modification; 3= substantially unmodified	1= irreversible, no chance to restore; 2= some opportunity to restore; 3= substantially unmodified, can fully restore	1= high level of risk; 2= moderate level of risk; 3= no or minimal risk	
		Scores for the assessment of wahi taonga can range from a total of 5 - 15							
		Mataura	Y		3.00	1.40	2.10	2.00	**2.13**
		Oreti	Y		3.00	1.10	2.00	2.00	**2.03**
		Waikawa	Y		3.00	2.00	1.95	2.00	**2.24**
		Clutha	Y		2.30	1.25	1.80	2.00	**1.84**
		Tautoko	Y		2.16	3.00	2.80	3.00	**2.74**
		Waihopai	Y		1.80	2.40	2.40	2.00	**2.15**

Part B: Sustains cultural use	Part C: Assessment of indicators of attributes							Part D: Significance				
Step 7: Assess as being fit for cultural use	Step 8: Apply indicators to assess health of river system							Step 9: Component scores				Step 10: Assessing overall significance
Assign a 1 - 3 score as to whether or not the river sustains uses as desired by tangata whenua - including economic use	**Takiwa**	**Wai**	**Mahinga kai**	**Settlement**	**Wahi ingoa**	**Access**	Divide the total scores for the assessment of indicators by 19 to get an overall score between 1 - 3	**A. Significance**	**A. Presence and condition of wahi taonga in the catchment**	**B: Ability to sustain cultural uses**	**C: A healthy functioning river system**	Add the three thresholds scores and divide by 3
	Score 1 (No) or 3 (YES) for eight indicators - source waters protected, integrity of whenua and awa, connections maintained ground-surface, connections riparian to surface, movement sediment throughout system, natural river mouth, mostly native plants - few introduced, variable flow.	Score 1 - 3 for four indicators - continuity of flow source to sea, character of different water bodies protected, quality of waters in different water bodies protect, and continued utility of different water bodies	Score 1 -3 for four indicators - presence / absence of key kai species, abundance of key kai species, condition of key kai species & fit for use, access to gather and use	Score 1 (No) or 3 (YES) for one indicator - marae, kaika or nohoanga in catchment have access to safe water supply	Score 1 (No) or 3 (YES) for one indicator - wahi ingoa in catchment still relevant to condition of awa	Score 1 - 3 for one indicator - satisfactory physical access to wahi taonga		1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1= low; 2= medium; 3= high	1.0 - 1.50 lesser significance 1.51 - 2.50 moderate significance 2.51 - 3.0 higher significance
	TOTAL SCORE CAN VARY FROM 19 - 57							TOTAL SCORE VARIES FROM 1 - 12				
3.00	2.04	2.00	3.00	2.00	2.00	2.50	**2.26**	3.00	2.13	3.00	2.26	**2.60**
2.17	2.10	2.00	2.35	2.00	2.00	2.00	**2.08**	3.00	2.03	2.17	2.08	**2.32**
2.30	2.50	2.00	2.30	2.00	3.00	2.00	**2.30**	3.00	2.24	2.30	2.30	**2.46**
2.00	2.15	2.00	2.00	3.00	3.00	2.00	**2.36**	2.30	1.84	2.00	2.36	**2.12**
1.00	3.00	3.00	1.00	3.00	2.00	2.00	**2.33**	2.16	2.74	1.00	2.33	**2.06**
2.70	1.60	2.27	2.70	2.70	3.00	2.50	**2.46**	1.80	2.15	2.70	2.46	**2.28**

8.9 Review of the Framework

This section reflects on:
- The application of the process in Murihiku;
- The ongoing challenge of identifying significance; and
- The question of "thresholds".

8.9.1 *Questions raised in Murihiku*

Concern was expressed about the whole concept of "significance". Some comments were:

1 Do we assess all the rivers?
2 All waters are important. They are all of high significance. Therefore a method is not required.
3 How can we class a waterway as being of low significance?
4 What does it mean if we say a river is of low significance?
5 If we have to make distinctions, we can't use a 1-3 scale. It needs to be 1 – 5 or 1 - 10
6 How will this sort of rating be used? Who will use the rating?
7 We will rate the river closest to home, that we use the most, as the most significant. We will always be biased.
8 How do we balance historical significance and today's significance?
9 How do we recognise a site and use that has been destroyed but still remains significant to us?
10 Are we going to visit these sites? How can we assess without visiting each catchment?
11 What do we do when a catchment is made up of a lot of different parts, e.g., *"the tributaries are munted, but the upper reaches are okay"?*

These questions are discussed briefly in the paragraphs that follow.

It is important to note that in response to the queries about according significance indirectly or by default Ngai Tahu might have accorded significance by some of its recent decisions.
- It has supported Water Conservation Orders that confirm that a river is "outstanding" for defined values.
- Ngai Tahu has agreed to Statutory Acknowledgements as part of the Ngai Tahu Claims Settlement Act 1998. But not all rivers in regions across the South Island were given this status.
- A third indication of differentiating between rivers is seen in the case of the Mataura, where Hokonui Runanga applied for a mataitai, in part, because of the mahinga values the river sustains.

As explained earlier, these mechanisms are negotiated with the Crown and other parties so arguably do not represent a strictly cultural determination of significance. They do however remain valid examples of how Ngai Tahu has appeared to differentiate between rivers on the basis of significance or status.

8.9.2 *A catchment assessment*

The participants believed that there needed to be flexibility built into the assessment to consider particular river reaches and sites within a catchment. In the case of the Mataura we have a breakdown of different reaches and will separately analyse the data and means of aggregation before our feedback hui with tangata whenua.

8.9.3 *The Expert Panel of Assessors*

Manawhenua also incorporates the concept of the land as the source of all knowledge, history and kinship ties (Jull, 1989, p11).

The assessment method is to be applied by those who know the river. It is therefore necessary to understand the context of Matauranga Maori. Manawhenua rights are accompanied by responsibilities. Matauranga Maori constrained the rights of manawhenua to sustain themselves and economically prosper through the use of natural resources by imposing obligations not to use resources in ways that would damage them beyond restoration.

It is fundamental to Ngai Tahu that resources were available to meet the needs of present generations of people in order that whanau, hapu, and iwi would survive into the future. The assessment methods we propose are dependent upon the engagement of manawhenua but they must know the river systems. It is also necessary to understand the knowledge that is held within whanau, hapu and iwi.

While matauranga emphasises continuity and long term practices it is important to note that this does not mean static and unchanging. Matauranga is rooted in and informed by a traditional or customary lifestyle but it adapts to change and incorporates contemporary information and technology. New information is continually added as the environment is transformed. For example, in our discussion of the Mataura River whanau provided examples of valued species intolerant to shallow, warm water, that is polluted from herbicides, pesticides, in particular the nitrates and phosphates found in the runoff from intensive agriculture. Dairying was a concern for all participants. Members of our Expert Panel were able to describe in detail the effects of land uses on the different parts of the river system.

Internationally there are ongoing discussions about the loss or erosion of traditional knowledge as indigenous communities become more integrated into regional or national economies. It is recognized, however, that just because resource uses have changed with consequent changes to the type and frequency of cultural activities, it does not necessarily mean that matauranga held by whanau and hapu is lost or is irrelevant. In respect to this project, it enables us to link to the other work-streams.

It is also critical to understand the political context of matauranga. The expression of matauranga is also seen as an expression of rangatiratanga – in effect greater control over natural resources.

Contemporary discussions of matauranga often focus on the antiquity of knowledge and invariably make reference to the often broad generalised value statements derived from oral histories. To understand rivers, one must participate in the real life processes of hunting, fishing, gathering and processing kai and other cultural materials, and continue to interact with sites of significance. This is a form of pragmatic knowledge that is dynamic and responsive to changes within the environment. In other words whanau with a history of use and those who continue to use waterways and resources are those that retain and continue to generate the matauranga. In this way, directly or indirectly the whanau is the main perpetuator of the Ngai Tahu way of life and stories.

If matauranga is to be understood and valued as anything more than culturally specific stories it is imperative that resource managers recognise that ecological knowledge is dynamic and emerges from locally specific interactions between people and their surrounding environment in the context of their everyday livelihood practices. Indeed dimensions of matauranga now include ideas about relations between nutrient runoff from agriculture on water quality, or the impact of climate change on rivers lakes and the species inhabiting them. It also helps explain how whanau are likely to have detailed knowledge of the "local river" and accord it greater significance because it is their awa. This helps explain why it may be difficult to define local, regional and national significance – as in effect every **local** river that is used by whanau could to that whanau be the most important – i.e., **nationally** significant.

The settlement of Murihiku and the alienation of lands and resources has had significant impact on Ngai Tahu. The mahinga kai practices of Ngai Tahu have been transformed during the generations since the Treaty was signed and therefore the knowledge generated by cultural usage of various sites has been impacted. It must be recognised that due to colonisation, the application of Matauranga has been disrupted and subject to interference. Nevertheless for some whanau, for some resources, in some areas, there has been regular, relatively uninhabited resource use through the generations. Many Ngai Tahu continue to gather kai awa, kai roto and kai moana. Settlement, however, precluded the existence of a system of use unchanged by external forces. Ngai Tahu now operate within a highly politicised context and against several different levels of opposing claims. Matauranga is therefore framed by the broader struggle for recognition of customary and Treaty rights.

A fundamental question to enable this assessment method to be applied in a region is to identify who holds the knowledge of rivers. Matauranga is generated, held and transmitted by users. Detailed knowledge is gained through ongoing contact with the rivers and resources. Guidance in the initial stages will be necessary to ensure that the participants are those that know the rivers.

Tipa and Teirney (2003) and Synexe (2009) describe the information held within fishing whanau, including:

- Species found within the system;
- Abundance;
- Spawning/breeding grounds;
- Fishing sites;
- Access sites;
- Patterns of vegetation & habitat;
- Levels of water flow – low flows as well as the magnitude and frequency of floods;
- Withdrawals and discharges;
- Sediment deposition and conversely erosion;
- Areas of blockage;
- Farming and industrial activities;
- Sites of cultural and spiritual significance; and
- Habitation sites including settlements and burial grounds.

Synexe (2009, p.18) also cautions, however, that "there may be resistance to the use of this type of knowledge among scientists"). This method assumes that there is acceptance for the application of the method by tangata whenua.

8.9.4 ***The question of thresholds***

At this stage of developing a method, it is recommended that the terms low, medium and high significance not be used. We have simply used the phrase of moderate significance – scores below that can be of lesser significance, while others can be of higher significance.

This also avoids the use of the terms, local, regional and national significance.

To reiterate, ultimately, it is the right of manawhenua to determine that every waterway within their takiwa to be of the highest significance.

This method is proffered as a tool available to help tangata whenua and regional councils. However, it would not be appropriate for a significance rating to be imposed. Tangata whenua need confidence in how the method and the results of its application could be used in resource management.

This is an area that needs to be discussed more widely among tangata whenua.

8.9.5 *Will the assessment method complement other iwi initiatives*

A central tenet of this project was to develop a method that used available information. The assessment method proposed can link to some of the initiatives that whanau, hapu, and iwi already have underway. Some examples are presented in Table 8-9.

Please note the Table is illustrative as we acknowledge that there are many other initiatives underway. The intent of this method is to complement whanau, hapu and iwi initiatives.

Table 8-9
Links with initiatives that tangata whenua have underway

Categories in the framework	Iwi initiatives that can inform this stage
Wahi taonga / wahi tapu	**Resource inventories** – Harmsworth (2002) describes inventories as a "stock take" of tribal resources". Many whanau, hapu and iwi are in the process of preparing inventories, some of which form part of a GIS (Geographic Information Systems) and computerised database. These inventories can help with the identification of wahi taonga and wahi tapu. **Cultural mapping** encompasses a wide range of techniques and activities from community-based participatory data collection and management to sophisticated mapping using GIS. Many of the approaches being adopted by tangata whenua are participatory and encourage tangata whenua to identify, record, and investigate cultural assets – both tangible or intangible and that form the foundations of the culture. **Cultural values reports** (CVR) are used in assessing or providing background information as they can identify and describe values of tangata whenua pertaining to a particular area or resource. Cultural values reports can provide direction as to the relevant issues and how these should best be addressed. They are useful for facilitating discussion.
Cultural use	A range of initiatives are underway to record customary fisheries data. Catch records are available from Tangata Tiaki and MAF. Matauranga Maori is being recorded to support applications for mataitai and/or taiapure, or is being recorded to inform management strategies of fisheries managers, including Tangata Tiaki. Cultural values reports also document use.
Nga mahi (ahua o te awa) • Wai • Mahinga kai • Settlements • Takiwa o Nga Awa	Some of the indicator programmes of tangata whenua already being implemented include: • Development of cultural indicators for wetlands (Harmsworth 1999). • Development of a cultural health index (Tipa & Teirney 2003, 2006). • Development of State of Takiwa (see www.ngaitahu.iwi.nz) • Adaption of the cultural health index by Tiakina Te Taiao for their own use and application in the Upper South Island (Young et al 2008). • Development of a coastal marine health index (underway). • Development of cultural indicators for lakes (underway by Ngai Tahu).

8.9.6 ***Does the assessment method enable linkages to other assessment methods (e.g., wildlife, native fisheries)***

In addition to the proposed assessment method for tangata whenua being responsive to their beliefs, values and practices, it needs to link with other assessment methods that comprise the RiVAS Process and not be seen as merely an 'add on'. Identifying an interface with other parts of RiVAS enables linkages with stakeholders, communities, scientists and resource managers (Table 8-10).

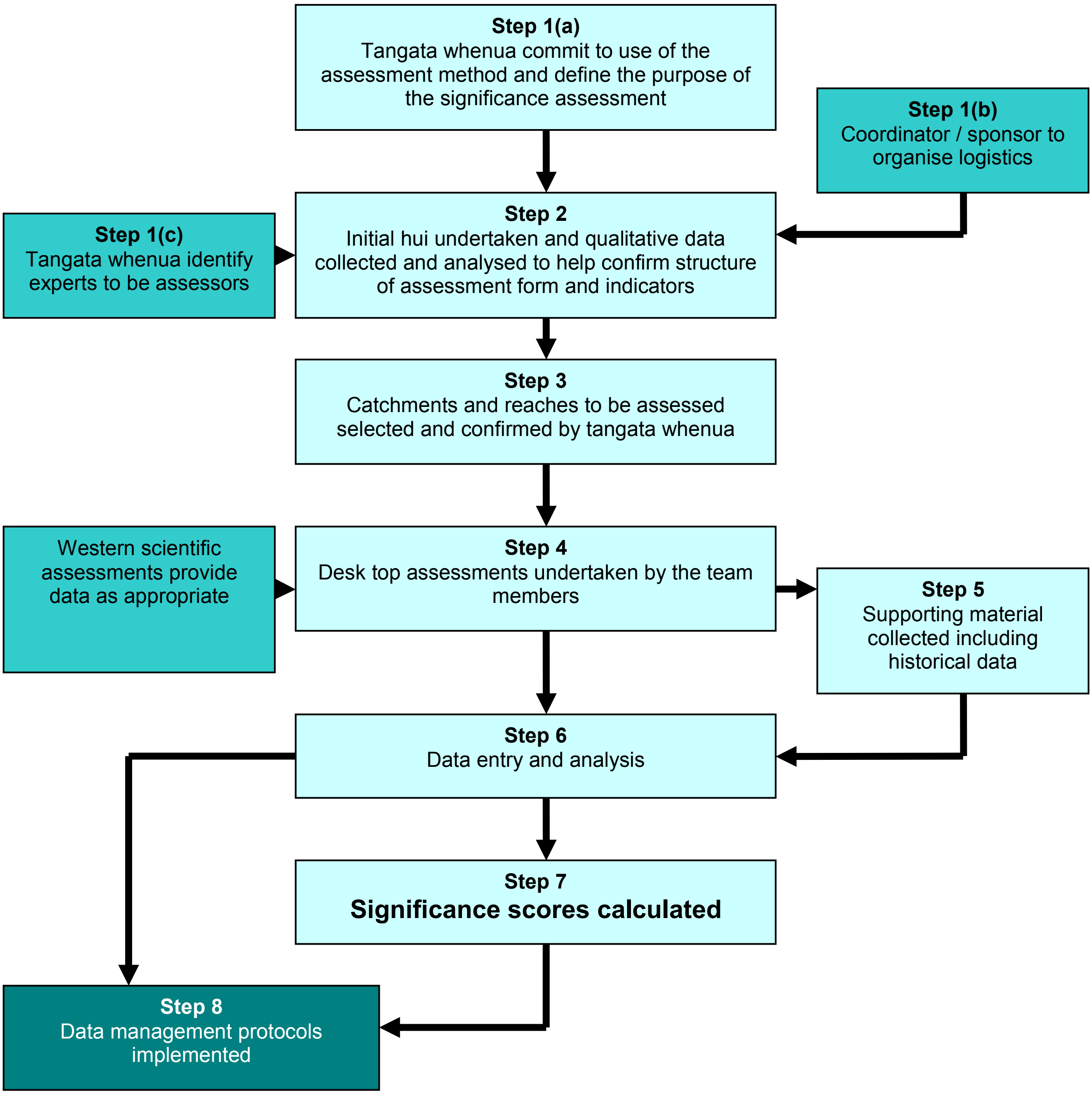
Table 8-10
Links with other RiVAS Assessments

Categories in the framework	Assessed in the framework via indicators	Links to other significance assessment methods within the RiVAS framework
Nga mahi (ahua o te awa) • Wai • Mahinga kai • Settlements • Takiwa o Nga Awa	Continuous flow source to sea	
	Variable flow	Native birds, native fish Natural character (?)
	Mostly native / little or no invasive species Source protected	
	Connections – groundwater/surface water	
	Connections – riparian to surface water	
	Natural river mouth	Natural character (?)
	Ecosystem integrity	
	Passage	
	Character of different water bodies protected	Natural character (?)
	Quality of waters in different water bodies protected	
	Continued utility of different water bodies	
	Connections – riparian to water	Natural character (?)
	Nohoanga, kaika, marae have a safe water supply	
	Presence of mahinga kai species,	Native birds Native fish
	Abundance populations of target species,	Native birds Native fish
	Healthy condition of target species & fit for use	Native birds (?) Native fish (?)
	Passage throughout catchment	
	Place names as indicators of condition of awa	
	Satisfactory physical access for tangata whenua	

8.9.7 ***Moving forward - Applying the Significance Assessment Method***

Once it has been decided that a significance assessment is to proceed, a number of steps are to be implemented (see Figure 8-2). Managing the logistics of a significance assessment study will be a factor critical to its success. The following paragraphs simply describe the steps that need to be considered. Once the method has been validated a more substantive guide can be developed.

Figure 8-2
Steps to Implement a Significance Assessment



8.9.8 *Step 1: Choosing the team*

Tangata whenua appoint the Expert Panel:

- It is recommended that team members have a strong connection with the catchment being assessed, especially an appreciation of customary fisheries, together with people with knowledge of the kind of changes that have taken place over time.
- It is important that there is consistency in the people involved throughout the duration of the assessment.
- The inclusion and involvement of kaumatua will ensure that different life experiences and perspectives are represented and incorporated.
- A significance assessment is a learning experience and environment. It may be appropriate to include rangatahi to observe the assessment process.

8.9.9 ***Step 2: The initial hui***

The purpose of the initial hui is to discuss the appropriateness of the recording form and the spreadsheet with tangata whenua. Any alterations need to be recorded with the reasons for change.

8.9.10 ***Step 3: Selecting catchments and reaches for your significance assessment***

Catchment, reaches and sites are chosen from any part of the region. The final number of catchment for the assessment will be determined by tangata whenua in collaboration with the regional council (if they are the ones wanting the assessment). Once the catchments have been agreed, a visit to each site may be necessary to record its GPS reference and the physical boundaries of the reach. During this initial visit it is recommended that a description of the reach be prepared and photo points established.

Once all reaches have been identified, the hui and any necessary field visits can be planned. If field visits are considered necessary vehicles; travel time; access (legal access, talking with land owners and physical access); equipment; food and drink for the team; and other relevant logistics must be considered. It is recommended that a health and safety plan be prepared with all team members briefed on the plan before fieldwork actually starts.

8.9.11 ***Step 4: The data collecting hui***

Through hui, data specific to the rivers being studied will be collected. Tangata whenua will identify people with the knowledge and right to speak about their rivers for the panel. Ideally the panel would include kaumatua, those who have lived and used the rivers for a long period, those who fish and gather kai in the area, and those who are active in resource management, customary fisheries etc.

The purpose of the hui with tangata whenua is threefold – to identify:

- Wahi taonga within the catchments;
- Why sites were valued and how they have been used by tangata whenua – historically and today; and
- How sites and their uses have changed over time.

To reiterate it is essential that the panel members have an active relationship with the rivers being assessed. In the course of the interview the interviewer should discuss every part of the recording form (in Appendix 1). It is recommended that the hui be informal in nature, carried out in a conversational style and free of jargon or technical language. Wherever possible corroborating material should be identified and where possible collected (e.g., maps, evidence, manuscripts, cultural impacts assessments (CIAs), cultural values reports, etc).

8.9.12 ***Step 5 - Collecting supporting material including historical***

It is recommended that supporting material identified by tangata whenua should be collected to support the results of the assessment.

8.9.13 ***Steps 6 & 7: Collating and analysing the data***

Once hui are completed the data have to be analysed. Scores are to be entered into the spreadsheet. The spreadsheet automatically calculates the significance ratings.

8.9.14 ***Step 8: Managing Data***

During the course of a significance assessment various types of data will be collected including:

- Tapes and transcripts;
- Maps;
- Photographs and diagrams;
- Lists of reaches and wahi taonga;
- Species data;
- Record and assessment sheets; and
- Various other notes, planning papers and reports.

The significance assessment has been designed to accommodate and incorporate the knowledge of tangata whenua. In fact, the significance assessment score cannot be calculated without access to this knowledge. There is often, however, concern about the disclosure of sensitive information. There are a number of ways that data and information can be handled to minimise risks. It must be stressed that tangata whenua manage data throughout a significance assessment.

Decisions about where and how to store data will need to be made before starting the assessment. For example, questions to be answered include:

- How will records be protected from physical degradation or computer failure?
- Where will multiple backup copies of data get kept?
- Who can access information and how is it accessed?
- How is information to be protected when hapu members move away or pass on?

8.10 **Thoughts on presenting the data to tangata whenua**

For the purpose of presenting the significance assessment results to tangata whenua and enabling a simple yet effective comparative assessment in order to test if the results "make sense" colour coding could be used. Each component of the assessment plus the overall score can be colour coded as suggested below.

Ratings	Key
1.0-1.5 Lesser	(red)
1.51 - 2.50 moderate	(yellow)
2.51 – 3.0 higher	(green)

To reiterate:

Initial – Significance of range of wahi taonga

Step B: Presence and condition of wahi taonga in catchment

Step C – Cultural use

Step D - Indicators of a healthy system
These four parts of the significance assessment would be shown along with the overall significance score between 1 – 3.

Visually depicting the results helps explain how the scores for the different components affect overall significance ratings. Three examples are presented over the page.

Mataura

Significance	Step B Presence and condition of wahi taonga	Step C Cultural use	Step D Health of the river system
3.00	2.13	3.00	2.26
OVERALL 2.60			

Oreti

Significance	Step B Presence and condition of wahi taonga	Step C Cultural use	Step D Health of the river system
3.00	2.03	2.17	2.08
OVERALL 2.32			

Tautuku

Significance	Step B Presence and condition of wahi taonga	Step C Cultural use	Step D Health of the river system
2.30	2.74	1.0	2.33
OVERALL 2.06			

Please note, that this form of presentation is only a suggestion to try and make the results from easily understood by tangata whenua. A spreadsheet and a table of numbers may be difficult to understand.

8.11 Going Forward: Recommendations

It is recommended that:

Within Murihiku:

1. The tangata whenua Expert Panel in Murihiku complete the **technical** assessment of other rivers in Murihiku;
2. The overall significance scores are discussed with the tangata whenua working group to see if they "make sense";
3. The results of the Murihiku assessment are discussed with the respective runanga in Murihiku to see there is **political** buy-in to the method; and
4. That we visit three sites from one of the catchments to "ground truth" the assessments of the Expert Panel.

Outside of Murihiku:

1. Trial the assessment method in another region with an iwi that has all the "building blocks" in place, e.g., an iwi plan, a resource inventory, an identifiable Expert Panel;
2. Trial the assessment method in another region with a hapu or an iwi that has none of the "building blocks" in place, e.g., an iwi plan, a resource inventory, an identifiable Expert Panel but a commitment to the method. This may require the use of a number of participatory methods, e.g., cultural mapping;
3. Convene a hui to discuss the value of a significance method for their wider freshwater management aspirations; and
4. Choose a region and link the assessment method with other iwi initiatives as a tool not only for assessment but to advance the aspirations of tangata whenua.

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Appendix 8-1
Assessment Forms

ATTRIBUTE	PRESENCE / ABSENCE IN CATCHMENT	ASSESSMENT			SIGNIFICANCE	
	Y/N	Current condition	Risk	Ability to restore	Existing value	Historically
Wahi Taonga						
Wahi tapuketia – buried taonga						
Wahi ana – important cave areas						
Tuhituhi nehera – rock drawing areas						
Wahi tohu – locators and their names within landscapes						
Wahi paripari – cliff areas		Wahi taonga are to be identified during discussions with tangata whenua. Discussions may be complemented by mapping, by the sharing of reports, etc. It is necessary to get the following outputs – • Identification of wahi taonga within a catchment with site specificity wherever possible. • Identification of any difference in the status or significance of sites, e.g., wai tapu are likely to be accorded a higher level of significance • Identification of other data sources that could be accessed to provide additional data to support the identification by tangata whenua, e.g., historical maps, manuscripts, Tribunal evidence, historical text, inventories, oral histories etc.				
Tuahu – sacred place for spiritual purposes						
Wahi rakau – area of important trees						
Pa tawhito – ancient pa sites						
Wahi raranga – sources of weaving materials						
Maunga						
Wahi rua – food storage areas						
Wahi kaitiaki – resource indicators in the environment						
Wahi kohatu – rock formations						
Wahi mahi kohatu – quarries						
Wahi pounamu – greenstone, sources						
Tauranga waka						
Ara tawhito						
Wahi tapuketia – buried taonga						
Wahi ana – cave areas						
Tuhituhi nehera – rock drawing areas						

ATTRIBUTE	DATA COLLECTED
Takiwa	
1. Source protected	
2. Variable flow	Discuss basic hydrology – low flows, freshes, floods etc
3. Productive ecosystems – integrity of whenua and awa	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made.
4. Mostly native / little or no invasive species	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made. • Links to other assessment methods • Links to other monitoring initiatives
5. Connections – groundwater/surface water	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made. • Map if necessary
6. Connections – riparian to surface water	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made. • Map if necessary
7. Passage / movement of sediment through the system	• Record observations of tangata whenua and context in which observation made. • Map if necessary
8. River mouth	Record observations of tangata whenua and context in which observation made.
Wai	
9. Different utility of different water bodies	• Discuss & map if necessary • Record discussions
10. Character of different water bodies protected	• Discuss & map if necessary • Record discussions
11. High quality water protected	• Discuss & map if necessary • Record discussions
12. Continuous flow source to sea	Record observations of tangata whenua and context in which observation made.
Settlements	
13. Kaika nohoanga, marae – all have safe water supplies	• Discuss & map if necessary • Record discussions
Mahinga kai	
14. Presence / absence of target kai species	• Record historical • Identify expected species composition • Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made. • Map if necessary • Links to other assessment methods
15. Abundance of target kai species	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made • Links to other assessment methods
16. Condition of species – fit for use	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made
17. Access for tangata to gather and use	• Identify formal assessments undertaken • Record observations of tangata whenua and context in which observation made
Wahi ingoa	
18. Place names as indicators	Record observations of tangata whenua and context in which observation made
Access	
19. Access to wahi taonga	Record observations of tangata whenua and context in which observation made

Appendix 8-2
Terms Used

Key species
Although other assessments are targeting native fish, salmonids, and birds, it is for tangata whenua to identify the species that they regard as kai or taonga. This means that the assessments made by tangata whenua could differ from scientific assessments.

Surface waters
Once again it is for tangata whenua to highlight tributaries, mainstem, puna or wetlands that are a particular focus of their activities.

Chapter 9
Irrigation

Preamble

The Canterbury region already contains most of New Zealand's irrigated land but also has the largest remaining area available for potential irrigation development. In addition it has many rivers that might, under appropriate conditions, be used as sources of water – these rivers are also important for other values including many dealt with in other chapters of this report, e.g., native birds and salmonid angling. It was thus appropriate that the first trial application of RiVAS for irrigation should occur in Canterbury (Part A) and the second application should also occur in another significant area for irrigation, namely Tasman District (Part B). No significant issues occurred in undertaking the two applications although it should be noted that a weighting factor has been applied to key primary attributes.

Part A: Irrigation in Canterbury Region: Application of the River Values Assessment System (RiVAS)

Simon Harris (Simon Harris Consulting)
Claire Mulcock (Mulgor Consulting)

Peer reviewed by: Dr Nick Brown

9.1 Introduction

9.1.1 *Purpose*

This section describes testing the River Values Assessment System (RiVAS) described by Hughey et al. (herein) with irrigation as the river value. The attributes and indicators derived for irrigation are applied to Canterbury rivers as a case study.

9.2 Significance Assessment Method

The RiVAS aims to outline assessment criteria and significance thresholds for river values, for application within national and regional planning under the Resource Management Act (RMA). It involves the development of attributes and indicators in conjunction with an Expert Panel. In this project the RiVAS for irrigation has been developed in conjunction with a group of experts on irrigation and water resource management and tested in a case study setting of the Canterbury region. Figure 9-1 provides a summary of the RiVAS process.

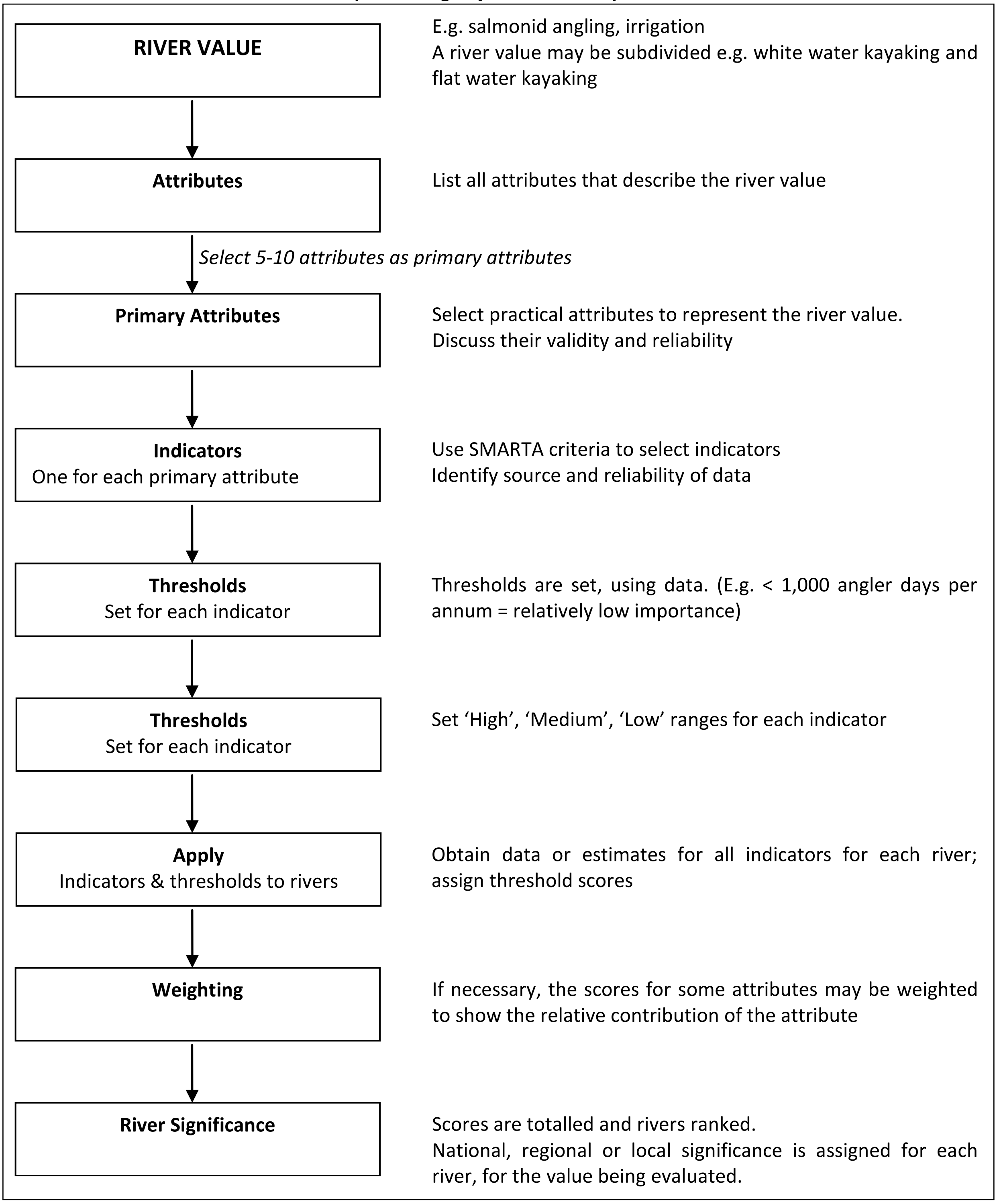
It is intended that RiVAS is applicable to all river values[9]. Hughey et al. (Chapter 3, herein) anticipate that the implementation of the method may be varied to accommodate the particular characteristics of each river value, but that once applied for a specific river value (e.g., irrigation) the method for that value will be consistent across New Zealand.

The members of the National Expert Panel who developed the irrigation attributes and indicators and carried out the Canterbury case study were: Dr Terry Heiler (Irrigation NZ), Murray Doak (MAF), Simon Harris (Harris Consulting) and Claire Mulcock (Mulgor Consulting). Lynda Weastell (ECan)

9 **River value:** A river-related tangible resource (e.g. birdlife), activity (e.g. salmonid angling), or resource use (e.g. irrigation) *(*Hughey et al. Herein*)*

contributed to the development of the attributes and indicators, but did not participate in the Canterbury case study. Ken Hughey sat in on part of the panel deliberations and provided guidance on application of the methodology. Dr Nick Brown undertook a peer review of the project. Information on the panel members and reviewer is given in Appendix 9A-1.

Figure 9-1
Summary of RiVAS Method
(from Hughey et al. Herein)



9.3 Application of the Method

9.3.1 *Step 1: Defining categories for the river value and river segments*

The RiVAS enables assessments to be undertaken for categories[10] of river values or for individual river segments. No categories were identified for irrigation, and therefore the assessment for irrigation was developed with no sub-categories.

Consideration was given to segmenting rivers where there are major differences in upper and lower catchment attributes relating to irrigation. For example: one or more of: mean annual rainfall greater than 1200 mm; average slope greater than 15 degrees; altitude greater than 600 m. In Canterbury, the mountain rivers may be usefully divided into 2 segments: above and below gorges (e.g., Waimakariri, Rakaia, Rangitata, and Waitaki). However, because of the transportability of water among different parts of a region, and because of the need to make the method nationally applicable, the Expert Panel decided that for the purposes of irrigation assessment it was not necessary to use river segments.

9.3.2 *Step 2: Identifying attributes*

The first major task for carrying out the RiVAS in respect of irrigation was to identify the major attributes of irrigation. The attributes are the facets of the river value that, taken collectively, describe that river value. For example, salmonid angling includes the attributes of level of use, anticipated catch rate, perceptions of scenic attractiveness, etc. Consideration was given to identifying at least one attribute for each of the four 'well-beings', i.e., social, economic, environmental, cultural.

The panel assessed a draft list of the major attributes of irrigation considered necessary to describe the nature of the river for irrigation purposes. These were divided into two 'attribute clusters' (c.f. Booth et al., application to salmonid angling, herein) – supply and demand.

The panel assessed the draft list for usefulness, made amendments and added further attributes. The agreed attributes are listed below in Table 9-1.

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10 **River value category**: A specific type or style of the river value. For example recreational values can be categorised into. whitewater kayaking, flatwater kayaking; wilderness fishery, lowland fishery.

Table 9-1
Description of Attributes

Attribute	Description
Cluster: Supply attributes	
Size of resource	A description of the magnitude of the flows in the river
Technical feasibility of abstraction	How difficult it is to access water for irrigation.
Technical feasibility of storage	Whether storage is likely/feasible in this location. Storage was considered to be significant storage on- or off- river that would improve seasonal and inter-year reliability, but did not include small on-farm storages.
Hydrological reliability for run of river	How often flows in the river are available for abstraction.
Hydrological reliability for storage	The reliability of the resource from a storage point of view.
Timing/seasonal availability	The availability of water during the irrigation season, which is a combination of volumes and reliability over the September to April period.
Cluster: Demand Attributes	
Soil moisture deficit	The need for irrigation during the irrigation season, being a combination of rainfall and potential evapotranspiration (PET)
Potentially irrigable area	This is the area which could feasibly be irrigated from the resource. It comprises the river riparian areas as well as neighbouring areas where water could be transported through schemes.
Receiving environment	Whether the potentially irrigated areas have environmental impacts, both positive (such as recharge) and negative (such as water quality), which affect the desirability of irrigating in that location.
Alternative water supply	Whether the soil moisture deficits can be overcome from other sources – such as groundwater.
Socioeconomic benefit	The impact for users and the wider community from the likely land uses to which the water will be put.

9.3.3 *Step 3: Selecting and describing primary attributes*

From the list of attributes identified in Step 2, 'primary' attributes were selected to represent irrigation. Primary attributes are described as 5-10 of the attributes that can best be used to represent the river value under consideration. The Expert Panel discussed the validity and reliability of each attribute, i.e., its strengths and weaknesses as a means to represent the river value, i.e., irrigation. In practice the list of attributes was sufficiently small that all were included as primary attributes, although 'timing/seasonal availability' was incorporated with reliability measures. There are some interlinkages between attributes that means they are not completely independent of each other, but the panel felt that there was a need for the additional descriptive information that each provided to the overall assessment.

9.3.4 *Step 4: Identifying Indicators*

This step defines one indicator that can be used to measure each primary attribute. The indicator needed to provide a cost-effective and quantitative measure of the attribute and, where possible, fit with the 'SMARTA' criteria, i.e., indicators that are **s**pecific, **m**easurable, **a**chievable, **r**elevant, **t**imely, and may be **a**lready in use.

One indicator was identified for each primary attribute, based on:
- Existing data, especially reliable, nationally available data; and
- Expert Panel judgement.

Difficulties in devising measurable indicators included:

- Data availability – availability of information was a key criterion for the Expert Panel. For each attribute the indicator with the most readily available information was selected, provided it gave sufficiently accurate information to discriminate among resources. Thus, for example, soil moisture ultimately came to be represented by average annual rainfall from long term rainfall site, because long term annual PET was found to vary little across the region, and total rainfall was closely correlated to irrigation season rainfall in the case study catchments. These assessments may need to be altered for regions where there is a marked difference between summer and winter rainfall.
- Feasibility – where an indicator was identified but it was not feasible to collect information, the panel tended to go to Expert Panel assessment as the preferred approach. An example is the measure of socio economic benefit, for which the preferred indicator was differences in land value with and without irrigation. It was decided however that this information would be too difficult to collect and so the panel went for expert assessment as the selected indicator. Similar reasons led to expert assessment for feasibility of abstraction, feasibility of storage, and receiving environment impacts.
- The receiving environment attribute is an expert assessment of the likely environmental effects of applying irrigation, with 1 being low risk and 5 being high risk. The panel attempted to use a 1 – 3 ranking that would then translate directly to the threshold score, but found that they needed a wider range of scoring options.
- The issue of whether or not the assessment used a *de novo* approach (see step 6), was found to be important when considering the availability of storage. The attribute was agreed as 'technically feasible storage'. However, in the Canterbury case study there are two major rivers with water conservation orders that prohibit damming of the main stems, as well as regional policies that mean that development of storages on the main stems are not realistic options. The panel concluded that in this case, their approach would be to exclude feasible storage options that were clearly unlikely to be considered possible to consent. This is consistent with the Canterbury Strategic Water Study stage 3 approach to evaluating water storage options across the region.

An assessment of the indicators using the SMARTA criteria is given in Appendix 9A-2.

9.3.5 *Step 5: Determining Indicator Thresholds*

Once the values had been determined, the next step was for the panel to set 'break points' for each indicator for categories of high, medium and low (High importance = 3; Medium importance = 2; Low importance = 1). These break points are known as "indicator thresholds" and are applied to an indicator to determine high, medium and low relative importance for irrigation in each river. The indicator thresholds allow mathematical calculation in subsequent steps.

The thresholds were developed by the panel in an iterative fashion using the case study data. The key areas of difficulty in setting thresholds were in relation to irrigable areas, size of resource and soil moisture deficits. Because the case study region had a large range of values in two of the indicators (mean annual flow varied from less than 1 to over 300 cumecs; irrigable area from less than 1,000 to over 100,000 ha), and because nationally the range of rainfall and PET is very large, it was difficult to define points at which the significance thresholds should be implemented. It is considered likely that the lower boundary of significance may need to be adjusted for each of these to suit the region being investigated. However the upper boundaries (defining the "3" score) should remain constant because of the importance of these attributes in defining national significance, and the need therefore to retain consistency across regions.

For the 'risk to the receiving environment' attribute the rankings of 1- 5 were assigned to the threshold scores of 1 – 3:

- Rank 1 and 2 = 3 (low risk);
- Rank 3 and 4 = 2 (medium risk);
- Rank 5 = 1 (high risk).

The high, medium and low thresholds for each indicator as determined by the Expert Panel are shown below in Table 9-2.

Table 9-2
Summary of Attributes, Indicators, Thresholds and Threshold Scores for Irrigation

Attribute	Indicator (ranges are from the Canterbury case study)	Thresholds
Technical feasibility of abstraction	Expert ranking (range 1 - 3)	Direct transfer (3 = 3)
Technical feasibility of storage	Expert ranking (range 1 - 3)	Direct transfer (3 = 3)
Reliability (ROR)	MALF/Mean annual flow as % (range: 4% - 72%)	>40% = 3 >20% = 2 <20% = 1
Reliability (Storage)	Annual volume million m^3 (range: 32 - 11,000)	> 3000 = 3 >=100 and <= 3,000 = 2 <100 = 1
Size of resource	Mean annual flow cumecs (range 1 - 370)	>70 = 3 > 5 = 2 <= 5 = 1
Soil moisture deficit	Annual average rainfall over irrigable area (mm at nearest long term rainfall site; range: 500 – 1,200 mm)	<=1,200 = 3 > 1,200 = 2 >1,700 = 1
Irrigable area	Irrigable area ha (range 1,000 - 270,000)	> 100,000 ha = 3 > 5,000 ha = 2 <= 5,000 = 1
Receiving environment	Rank 1 - 5 with 1 being low risk and 5 being high risk (expert assessment)	Rank 1 and 2 = 3 Rank 3 and 4 = 2 Rank 5 = 1
Alternative supply	Bypass solution[1]: Ranking using % (based on groundwater availability maps from Lincoln Environmental 2000 for CSWS)	<=30% = 3 > 30% = 2 > 60% = 1
Socio economic benefit	Expert Ranking from 1 (low) to 3 (high)	Direct transfer (3 = 3)

[1] Bypass solution: where a proportion of the irrigable area can be supplied from groundwater this is considered to reduce the demand for supply from the river, i.e., little groundwater available gives the river a 'high' score (3).

9.3.6 *Step 6: Applying Indicators and Indicator Thresholds*

Most indicators were assessed using objective and quantitative data - this step involved entering data from the relevant data sources. Data were kept in their original format where possible (e.g., irrigable area). This assisted the Expert Panel when evaluating the data, and helps achieve process transparency.

Outcome

Applications of thresholds are given in Appendix 10A-2.

9.3.7 *Step 7: Weighting the Primary Attributes*

The indicators and their thresholds were applied to case study data for Canterbury during the by the Expert Panel in order to categorise the rivers in the region according to their significance for irrigation. The approach to categorisation can involve some relative weighting of different attributes, depending on their relative importance, and in the case of irrigation, weightings were applied.

The RiVAS is intended to be applied to rivers *'de novo',* i.e., without planning or regulatory constraints because at least in theory, rules and regulations can be changed. However, after considerable discussion the Expert Panel concluded that for the RiVAS to be practical, it was appropriate to partly take into account the existing situation. For the Canterbury case study examples of existing constraints to irrigation that were acknowledged included: water conservation orders on the Rakaia, Rangitata and Ahuriri Rivers, regional policies and rules precluding damming of main stems of major rivers and urban development in the Avon River catchment. This situation may be different for other regions.

A simple aggregation of the scores for each attribute did not provide sufficient discrimination amongst rivers in the case study region. The lack of discrimination was exacerbated by the narrowness of the 1 – 3 range, and the interdependence of some variables.

The scoring range of 1 – 3 was very narrow in the context of a region like Canterbury, where the rivers differ in a major way from very large alpine rivers to small, groundwater streams. This resulted in rivers with substantially different characteristics being given the RiVAS score. However it is accepted that the 1 – 3 range increased the ease of undertaking the analysis, and the weighting criteria and expert input in individual cases were used to partially offset the narrowness of the range.

There were some further problems with aggregation because not all attributes were independent. An example would be those attributes affected by the nature of the resource (reliability, size and storage). This again reduces the ability of a simple aggregation to discriminate, and reinforced he need for weighting of scores.

For these reasons the panel agreed that some weightings were required as some indicators were of lesser importance than others for determining the significance of a particular river for irrigation.

Where a significant soil moisture deficit is indicated, a weighting is applied to emphasise both the size of the resource from a supply perspective, and size of the irrigated area from a demand perspective. The weighting selected is that when the soil moisture deficit threshold for a river is two (medium) or three (high), then the threshold scores for both size of resource and irrigated areas are weighted to power of three. For all rivers, the key secondary attributes of soil moisture deficit, reliability and presence of an alternative supply are all weighted +50%. The other attributes were not weighted. Table 9-3 summarises the weightings.

Table 9-3
Primary Attributes and Weightings

Primary Attribute	Weighting
Supply Attributes	
Technical feasibility of abstraction	Not weighted
Technical feasibility of storage	Not weighted
Reliability (Run of River)	Weighted + 50%
Reliability (Storage)	Not weighted
Size of resource	Weighted to the power of 3 where a soil moisture deficit is present, i.e., score = 2 or 3
Demand Attributes	
Soil moisture deficit	Weighted + 50%
Irrigable area	Weighted to the power of 3 where a soil moisture deficit is present, i.e., score = 2 or 3
Receiving environment	Not weighted
Alternative supply	Weighted + 50%
Socio economic benefit	Not weighted

9.3.8 *Step 8: Determining the River Significance*

There are two parts to determining the river significance: ranking the rivers, and then identifying the river as nationally, regionally or locally significant.

The total weighted scores developed in step 7 were used to order the rivers according to their value for irrigation. The significance rankings for Canterbury rivers, using the case study data, are shown in Appendix 9A-3.

The panel then developed criteria to categorise rivers according to their national, regional and local significance. To determine the level of significance of each river a combination of trigger attributes, predictor attributes or aggregates of attributes can be used, as set out in Hughey et al. (herein). To determine national, regional or local significance for irrigation three 'trigger' attributes were selected: size of water resource, potentially irrigable area and soil moisture deficit.

- *National significance* is defined by the combined presence of a large water resource (>70 cumecs; i.e., Score = 3), a large potentially irrigated area (>100,000 ha; i.e., Score = 3), and a soil moisture deficit (Score >=2).
- *Local significance* is defined by the presence of either a small resource (< 5 cumecs; i.e., Score = 1), a small irrigated area (<5000 ha; i.e., Score = 1) or no significant soil moisture deficit (Score = 1).
- The remaining rivers not defined as nationally or locally significant are, by default, *regionally significant*.

This ranking approach reflects the fact that while there are other significant issues for suitability of a resource for irrigation, there is potential to manage these other issues - for example reliability can be modified by storage. However the absence of water and irrigable land cannot be changed. We therefore consider that these should be the major drivers of determining the significance of the resource for irrigated agriculture.

9.3.9 *Step 9: Other Factors relevant to the Assessment of Significance*

In this phase the panel considered whether the methodology has appropriately reflected the importance of the different river systems in the case study. In particular, it considered whether there are any of the attributes of the irrigation values which cannot be captured adequately by quantified indicators, and whether these should be included in the final consideration.

The key concerns of the panel relate to consentability, defining potentially irrigable areas and storage:

- While it is understood that it is intended that the assessment should be undertaken as a *de novo* exercise, in practice the status of a resource in a region pertains to the availability of other resources. Thus if a more desirable irrigation resource is not available for reasons of difficulties in the consentability of abstraction, then the status of other more consentable resources in the vicinity become higher. Because it is clear there are some resources which are likely to be considered so iconic that they cannot be used for any significant abstraction, the ranking of other resources is potentially affected. For this reason, the panel considers it appropriate that some expert judgement should be applied to the value of some resources for irrigation purposes to reflect both its expected consentability, and the likely availability of other resources in the region.
- It is difficult to define the areas potentially irrigated from a particular river for regions, such as Canterbury, where water can be moved from catchment to catchment. In this case study we applied some expert assessment in defining the irrigated area for a specific resource. We consider it likely that this will need to be done in other regions where cross catchment transfer is possible.
- Storage has the potential to completely modify the profile of a resource from an irrigation point of view. In concept, most rivers have some potential for storage, but in practice the availability will depend on cost and on consentability. The approach for Canterbury drew heavily on the Canterbury Strategic Water Study, which had undertaken a detailed assessment of potential storage sites. In many regions this work may not have been undertaken, and it may be difficult to make an informed assessment of the suitability of rivers for storage. Because storage is generally considered in the context of a scheme approach to irrigation, it is likely that the suitability of a specific site for storage is less important that the availability of some storage in the vicinity. This grading of a resource for this attribute will therefore need to be considered carefully; and again some judicious expert assessment undertaken.

9.3.10 *Step 10: Reviewing Assessment Process and Identifying Future Information Requirements*

The panel considered the adequacy of the approach overall, and whether adequate information is available to allow it to make an appropriate assessment. In our view the approach worked satisfactorily for the purposes of assessing resources from an irrigation perspective. The panel had some unresolved concerns about the consentability issue and the extent to which the assessment should be *de novo* or include practical realities of some resources not being available for irrigation. There were also some significant difficulties in resolving storage and irrigated areas. However the final chosen methodology, relying as heavily as it does on irrigated areas and the size of the resource for rankings, should be reasonably resilient to decisions made about other attributes.

The rankings resulting from the Canterbury case study did not provide any surprises for the Expert Panel, and would be those anticipated by informed professionals. It is unlikely, therefore, that the RiVAS would add value for professionals who are experienced in water resources/irrigation development and associated planning and regulatory constraints. The value of the approach may be more apparent when irrigation is considered alongside other 'river values' (salmonid fishing, kayaking, etc.), as it could assist in providing a comparative understanding of potential resource allocation issues.

Future key information requirements that would assist other regions in undertaking this assessment include:

- Seasonal soil moisture deficit maps;
- Seasonal information on rainfall and river flows, particularly 5 year low volumes;
- Mapping of groundwater availability; and
- Potential storage sites related to each river resource.

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Appendix 9A-1
Expert Panel Members and Peer Reviewer

Expert Panel
Terry Heiler is a water resources research and engineering specialist and at the time of the work (2009) was CEO Irrigation New Zealand.

Murray Doak is a Senior Policy Analyst, Natural Resources Group, MAF, with considerable experience in irrigation economics and policy.

Simon Harris, Harris Consulting, is a consultant in resource economics and public policy analysis – he has done much recent work on irrigation scheme proposals.

Claire Mulcock is a resource management consultant and hydrologist with much experience of working with farmers and with irrigation scheme proposals.

Advisors
Ken Hughey

Linda Weastall, Principal Planning Advisor, Environment Canterbury – Linda contributed to development of the attributes and indicators, but did not participate in the Canterbury case study.

Peer reviewer
Dr Nick Brown is an economist specialising in resource economics, national and regional impact analyses, regional economics, cost-benefit analysis and development economics, including involvement in irrigation related work.

Appendix 9A-2
Assessment of indicators by SMARTA criteria

Attribute	Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use	Strengths and Weaknesses
Technical feasibility of abstraction	Expert ranking (range 1 - 3)	Yes	Can be assessed from geomorphic data	Can be determined	Influences likelihood of irrigation	Expert assessments practical	Yes	Difficult to assess, and varies by river reach. However important in overall usability of resource
Technical feasibility of storage	Expert ranking (range 1 - 3)	Yes	Can be assessed	Assessments of storage options may be available	Shows whether storage is feasible / likely	Expert assessments practical	Yes	Difficult to assess as site dependent. Problems with de novo approach because of policies preventing dams
Reliability (Run of River)	MALF/Mean annual flow as %	Yes	Yes, or natural flows calculated	Long term records or estimates	Shows how often flows are available for irrigation	Data / estimates available	Yes	Reliability if very difficult to describe fully. No indicator will do justice. However key implications for users.
Reliability (Storage)	Annual volume (million m^3)	Yes	Calculated	Can be determined	Shows whether flows are regularly available for storage	Can be calculated	Yes	Requires complex modelling to properly determine, and very dependent on river rules.
Size of resource	Mean annual flow (cumecs)	Yes	Yes, or natural flows calculated	Data or estimates available	Indicates relative amount of water for irrigation	Data available	Yes	Key indicator as availability is a direct function of size. Easily accessed.
Soil moisture deficit	Annual average rainfall over irrigable area (mm) at nearest long term rainfall site	Yes	Yes	Data available	Strongly influences irrigation demand	Data available	Yes	Key indicator, and reasonably accessible. Can vary somewhat.
Irrigable area	Irrigable area (ha)	Yes	Yes	Data available	Influences magnitude of demand	Data available	Yes	Difficult to determine because of transferability

Attribute	Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use	Strengths and Weaknesses
								of water. Key indicator for demand side.
Receiving environment	Rank 1 - 5 with 1 being low risk and 5 being high risk (expert assessment)	Yes	Assessed from a range of criteria	Can be determined	Adverse effects may constrain irrigation development	Can be estimated	Yes	Difficult to assess as determined by land use, local characteristics. May be major constraint on development potential of resource.
Alternative supply	Bypass solution: rank % of irrigable area that can be supplied	Yes	Yes	Data available	Influences magnitude of demand from river	Hard to assess in a timely manner other than by expert	Yes	Difficult to determine in case of groundwater, for both physical reasons (is there alternative water?) and whether that water will be made available.
Socio economic benefit	Expert Ranking from 1 (low) to 3 (high)	Yes	Can be assessed, but not easily	In some cases	Influence on the importance of the resource for the community	Hard to assess in a timely manner other than by expert	Yes	Hard to assess as land use can change over time. However the use of water for high value land uses has major socioeconomic implications.

Appendix 9A-3
Significance Assessment Calculations for Irrigation from Canterbury Rivers

River	Attributes and indicators											Conversion to threshold values										Ranking and scores		
	Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit		Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit	Aggregate	Ranking (weighted)	Significance
	Expert ranking (1 - 3)	Expert ranking (1 - 3)	MALF/Mean %	Annual vol m3	Mean annual flow[i] (m3/s)	Rainfall[ii] (mm)	Irrigable area (ha)[iii]	Rank 1 - 5[iv]	Bypass solution[v] %	Ranking[vi] from 1-3		3 = 3	3 = 3	>40% = 3, >20%=2,<20%=1	>3000=3, <100 = 1	>70 = 3,>5 = 2,	>1700 = 1,>1200 = 2	> 100000 = 3, > 5000 = 2 ha	Rank 5 = 1, 3 and 4 = 2, 1 and 2 = 3	> 60% = 1, > 30% = 2	Direct transfer (3 = 3)	Sum	See note below[vii]	See note below[viii]
Waitaki	3	3	53	11668	370	500	212596	2	0	2		3	3	3	3	3	3	3	3	3	2	29	81.5	National
Rakaia	2	3	43	6402	203	700	270000	2	30	2		2	3	3	3	3	3	3	3	3	2	28	80.5	National
Rangitata	2	2	42	3154	100	700	270000	2	30	2		2	2	3	3	3	3	3	3	3	2	27	79.5	National
Waimakariri	2	2	32	3784	120	700	141000	3	20	2		2	2	2	3	3	3	3	2	3	2	25	77	National
Sth Ashburton	3	3	39	347	11	700	270000	2	30	2		3	3	2	2	2	3	3	3	3	2	26	60	Regional
Waiau	3	1	26	3059	97	900	54206	1	0	2		3	1	2	3	3	3	2	3	3	2	25	59	Regional
Hurunui	3	3	30	2302	73	600	63716	3	0	2		3	3	2	2	3	3	2	2	3	2	25	59	Regional
Opihi	3	3	24	189	6	600	105012	4	10	2		3	3	2	2	2	3	3	2	3	2	25	59	Regional
Opuha	3	3	27	315	10	600	105012	4	10	2		3	3	2	2	2	3	3	2	3	2	25	59	Regional
Ashley	3	3	18	378	12	700	141000	3	10	2		3	3	1	3	2	3	3	2	3	2	25	58.5	Regional
Orari	3	2	28	347	11	600	105012	4	10	2		3	2	2	2	2	3	3	2	3	2	24	58	Regional
Nth Ashburton	2	2	32	284	9	700	270000	2	10	2		2	2	2	2	2	3	3	3	3	2	24	58	Regional
Clarence	3	1	26	2271	72	900	1653	1	0	3		3	1	2	2	3	3	1	3	3	3	24	52	Local
Hope	3	1	33	1419	45	1200	54206	1	0	1		3	1	2	2	2	3	2	3	3	1	22	38	Regional
Ahuriri	2	3	38	757	24	500	24000	4	0	1		2	3	2	2	2	3	2	2	3	1	22	38	Regional
Hakataramea	3	1	18	189	6	500	8077	2	0	1		3	1	1	2	2	3	2	3	3	1	21	36.5	Regional
Pareora	3	2	13	126	4	600	41000	2	0	2		3	2	1	2	1	3	2	3	3	2	22	31.5	Local

River	Attributes and indicators											Conversion to threshold values										Ranking and scores		
	Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit		Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit	Aggregate	Ranking (weighted)	Significance
	Expert ranking (1 - 3)	Expert ranking (1 - 3)	MALF/Mean %	Annual vol m3	Mean annual flow[i] (m3/s)	Rainfall[ii] (mm)	Irrigable area (ha)[iii]	Rank 1 - 5[iv]	Bypass solution[v] %	Ranking[vi] from 1-3		3 = 3	3 = 3	>40% = 3, >20%=2,<20%=1	>3000=3, <100 = 1	>70 = 3,>5 = 2,	>1700 = 1,>1200 = 2	> 100000 = 3, > 5000 = 2 ha	Rank 5 = 1, 3 and 4 = 2, 1 and 2 = 3	> 60% = 1, > 30% = 2	Direct transfer (3 = 3)	Sum	See note below[vii]	See note below[viii]
Selwyn	3	3	23	95	3	700	5000	5	20	2		3	3	2	1	1	3	2	1	3	2	21	31	Local
Waipara	3	2	4	95	3	600	60000	3	10	3		3	2	1	1	1	3	2	2	3	3	21	30.5	Local
Tengawai	3	2	14	126	4	600	41000	3	0	2		3	2	1	2	1	3	2	2	3	2	21	30.5	Local
Maerewhenua	3	1	22	95	3	500	74000	2	0	1		3	1	2	1	1	3	2	3	3	1	20	30	Local
Waihao	3	1	9	126	4	600	41000	4	10	2		3	1	1	2	1	3	2	2	3	2	20	29.5	Local
Cust	3	1	24	32	1	700	1000	3	20	2		3	1	2	1	1	3	1	2	3	2	19	23	Local
Okuku	3	1	14	158	5	700	1000	3	0	2		3	1	1	2	1	3	1	2	3	2	19	22.5	Local
Halswell	3	1	67	32	1	700	1000	5	100	2		3	1	3	1	1	3	1	1	1	2	17	20.5	Local
Kaituna	3	1	5	32	1	700	1000	5	80	3		3	1	1	1	1	3	1	1	1	3	16	18.5	Local
Avon	3	1	72	63	2	700	0	5	0	2		2	1	3	1	1	3	1	1	1	1	15	18.5	Local

Red coloured cells show where threshold score has been adjusted by Expert Panel
Shaded columns show the attributes that have been weighted to obtain the total score

Part B: Irrigation in Tasman District: Application of the River Values Assessment System (RiVAS)

Simon Harris

9.4 Introduction

9.4.1 *Purpose*

This section describes an application of the RiVAS Method to irrigation in Tasman District – it is the second application to irrigation.

9.4.2 *Significance Assessment Method*

The River Values Assessment System (RiVAS) aims to outline assessment criteria and significance thresholds for river values, for application within national and regional planning under the Resource Management Act (RMA). Its first application involved the development of attributes and indicators in conjunction with an Expert Panel, and then the population of those indicators with raw data for subsequent evaluation and ranking for Canterbury region. This second application briefly reassesses that work and then applies it to Tasman District using another Expert Panel (see Appendix 9B-1).

9.5 Application of the Method in the Tasman Region

9.5.1 *Defining categories for the river value and river segments*

The RiVAS enables assessments to be undertaken for categories[11] of river values or for individual river segments. No categories were identified for irrigation, and therefore the assessment for irrigation was developed with no sub-categories.

Consideration was given to segmenting rivers where there are major differences in upper and lower catchment attributes relating to irrigation. For example: one or more of: mean annual rainfall greater than 1200 mm; average slope greater than 15 degrees; altitude greater than 600 m. In the original case study because of the transportability of water, and because of the need to make the method nationally applicable, the panel decided that it was not necessary to use river segments.

In the Tasman case the group initially segmented the major rivers (Motueka, Waimea, Buller, Takaka and Aorere) into two or more reaches. However in the final ranking most of these were aggregated together to better reflect the value of the river overall, since individual segments may not have been regionally significant, but aggregated together they were. The final scores and rankings are therefore based on the river overall without segmentation (with the exception of the Wangapeka/Baton which was treated separately from the Motueka)

9.5.2 *Attributes, scoring and weighting*

The attributes are the facets of the river value that, taken collectively, describe that river value. For example, salmonid angling includes the attributes of level of use, anticipated catch rate, perceptions of scenic attractiveness, etc. The attributes, scoring and weightings developed for irrigation as per Harris and Mulcock (Part A, Herein) were used directly in the Tasman case study. These are described in Table 9-4 below.

11 **River value category**: A specific type or style of the river value. For example recreational values can be categorised into. whitewater kayaking, flatwater kayaking; wilderness fishery, lowland fishery.

Table 9-4
Summary of Attributes, Indicators, Thresholds and Threshold Scores for Irrigation

Attribute	Indicator (ranges are from the Canterbury case study)	Thresholds
Technical feasibility of abstraction	Expert ranking (range 1 - 3)	Used directly (3 = 3)
Technical feasibility of storage	Expert ranking (range 1 - 3)	Used directly (3 = 3)
Reliability (ROR)	MALF/Mean annual flow as % (range: 4% - 72%)	>40% = 3 >20% = 2 <20% = 1
Reliability (Storage)	Annual volume million m^3 (range: 32 - 11,000)	> 3000 = 3 >=100 and <= 3,000 = 2 <100 = 1
Size of resource	Mean annual flow cumecs (range 1 - 370)	>70 = 3 > 5 = 2 <= 5 = 1
Soil moisture deficit	Annual average rainfall over irrigable area (mm at nearest long term rainfall site; range: 500 – 1,200 mm)	<=1,200 = 3 > 1,200 = 2 >1,700 = 1
Irrigable area	Irrigable area ha (range 1,000 - 270,000)	> 100,000 ha = 3 > 5,000 ha = 2 <= 5,000 = 1
Receiving environment	Rank 1 - 5 with 1 being low risk and 5 being high risk (expert assessment)	Rank 1 and 2 = 3 Rank 3 and 4 = 2 Rank 5 = 1
Alternative supply	Bypass solution[1]: Ranking using % (based on groundwater availability maps from Lincoln Environmental 2000 for CSWS)	<=30% = 3 > 30% = 2 > 60% = 1
Socio economic benefit	Expert Ranking from 1 (low) to 3 (high)	Used directly (3 = 3)

[1] Alternative supply: where a proportion of the irrigable area can be supplied from groundwater this is considered to reduce the demand for supply from the river, i.e., little groundwater available gives the river a 'high' score (3).

The indicators were weighted in order to reflect the importance of that indicator in determining the significance of a river for irrigation. Where a significant soil moisture deficit is indicated, a weighting is applied to emphasise both the size of the resource from a supply perspective, and size of the irrigated area from a demand perspective. The weighting selected is that when the soil moisture deficit threshold for a river is two (medium) or three (high), then the threshold scores for both size of resource and irrigated areas are weighted to power of three. For all rivers, the key secondary attributes of soil moisture deficit, reliability and presence of an alternative supply are all weighted +50%. The other attributes were not weighted. Table 9-5 summarises the weightings.

Table 9-5
Primary attributes and weightings

Primary Attribute	Weighting
Supply Attributes	
Technical feasibility of abstraction	Not weighted
Technical feasibility of storage	Not weighted
Reliability (Run of River)	Weighted + 50%
Reliability (Storage)	Not weighted
Size of resource	Weighted to the power of 3 where a soil moisture deficit is present, i.e., score = 2 or 3
Demand Attributes	
Soil moisture deficit	Weighted + 50%
Irrigable area	Weighted to the power of 3 where a soil moisture deficit is present, i.e., score = 2 or 3
Receiving environment	Not weighted
Alternative supply	Weighted + 50%
Socio economic benefit	Not weighted

The total weighted scores developed in step 7 are then used to order the rivers according to their value for irrigation. To determine national, regional or local significance for irrigation three 'trigger' attributes are applied: size of water resource, potentially irrigable area and soil moisture deficit.

- *National significance* is defined by the combined presence of a large water resource (>70 cumecs; i.e., Score = 3), a large potentially irrigated area (>100,000 ha; i.e., Score = 3), and a soil moisture deficit (Score >=2).
- *Local significance* is defined by the presence of either a small resource (< 5 cumecs; i.e., Score = 1), a small irrigated area (<5000 ha; i.e., Score = 1) or no significant soil moisture deficit (Score = 1).
- The remaining rivers not defined as nationally or locally significant are, by default, *regionally significant*.

This ranking approach reflects the fact that while there are other significant issues for suitability of a resource for irrigation, there is potential to manage these other issues - for example reliability can be modified by storage. However the absence of water and irrigable land cannot be changed. It is appropriate that these are the major drivers of determining the significance of the resource for irrigated agriculture.

9.6 **Application to Tasman**

The scores for each attribute are shown in Appendix 9B-2 and the rankings generated using the river. Because the rainfall profile in the Tasman district differs from that of the Canterbury region where the method was developed, it was considered necessary to manually adjust the scores in the soil moisture deficit category to better reflect the prevalence of summer drought in the Aorere catchment.

The method defines the Buller, Waimea, Motueka, Takaka, and Aorere as having regionally significant values from an irrigation perspective. Of these the Buller is perhaps something of a surprise, because irrigation is not generally considered for this area. However it is noted that in this area the amount of rainfall in the valleys, the size of the river resource and area of flat land suitable for irrigation all point to the potential for it to become a significant part of the region's irrigated land.

Other resources are considered local, largely because of the small size of the resource available and therefore limited area that can be supplied.

9.7 **Other Factors relevant to the Assessment of Significance in Tasman**

Consideration was also given to the need to better reflect the value of land irrigated in the Tasman district. Irrigation from the Motueka catchment in particular supports a number of very high value land uses such as horticulture, glasshouses, and vegetable production. The thresholds for the significance of the area irrigated did not adequately reflect the value of the land, even taking into account the socio-economic benefit category. This meant that the Motueka, which was on the threshold of national significance for size, did not qualify because of the smaller irrigated area. The panel suggested that this may need to be reviewed.

A further issue was raised regarding the overall significance of the value. While individual rivers in the Tasman district may only have ranked as regional significance, the value of irrigation overall in the district is probably of national significance given its role in horticultural production. The panel considered that the methodology did not adequately reflect the importance of the value overall, in addition to contribution of each river to the value.

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Appendix 9B-1
Expert Panel Members

Nigel Hayward is an Irrigator

Evan Baigent is an Irrigator

Richard Inglis is an Irrigator

Joseph Thomas is a Hydrologist with Tasman District Council

Simon Harris – see Part A, Appendix 9A-1

John Bealy is a Consultant

Appendix 9B-2
Significance Assessment Calculations for Irrigation from Tasman Rivers

River	Attributes and indicators											Conversion to threshold values										Ranking and scores		
	Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic		Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic	Aggregate	Ranking (weighted)	Significance
	Expert ranking (1 - 3)	Expert ranking (1 - 3)	MALF/Mean %	Annual vol (M m3)	Mean annual flow[ix] (m3/s)	Rainfall[x] (mm)	Irrigable area (ha)[xi]	Rank 1 - 5[xii]	Alternative supply[xiii] %	Ranking[xiv] from 1- 3		3 = 3	3 = 3	>40% = 3, >20%=2,<20%=	>3000=3, <100 = 1	>70 = 3,>5 = 2,	>1700 = 1,>1200 = 2	> 100000 = 3, > 5000 = 2 ha	Rank 5 = 1, 3 and 4 = 2, 1 and 2 = 3	> 60% = 1, > 30% = 2	Direct transfer (3 = 3)	Sum	See note below[xv]	See note below[xvi]
Buller	3	2	29%	2334	74	1300	9666	5	10%	2		3	2	1	3	3	2	2	1	3	2	22	55	Regional
Waimea	3	3	12%	504	16	1000	13400	2	10%	3		3	3	1	3	2	3	2	3	3	3	26	41.5	Regional
Motueka	3	2	18%	1798	57	1200	29520	4	10%	3		3	2	1	3	2	3	2	2	3	3	23	39.5	Regional
Takaka	3	2	15%	978	31	1500	12500	2	10%	3		3	2	1	3	2	2	2	3	3	3	24	39	Regional
Aorere	3	2	18%	2,173	68.9	2200	9800	3	10%	2		3	2	1	3	2	2	2	2	3	2	22	37	Regional
Moutere	1	3	10%	44	1.4	1100	5660	2	50%	3		1	3	1	1	1	3	2	3	2	3	20	29	Local
Maruia	3	3	34%	1,829	58	2500	10140	1	10%	2		3	3	1	3	2	1	2	3	3	2	23	27.5	Local
Maitai	3	3	14%	44	1.4	900	150	3	10%	3		3	3	1	1	1	3	1	2	3	3	21	24.5	Local
Motueka	3	1	19%	693	22	2000	4200	4	10%	2		3	1	1	3	2	1	1	2	3	2	19	23	Local
Eastern Golden Bay/Clifton/Marahau	2	1		9	0.3	2200	500	1	10%	3		2	1	1	3	1	1	1	3	3	3	19	22.5	Local
Motupipi	3	1		31	1	1500	300	3	10%	2		3	1	1	3	1	2	1	2	3	2	19	22	Local
West Coast rivers	1	3	19%	145	4.6	1750	1262	1	10%	1		1	3	1	3	1	1	1	3	3	1	18	21.5	Local
Minor north west rivers	3	1	18%	31	1	2500	640	1	10%	1		3	1	1	3	1	1	1	3	3	1	18	21.5	Local
Minor Aorere-Takaka	2	1	18%	12	0.4	2500	1000	2	10%	2		2	1	1	3	1	1	1	3	3	2	18	21.5	Local

Red coloured cells show where threshold score has been adjusted by Expert Panel

Shaded columns show the attributes that have been weighted to obtain the total score

Chapter 10
Native Birdlife

Preamble

The Canterbury Region was chosen for application of the RiVAS method to native birdlife. The choice was obvious – the braided rivers of Canterbury are internationally significant for their importance to native birds; there has been much previous work on comparative ranking systems; and, research and management staff, in both the Department of Conservation and Environment Canterbury, were supportive. The second application, in Tasman District, was relatively straightforward with no changes required to the initial application – both are now presented respectively as parts A and B of this chapter.

Part A: Native Birdlife: Application of the River significance assessment method to the Canterbury region

Ken Hughey (Lincoln University)
Colin O'Donnell (Department of Conservation)
Frances Schmechel (Environment Canterbury)
Andrew Grant (Department of Conservation)

Peer reviewed by:
Paul Sagar (NIWA) and Murray Williams (Victoria University)

10.1 Purpose

Regional councils are faced with the task of identifying water bodies of importance in their region – there is no objective method for undertaking this evaluation. As part of developing a 'tool' to achieve this task, this section applies the method for significance assessment[12] outlined in a companion report, *A significance assessment method for river values* (Hughey et al., Chapter 3, herein), to birdlife. Its purpose is to:

- Provide a case study of how to apply the method to birdlife in the rivers of the Canterbury region;
- Provide a tool to enable regional councils, and others, to evaluate the value of their rivers to birdlife.

10.2 Preparatory step: Establish an Expert Panel and identify peer reviewers

The Expert Panel for the birdlife trial in the Canterbury region comprised Ken Hughey, Colin O'Donnell, Frances Schmechel and Andrew Grant. Peer reviewers were Murray Williams and Paul Sagar. Ken Hughey managed the case study.

Credentials of the Expert Panel and peer reviewers are provided in Appendix 10A-1.

12 This tool was developed under FRST Envirolink funding and involves development of a method that enables regional and district councils to prioritise, in terms of national, regional and local importance, the various values of rivers in their region.

10.3 Application of the method

10.3.1 *Step 1: Define river value categories and river segments*

River value categories

There is a distinction, typically, between the birdlife of braided rivers and that of single channel rivers. The former is typified by a community of birds that includes gulls and terns, waders, shags and a variety of waterfowl – multiple species are considered 'threatened or at risk'[13]; the latter is typified by waterfowl and shags with far fewer species threatened or at risk, Despite this distinction it is proposed to treat all rivers primarily in the same way, except where distinctive indicators for the prime attributes (see steps 3 and 4 below) can be identified and used appropriately.

River segments

Work in advance of the Expert Panel meetings to collate existing data, identified that the multiple riverbed bird surveys, organised primarily by the Department of Conservation[14], but also by Environment Canterbury on occasions, would be the primary data source. The surveys span almost all rivers in Canterbury considered of significant value to birdlife (but see also the following two paragraphs). A few rivers considered of potentially significant value to birdlife have not been formally surveyed, but are included where the Expert Panel had sufficient information to warrant such inclusion (e.g., the Avon and Selwyn). For the purposes of this analysis, we generally consider catchments as a whole (except the Waitaki because of its large geographic separation between upper (and the main rivers therein) and lower catchments, due to hydroelectric power development. Thus, in the Waitaki case we have identified and separately evaluated both upper and lower sections, and then we have separately listed and evaluated the major tributaries of the upper Waitaki. We consider that for a river of the geographic scale of the Waitaki, this approach has merit and for completeness have included both categorisations.

Following a preliminary scanning exercise many rivers within the Canterbury region were excluded from further assessment. Criteria considered as part of this preliminary scanning were that the river or stream has:

- No known or suspected presence of breeding threatened or at risk species;
- A very small amount of habitat (e.g., less than 50ha for a braided river or less than 3km for a single channel river) of very low quality;
- Very low numbers (e.g., less than 100 and no breeding 'threatened or at risk' species) of native riverine birds; and/or
- Little or no flow at critical times, e.g., during the breeding season.

Examples of these rivers or streams include most of the streams of Banks Peninsula, and many other streams along the Canterbury and Kaikoura coastline (e.g., Kowhai). This still left some streams of potentially significant value to birdlife but currently data deficient, and therefore subject to consideration when data becomes available, e.g., the Halswell where breeding of southern crested grebe is suspected and which has been included in the evaluation. The system is designed to provide for updating and a plan for surveying and evaluating likely rivers and streams should be developed and implemented accordingly in all regions.

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13 This phrase is used here as an all encompassing term for the range of bird species defined to be, and listed as, at some conservation management risk in New Zealand, as listed in Miskelly et al. (2008). We use this listing of species as appropriate for the purposes of this report.

14 Note that there are also occasional surveys undertaken by individuals, consultants and NGOs (e.g., community groups, Forest and Bird, the Ornithological Society of NZ).

River mouths, estuaries, lagoons, etc., considered integral/seamless parts of a river with a significant birdlife value, are typically included within that river's assessment, e.g., the Rakaia, Hurunui and Ashburton lagoons. However, where they are somewhat separate from a river's main birdlife values, e.g., Brooklands Lagoon on the Waimakariri and Milford Lagoon on the Opihi, then they have been excluded from this evaluation (and notably are not included in surveys of such rivers). Estuaries or lagoons with high birdlife values, e.g., Te Waihora/Lake Ellesmere and Avon-Heathcote Estuary are also not evaluated. A separate evaluation of all lagoons, estuaries, etc., is required.

Other considerations

The Expert Panel noted that the Freshwater Environments of New Zealand database developed by the Department of Conservation, and other initiatives provide a basis for finer scale rankings for other purposes. However, they also noted that a ranking based first at the river scale provides later scope for subsequent finer scale rankings – this argument is based partly on the desire to express connectivity at the catchment scale, and partly for pragmatic reasons.

It was also noted that while many bird surveys of rivers have been undertaken they are often characterised by:

- Only partial river coverage, even for nationally important rivers like the Rakaia;
- Differences between methods used;
- Large temporal gaps between surveys, or surveys undertaken some decades ago.

Given the need to use the 'best available information' it was decided that such data would still be used but that particular caveats around the source, reliability and other issues would be noted in the contents of the supporting decision making spreadsheet (Appendix 10A-4) where appropriate.

Related to the above, an important feature of many surveys and much evidence presented in hearings is associated with total bird numbers of a river. We note the imprecision of the survey data, but again reiterate it is the best available information. Note the following:

- On some rivers with only partial survey coverage, e.g., the Rakaia, the value is so high that a full river survey is not considered necessary, but would be desirable to fill an information gap;
- On some other rivers, e.g., the Ashley, on-going surveys are only over a small (c.<10%) part of the river and should be used cautiously when interpolating for overall river value;
- Some species are particularly difficult to find, e.g., crake and bittern, and until a reliable survey method is found, are excluded from this analysis. Equally, threatened and at risk species such as grey duck are present, but difficult to identify correctly – they too are excluded from that part of the analysis dealing with threatened and at risk species. At least one other species identified as 'threatened or at risk', i.e., NZ pipit, is not considered as it is mostly not recorded (for some unknown reason) in surveys.

A potentially larger issue is the influence that southern black-backed gulls (*Larus dominicanus*) have, on occasions, as a significant predator of threatened and at risk bird species, particularly where they comprise a large proportion of total bird numbers on some rivers, e.g., the Waimakariri. We recognise that Maori consider this a taonga species (see: Te Rūnanga o Ngāi Tahu. 2005. Te Waihora Joint Management Plan. Te Rūnanga o Ngāi Tahu and Department of Conservation, Christchurch), but we note that numbers now are sometimes extremely large (in the order of many thousands - as a result of the scavenging and opportunistic nature of this species and the large increase in resources available to it, largely as a result of agricultural practices). Consequently, the species is now considered a threat to some key bird species on some (e.g., the Waimakariri) braided rivers. While we recognise the taonga value we have decided to exclude the species from total native birdlife counts presented in this evaluation.

Outcomes

Treat birdlife as one river value (no separate categories for braided river vs. single channel river species).

Use whole catchments as the primary data set and populate with existing river bird survey data and/or Expert Panel considerations.

Present data for native bird species counts without southern black-backed gulls.

Ignore the presence of swamp species such as bittern and marsh crake until reliable survey data become available.

Do not include NZ pipit until routinely required within the standard survey method, and then record appropriately.

10.3.2 ***Step 2: Identify attributes***

Attributes, i.e., the facets of the birdlife river value. Taken collectively, attributes *describe* the river value. For example, salmonid angling includes the attributes of level of use, anticipated catch rate, and perceptions of scenic attractiveness. Attributes which describe birdlife were based initially on O'Donnell, C.F.J. 2000. (The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand. Environment Canterbury Unpublished Report U00/37. Environment Canterbury, Christchurch). A workshop of key ECan and DoC staff on 4 June 2009, including the report authors, subsequently refined these attributes.

Attributes for birdlife encompass only one (environmental) of the four well-beings defined in the Local Government Act 2002. However, cultural attributes are also relevant for birdlife and further discussion is needed on how this might be addressed, or if iwi values for rivers should be expressed separately to all others (Tipa, herein). Social attributes, e.g., recreational hunting, are also relevant but were not considered as important for this evaluation as environmental and were thus excluded. Economic aspects, perhaps associated with bird watching-based tourism, have little data and also are not considered.

Outcome

A list of all attributes is provided in Appendix 10A-2.

10.3.3 ***Step 3: Select and describe primary attributes***

From the list of attributes outlined in Step 2, primary attributes were selected to *represent* birdlife. Selection was based on:

1. The need for pragmatism – only six attributes were identified, but these were considered to be the most important and to describe most of the variation around relative importance;
2. Research literature on the attributes identified by O'Donnell (2000) is important. In addition, the opinion of Expert Panel members about the contribution of attributes to an understanding of birdlife was used.; and
3. Consideration was not given to the availability of existing data, as later steps account for data deficiency (via the Expert Panel) and provide for input into future research needs (to overcome future data deficiencies).

Outcome

Appendix 10A-2 identifies the six primary attributes (in bold) and describes them, with emphasis on explanation of the attribute's validity and reliability as a representative measure of birdlife on rivers.

10.3.4 *Step 4: Identify indicators*

One indicator, generally, for each primary attribute was identified, using SMARTA (Specific, Measurable, Achievable, Relevant, Timely, Already in use – see for example Hughey and Coleman 2007) criteria, based on:

1. Existing data – for birdlife, there is a wealth of appropriate if not always (due to data issues already described) fit-for-use-now data;
2. Expert Panel judgment – especially required for bird numbers, which is relevant to several attributes and their indicators.

Appendix 10A-3 shows the assessment of each indicator against the SMARTA criteria.

No primary attributes were omitted owing to difficulty in devising measurable indicators. Data deficiencies are outlined in Step 10.

Each indicator was considered carefully, and three were subject to considerable debate:

(a) The question of habitat distinctiveness within a national and regional context was raised by one of the peer reviewers – it was his view that we might potentially be double counting, i.e., a highly distinctive habitat might also be one that also has very high diversity, numbers, etc? While this point is accepted in part we are of the view that for this sort of method there will frequently be some similarity in measures, but that this should not prevent us from including them in the final analysis. Ultimately there is a limit on the number of attributes and every attempt is made to define separation, where possible.

(b) Evaluation of numbers of birds poses a real challenge, for several reasons. First, some rivers like the Rakaia have never been fully surveyed and recent surveys have covered only a small part of the river. We know from other work and panel member experience that the river holds very large numbers of some key species, e.g., likely greater than 30% of the wrybill population (see Appendix 10A-2), and these are not well covered by the surveys. We also know that the survey methodology leads to highly variable counts (see for example Brown and Robinson 2009) as some species, e.g., wrybill, are very difficult to find, and others are prone to double counting, or may be off-river during the survey, e.g., black-fronted tern. It was proposed that rather than considering the absolute survey numbers we convert the number to an index of numbers per kilometre of river surveyed. We tried this index approach but it too is flawed, e.g., river width can vary hugely and many braided rivers include relatively short single channel gorge sections which distort the results. Finally, we decided to remain with survey numbers as an index of abundance and to adjust where necessary based on our expert judgement.

(c) Some rivers, by their very nature, contain far more species and guilds of species than others, e.g., wide braided rivers c.f. narrow single channel rivers. It was argued that this distinction gave an 'unfair' advantage to braided rivers and that rather we should develop an index of observed vs. expected species or guild presence depending on river type. We gave this suggestion considerable thought and acknowledge that it may be a useful future development of the ranking system, but that it would require considerable further research before it could be adopted. We further considered that the 'unfair' advantage is really, simply, an indication of why braided rivers are often relatively more important for birdlife c.f. single-channel rivers, and thus we retained the guild presence or absence indicator.

(d) Discussion about threatened or at risk species included consideration of both *number of such species* and *strongholds (i.e., a significant proportion of the total population) for species*:

1. Was it appropriate to combine the two indicators into one, which was our initial starting point? or
2. Should there be two separate indicators because both diversity and stronghold are important for threatened and at risk species?

Ultimately we came to the view there should be two separate indicators given the importance of signalling the relative significance that threatened and at-risk species management poses, for example with respect to the New Zealand Biodiversity Strategy (DoC and MfE 2000).

Outcome

Indicators are listed in Appendix 10A-2 and assessed against SMARTA criteria in Appendix 10A-3.

10.3.5 ***Step 5: Determine indicator thresholds***

Thresholds are applied to an indicator to determine high, medium and low relative importance for that indicator. Thresholds are defined by real data (e.g., for recreational fishing <1,000 angler days per annum = relatively low importance, or Expert Panel judgements) for each indicator and were identified by the Expert Panel. Because birdlife is comparatively data rich (c.f. some other river values), this step was informed by 'hard' data for five of the six indicators.

Consideration was given to the meaning of the thresholds. For example:
For the attribute, *amount of habitat*, the indicator relied upon two measures depending on river and bird type, e.g., if predominantly a braided river then the measure was area, conversely if predominantly a single channel river then the measure was distance. In both cases we needed the thresholds to reflect an either/or set of thresholds that covered both area and distance. In this case the driver for distance criteria was the mean home range distance for blue duck pairs (1.5km)[15] – thus the minimum needed to score a '1' was the approximate distance needed to support 4-7 breeding pairs, i.e., 6 to ca.10km of river length.

Outcome

Thresholds are identified in Appendix 10A-2.

10.3.6 ***Step 6: Apply indicators and indicator thresholds***

Most indicators were assessed using objective and quantitative survey data - this step involved entering data from the relevant data sources (primarily the riverbed bird surveys). Data were kept in their original format (e.g., *actual area* of habitat, *number* of birds). This assisted the Expert Panel when evaluating the data, and helps achieve process transparency.

Outcome

Applications of thresholds are given in Appendix 10A-2.

10.3.7 ***Step 7: Weighting of primary attributes***

The Expert Panel reviewed the six primary attributes and considered whether some made a relatively greater contribution to birdlife as a whole. Initial thoughts were that they made an equal contribution. The decision was reached to keep weightings equal.

Considerations in choosing equal weights were:
1. Testing various weighting sets showed no fundamental difference in river ranking;

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15 Note that while blue duck is not a species widely abundant in Canterbury it is nevertheless extremely important nationally and is arguably the most significant of the single channel species. For this reason, and ultimately therefore for the national level application of the method, we have chosen to report this species for this criterion and associated threshold.

2. Applying weighting to attribute(s) potentially introduced spurious accuracy;
3. It reinforced the importance of selecting appropriate primary attributes earlier in the process; and
4. Any concern that endangered species are not being appropriately considered is dealt with already by having two 'related' measures regarding this attribute.

Outcome

Equal weighting
As a consequence of this decision it was decided to introduce a 'species stronghold' criterion into the decision support system for defining priorities, i.e., if a river contains 5% or more of a population of a threatened or at-risk species then it is of national importance – such a criterion is consistent with decisions made for national water conservation orders.

10.3.8 *Step 8: Determine river significance*

Step 8a: Rank rivers

The spreadsheet in Appendix 10A-4 was used to sum the indicator threshold scores for each river. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. This provided the list of rivers ranked by their significance scores.

Step 8b: Identify river significance

Using the ranked list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores. It was noted that a strong correlation existed between birdlife and rivers which scored a 3 (high) for the indicator *Number of 'threatened or at risk' species present*. Intuitively this made sense – a high number of such species is likely to be indicative of relatively high scores in many other attributes as well. It was also noted that the final indicator, relating to stronghold rivers for particular species or groups of species was important. The Expert Panel was of the view that this indicator and its related attribute should be a national importance trigger. The following criteria were thus applied to defining importance within the Appendix 10A-4 evaluation:

National significance:
Criterion 1: *Species strongholds* – if any river contained one or more species with over 5% of the total population(s) then = 3, and automatic national significance. We chose 5% as this level has been used in a number of Water Conservation Order decisions as being a threshold for national importance (despite the fact that the World Conservation Union (IUCN) uses a 1% level for international significance); or
Criterion 2: total score is 15 or more then national significance.

Regional significance:
Those rivers in the table not defined as nationally or locally significant, and scoring 11-14.

Local significance:
Sole criterion: *Number of 'threatened or at risk' species present* = 0 and all other indicator columns (i.e., 1-5) are 2 or less then automatic local significance; or if the total score <11 = local significance.

Translation of these functions to rivers is shown in Appendix 10A-4.

The Expert Panel assessed the output from this process against the results of existing assessments and other relevant considerations, including:
1. Sites of Special Wildlife Interest for braided rivers in Canterbury – O'Donnell and Moore (1983);
2. Existing Water Conservation Orders associated with birdlife;

3. Existing planning documents, including Regional Plans under the RMA; and
4. Reference to MfE Waters of National Importance work.

The results of these considerations showed that this significance assessment corresponded to the most significant water bodies for birdlife identified through other processes. The current method was considered to effectively discriminate rivers having attributes favourable to birdlife.

Other assessments confirmed that, compared with a national average, a much higher proportion of Canterbury rivers is likely to be nationally significant for their birdlife, due to the region having most of New Zealand's 'unique' large braided rivers. It is acknowledged that, owing to the judgmental nature of this exercise, rivers close to the threshold points could 'swing either way'.

Finally, and as a partial test against potentially very important single channel rivers elsewhere in New Zealand we included a hypothetical, very high value 'blue duck' river in our evaluation. The river achieved a relatively low total score (12) but was considered of national importance because it contained over 5% of the total blue duck population – the system worked for this test.

Outcome

A list of rivers ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 10A-4 (columns highlighted in green).

Rivers identified as significant at the national, regional and local level. See Appendix 10A-4.

Rivers in the Canterbury Region not listed have either low value to birdlife dependent on rivers or streams.

10.3.9 *Step 9: Outline other factors relevant to the assessment of significance*

Perhaps the most telling other issue concerns the 'state' of the survey data. Braided rivers are very difficult to survey for a variety of reasons, e.g., large, expensive to survey, and prone to flooding in the breeding season (thus making it difficult to co-ordinate volunteer effort). For these and other reasons it has not been possible to survey all rivers or sections thereof fully. As a result total counts are frequently not undertaken and data presented are significant underestimates.

Outcome

Notes have been made in Appendix 10A-4 about the year of the data and the relative river coverage if appropriate.

10.3.10 *Step 10: Review assessment process and identify future information requirements*

DoC's on-going river bird surveys in Canterbury provide a rich, but incomplete, regional database which greatly assists with indicator measurement. However, some desired data are not available or are out of date. For future assessment, desired data are noted in Appendix 10A-6.

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Te Rūnanga o Ngāi Tahu. (2005). *Te Waihora Joint Management Plan*. Te Rūnanga o Ngāi Tahu and Department of Conservation, Christchurch.

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Appendix 10A-1
Credentials of the Expert Panel members and peer reviewers

The Expert Panel comprised four members. Their credentials are:
Ken Hughey is Professor Environmental Management at Lincoln University. His expert knowledge of river birdlife spans the period 1981-2009, including his PhD thesis (habitat needs of birds of braided rivers), multiple river bird surveys in almost all regions of the South Island, expert evidence at multiple hearings and published research papers (e.g., Hughey 1997, 1998, Duncan et al., 2008). Ken is overall project manager of the river values project. Selected references:

Duncan, M.J., Hughey, K.F.D., Cochrane, C.H., Bind, J. 2008. River modelling to better manage mammalian predator access to islands in braided rivers. In: Sustainable Hydrology for the 21st Century, Proc. 10th BHS National Hydrology Symposium, Exeter. 487-492.

Hughey, K.F.D. 1997. The diet of the wrybill (*Anarynchus frontalis*) and the banded dotterel (*Charadrius bicinctus*) on two braided rivers in Canterbury, New Zealand. Notornis 44: 185-193.

Hughey, K.F.D. 1998. Nesting home range sizes of wrybill (*Anarynchus frontalis*) and banded dotterel (*Charadrius bicinctus*) in relation to braided riverbed characteristics. Notornis 45: 103-111.

Colin O'Donnell is a senior scientist with the Department of Conservation's Threatened Species Science Team. A major role is to develop, lead and undertake strategic research that is then applied to operational conservation management. He leads research programmes on the ecology and conservation of threatened species in New Zealand, particularly on forest and wetland birds and bats. He is a science adviser on national technical advisory groups focused on forest and wetland ecosystem restoration and eight national and international species recovery groups. He incorporates scientific findings into Environment Court cases, presents research findings at conferences and interprets scientific findings to produce management manuals, best practice and technical reports to support management. He has published over 120 science papers and conservation management reports.

Frances Schmechel is a Land Resources Officer (Ecology) at Environment Canterbury in Christchurch. Her experience in bird life spans the period 1992 – 2009 and includes her PhD thesis on the habitat needs and conservation management of the endangered Chatham Island oystercatcher. She authored a draft recovery plan for braided river bird species, provided expert evidence on braided river birds during hearings for a Water Conservation Order, has worked for the Black Stilt project, and coordinated and/or taken part in numerous river bird surveys in Canterbury.

Schmechel FA. 2001. Aspects of habitat selection, population dynamics, and breeding biology of the endangered Chatham Island oystercatcher (*Haematopus chathamensis*). PhD thesis, Lincoln University, Canterbury (http://hdl.handle.net/10182/1814).

Schmechel FA. 2008. Braided river bird surveys of the Waiau River and eight smaller Canterbury rivers, spring 2008. Christchurch: Environment Canterbury. Report No. R08/92.

Andrew Grant is a technical support officer with over 30 years experience, based with DoC in Christchurch. He has coordinated multiple braided river bird surveys and maintains the database for bird surveys in the Canterbury Conservancy of DoC.

Peer reviewers for this work were:

Dr Murray Williams was a waterfowl and wetlands scientist with the New Zealand Wildlife Service (1966-1987) and Department of Conservation (1987-2005) and presently teaches a postgraduate programme in restoration ecology at Victoria University. He has contributed approx. 50 papers to peer-reviewed science journals on the ecology and management of New Zealand's waterfowl (including blue ducks), chapters to international compilations on waterfowl biology (e.g., J. Kear (ed.), 2005, Ducks, geese and swans of the world) and compilations on New Zealand wetlands (e.g., W. Vant (ed.) 1987, Lake manager's handbook; J. Harding et al. (eds) 2005, Freshwaters of NZ). He has appeared as an expert witness on riverine bird ecology at tribunal and water conservation hearings, has been a technical advisor on waterfowl to FGNZ and Game Council New South Wales, and from time to time contributes peer review and evaluations on water birds and wetland management to Department of Conservation and private ecological consultancies.

Paul Sagar is a senior scientist with NIWA, Christchurch. Paul has studied wetland birdlife, has published widely in the peer reviewed literature (e.g., Sagar, P.M. 2008. Birds. Chapter in The Natural History of Canterbury 3rd ed. Winterbourne, M.J.; Burrows, C.J.; Knox, G.A.; Marsden, I.D. (eds). Canterbury University Press. Sagar, P.M.; Shankar, U.; Brown, S. 1999. Distribution and numbers of waders in New Zealand, 1983-1994. Notornis 46: 1-43. Whelan, M.B.; Hume, T.M.; Sagar, P.M.; Shankar, U.; Liefting, R. 2003. Relationship between physical characteristics of estuaries and the size and diversity of wader populations in the North Island of New Zealand. Notornis 50: 11-22. Miskelly, C.M.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Powlesland, R.G.; Robertson, H.A.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2008. Conservation status of New Zealand birds, 2008. Notornis 55: 117-135.

In addition, Paul has appeared as an expert witness at tribunal and Environment Court hearings on behalf of Environment Canterbury, Christchurch City Council, Department of Conservation, Marlborough District Council, Meridian Energy, and Kuku Mara Partnerships

Appendix 10A-2
Assessment criteria for birdlife (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (and reliability)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
Representativeness	Guild presence				
	Endemism				
	Quality of habitat				
	Distinctiveness	Measures the relative distinctiveness of the habitat type and/or bird species presence compared to others represented in New Zealand	Relative distinctiveness	1= low; 2= medium; 3= high Threshold data result from the following assessment: 1= Habitat type or species assemblage/presence widely represented elsewhere in NZ; 2= Habitat type or species assemblage/presence rarely represented elsewhere in NZ; 3= Habitat type or species assemblage/presence not represented in other regions in NZ	This is a subjective assessment based on the knowledge of the Expert Panel. As reliable as the experience and knowledge represented by the panel – in this case very high.
Life supporting capacity	**Habitat size**	Amount of Habitat - measured in area for braided rivers and distance for single channel	Objective and quantitative measures of: Area (ha) of riverbed for	For area/distance combined: 1=<5000ha and/or <10km; 2=5000-9999ha and/or 11-	Area is based on Wilson, J. 2001. National Distribution of Braided Rivers and the Extent

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (and reliability)
		rivers. Note that while some braided rivers also have single channel reaches it is the dominant habitat that is recorded.	braided rivers; Distance (km) for single channel rivers	30km; 3= >10000ha and/or >30km	of Vegetation Colonisation. Landcare Research Contract Report LC0001/068, Lincoln. Distance based on Google Map estimate.
	Numbers	Measures 'actual' numbers of native birds surveyed on the river (excluding southern black-backed gulls – see main text at section 2, step 1).	Total number for all (except Southern black-backed gull) native species recorded	1 = <1000 individuals; 2= 1000-4999 individuals; 3= >5000 individuals	Most 'significant for birdlife' NZ rivers have been subject to some survey effort but it varies greatly in spatial coverage and sometimes reliability. Where possible all survey information is referenced; otherwise Expert Panel judgement is also included.

	Foraging guilds	Provides a measure of species diversity on the river	Number of guilds present ranges from 0-8, i.e.,
			a= open-water divers;
			b= deep water waders;
			c= shallow water waders;
			d= dabbling waterfowl;
			e= torrent specialists;
			f= aerial hunting gulls and terns;
			g= swamp specialists;
			h= riparian wetland birds
				1= 1-4 = low;
				2= 5-6= medium;
				3= 7-8= high
					Guilds for wetland birds are defined in O'Donnell, C.F.J. 2000. The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand. Environment Canterbury Unpublished Report U00/37. Environment Canterbury, Christchurch.

	Feeding guilds				
	Roosting guilds				
Natural diversity	Within guilds				

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (and reliability)
	Microhabitat diversity				
	Number threatened species	Provides a measure of the diversity of threatened or at risk bird species using the river.	Actual number of species within 'threatened or at risk' conservation status categories, i.e., blue duck (BD); black stilt (BS); pied stilt (PS); wrybill (WB); banded dotterel (BDo); NZ pied oystercatcher (NZPO); black-fronted tern (B-FT); black-billed gull (B-BG); white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); dabchick (DC)	1=1 species; 2= 2-3 species; 3= 4 or more species	Based on actual surveys or Expert Panel knowledge: generally very reliable although some potential to under report.
Distinctiveness/ stronghold site	Overwintering				
	Migration stopover				
	Significant breeding site	Provides a measure of relative importance of rivers as strongholds for populations of 'threatened or at risk' species in New Zealand. (Note that Australasian bittern, marsh crake, and grey duck have been excluded due to imprecision with survey	Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations, ranges from 0-10, i.e., blue duck (BD), black stilt (BS), pied stilt, NZ pied oystercatcher (NZPO), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-	0= no species >1%; 1= 1 species at 1-4.9% = low; 2= 2 species at 1-4.9% = medium; 3= 1 or more species > 5%, or 3 or more 1-4.9% of total population = high	Based on actual surveys or Expert Panel knowledge: for some rivers and species, e.g., blue duck, the reliability is likely to be only moderate because of doubt about total population size and doubt about numbers on the river concerned, i.e., two sources of error.

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (and reliability)
		technique (first two species) and with identification (final species)	billed gull (B-BG), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); ; southern crested grebe (SCG); dabchick (DC)		
	Significant moulting site				
	Only region typically supporting a particular species				
	Habitat for specialist needs				
	Habitat for species with special diet or foraging behaviour				
Intactness/ naturalness	Level of modification				
Long term viability	Vulnerability to natural perturbations				

Appendix 10A-3
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Relative distinctiveness	Yes	Subjective measure	Experts available	Yes	Experts available	Yes
Amount of habitat: Area (ha) of riverbed for braided rivers; Distance (km) for single channel rivers	Yes	Area and Number of km	Data available	Yes	Data available	Yes
Total number for all native species recorded, with and without an adjustment of 'excessive' numbers of southern black-backed gulls	Yes	Quantitative and relatively easily measured	Survey data available	Yes	Data available	Yes
Number of guilds present, ranges from 0-8, i.e., a= open-water divers; b= deep water waders; c= shallow water waders; d= dabbling waterfowl; e= torrent specialists; f= aerial hunting gulls and terns; g= swamp specialists; h= riparian wetland birds	Yes	Quantitative and relatively easily measured	Survey data available	Yes	Data available	Yes
Actual number of species within 'threatened or at risk' conservation status categories	Yes	Quantitative and relatively easily measured	Survey data available (except for Australasian bittern and grey duck – they are excluded from the analysis)	Yes	Data available including experts	Yes
Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations	Yes	Quantitative and relatively easily measured – some expert assessment also needed	Survey data available, but experts also needed	Yes	Data available including experts	Yes

Appendix 10A-4
Significance assessment calculations for birdlife (Steps 1 and 5-8, 9)

	PRIMARY ATTRIBUTES							SCORING OF PRIMARY ATTRIBUTES										
	Step 6A: Apply indicators and thresholds							**Step 6B**: Apply indicators and thresholds						**Step 8**: River significance			**Step 9** - issues	
	1. Relative distinctiveness (Subjective)	2. Amount of Habitat (Objective) - measured in area for braided rivers and distance for single channel rivers. Note that while some braided rivers also have single channel reaches it is the dominant habitat that is recorded		3. Numbers (Obj)	4. Foraging guilds (Obj)	5. Number of 'threatened or at risk' species present (Obj) (Note: 3 species not included: grey duck, NZ pipit, Australasian bittern - see main report for reasons)	6. Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations (Obj/Subj)	1. Relative distinctiveness of habitat	2. Amount of Habitat	3. Numbers (ranked with SBBG removal adjustment)	4. Foraging guilds	5. Number of 'threatened or at risk' species present (Obj)	6. Species strongholds	Sum Weights 1	Rank1	Overall evaluation of importance		
	INDICATORS							INDICATOR THRESHOLDS										
River	1= Habitat type or species assemblage widely represented elsewhere in NZ; 2= Habitat type or species assemblage rarely represented elsewhere in NZ; 3= Habitat type or species assemblage not represented in other regions in NZ	ha for braided river birds	km for mainly single channel bird rivers	Number adjusted by removing SBBGs	Ranges from 0-8, i.e., a= open-water divers; b= deep water waders; c= shallow water waders; d= dabbling waterfowl; e= torrent specialists; f= aerial hunting gulls and terns; g= swamp specialists; h= riparian wetland birds	Principally: blue duck (BD), black stilt (BS), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-billed gull (B-BG), pied stilt (PS), NZ pied oystercatcher (NZPO), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); NZ dabchick (DC)	Principally: blue duck (BD), black stilt (BS), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-billed gull (B-BG), pied stilt (PS), NZ pied oystercatcher (NZPO), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); NZ dabchick (DC) - note that where surveys are based only on part sections then expert assessment is used to estimate proportionality.	1= low; 2= medium; 3= high	1=<5000ha and/or <10km; 2=5000-9999ha and/or 10-30km; 3= >10000ha and/or >30km	1=<1000 individuals; 2= 1000-4999 individuals; 3= >5000 individuals	1-4 = low = 1; 5-6= medium = 2; 7-8= high = 3	1=1; 2-3= 2; 4 or more = 3	0= no species with >1% of the total population; 1= 1 at 1-4.9% = low; 2= 2 at 1-4.9% = medium; 3= 1 or more > 5%, or 3 or more 1-4.9% = high	Standard		**DSS**: If column 6, of Step 6B, (threatened spp >5%) = 3; or total score is 15 or more = national importance; if all columns 1-5 are 2 or less and column 6 is 0; or the total score <10 = local; otherwise regional	Data source - note that for the Canterbury area the best source of data is the Department of Conservation via A. Grant. He has compiled a relatively comprehensive and up-to-date set of survey data incorporating DoC, ECan and other surveys.	Est. prop. river surveyed
Clarence	3	4168		315	a,b,c,d,f,h	BDo; B-FT; NZPO; PS	B-FT	3	1	1	2	3	1	11	14	Regional	1992 part survey (Hallas 2003)	50%
Kahutara	2	702		321	a,b,c,d,f,h	B-FT, B-BG, BDo, R-BG, NZPO, PS		2	1	1	1	3	0	8	22	Regional	A. Grant, 2008 DoC; also Hallas (2003)	100%
Hapuka	1	656		6	b,c,f	BDo		1	0	1	1	1	0	4	36	Local	A. Grant, 2008 DoC; also Hallas (2003)	Not known
Conway	2	845		556	a,b,c,d,f,h	BDo; B-FT; B-BG; R-BG; NZPO; PS; W-FT		1	1	1	2	3	0	8	22	Regional	A. Grant, 2008 DoC	100%
Waiau	3	7412		3825	a,b,c,d,f,h	B-FT, B-BG, R-BG, CT, NZPO, PS, BDo, WB, W-FT	B-FT (>5%); B-BG; BDo	3	2	2	2	3	3	15	7	**National**	ECan 2008 survey: most of river	60%
Hurunui	3	5138		2386	a,b,c,d,e,f,h	BD, B-FT, CT, B-BG, R-BG, BDo, WB, NZPO, PS	B-FT (>5%); B-BG; BDo	3	2	2	3	3	3	16	6	**National**	A. Grant, DoC, 2008 survey; 2009 pers. comm.	100%
Waipara	1	894		<100	a,b,c,d,f,h	BDo		1	1	1	2	1	0	6	32	Local	No recent data available	100%
Kowai	2	685		41	a,b,c,d,f,h	BDo, PS		1	1	1	1	2	0	6	32	Local	A. Grant, 2008 DoC	Not known

Ashley	2	3610		574	a,b,c,d,f,h	WB; BDo; B-FT; B-BG; NZPO; PS	B-FT	2	1	2	2	3	0	10	16	Regional	E. Spurr (2008), part river: A. Grant DoC data	10-20%
Waimakariri	3	14342		3396	a,b,c,d,f,h	WB, B-FT, BDo, B-BG, CT, W-FT; NZPO, PS	B-FT (>5%); WB (10%); BDo	3	3	3	2	3	3	17	1	**National**	A. Grant, DoC, 2008 survey; nothing above SH72 bridge	40%
Avon	2		c.30	1500	a,b,c,d,f,h	B-BG, R-BG, PS		2	2	2	2	2	0	10	16	Local	Expert Panel	100%
Kaituna	1		c.10	200	a,d,h	SCG		1	2	1	1	1	0	6	32	Local	Expert Panel	100%
Okuti			c.5	c.20	a,c,d,f	B-FT, BDo		1	1	1	1	2	0	6	32	Local	C.O'Donnell pers. Comm., 2009	100%
Halswell	2		c.25	<100	a,d,h	SCG		2	2	1	1	1	0	7	30	Local		
Selwyn	3		90	<300	a,b,c,d,h	Bdo, NZPO, PS		3	3	1	1	2	0	10	16	Local	K. Hughey pers. obs.	80%
Rakaia	3	32102		4342	a,b,c,d,f,h	WB, B-FT, BDo, B-BG, R-BG, CT, W-FT, NZPO, PS	B-FT; B-BG (>5%); WB (30%); BDo	3	3	3	2	3	3	17	1	**National**	A. Grant, DoC, 2007 part lower river only, i.e., none of upper	30%
Rangitata	3	18091		6926	a,b,c,d,f,h	WB, B-FT, BDo, B-BG, R-BG, CT, W-FT, NZPO, PS	B-FT (>5%); B-BG (>5%); WB (30%); BDo	3	3	3	2	3	3	17	1	**National**	Butcher 2001 lower; DoC 2001 upper	70%
Ashburton	2	2441		7856	a,b,c,d,f,h	B-FT; B-BG; R-BG; BDo; WB; W-FT; CT; NZPO; PS	B-FT; B-BG (12.5%)	2	1	3	2	3	3	14	9	**National**	A. Grant, DoC, 2008 survey	100%
Orari	1	2043		179	a,b,c,d,f,h	BDo; B-FT; B-BG; NZPO, PS		1	1	1	2	3	0	8	22	Regional	A. Grant, DoC, 2008 survey	70%
Opihi	1	1711		485	a,b,c,d,f,h	BDo; B-FT; NZPO; PS		1	1	1	2	3	0	8	22	Regional	A. Grant, DoC, 2006 survey	70%
Pareora	1	1070		68	a,b,c,d,f,	BDo; NZPO; PS; W-FT		1	1	1	2	3	0	8	22	Regional	A. Grant, DoC, 2008 survey	100%
Waitaki - Upper	3	c.30000		7907	a,b,c,d,f,h	BS, WB, B-FT, BDo, NZPO, PS, CT	BS (100%); B-FT (15%); WB (20%); BDo (>5%)	3	3	3	2	3	3	17	1	**National**	C. Woolmore pers. Comm. (94-08)	80%
Macaulay	1	1533		141	a,b,c,d,f	BDo, WB, B-FT, NZPO, PS		1	1	1	2	3	0	8	22	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Godley	3	6833		373	a,b,c,d,f,h	BDo, WB, B-FT, BBG, CT, NZPO, BS, PS	WB	3	2	1	2	3	1	12	11	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Cass	3	1432		498	a,b,c,d,f,h	BDo, WB, B-FT, BBG, CT, NZPO, PS		3	1	2	2	3	0	11	14	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Tekapo	1	3178		1034	a,b,c,d,f,h	BDo, WB, B-FT, B-BG, R-BG, CT, NZPO, BS, PS	B-FT (>5%)	1	1	2	2	3	3	12	11	**National**	C. Woolmore, DoC database, 2008 survey	Not known
Tasman	3	6897		1588	a,b,c,d,f,h	BDo, WB, B-FT, B-BG, CT, BS, PS, NZPO	WB, B-FT, BS (>15%)	3	2	2	2	3	3	15	7	**National**	C. Woolmore, DoC database, 2008 survey	Not known
Pukaki	2	512		57	a,b,c,d,f,h	BDo, B-FT, NZPO, PS		2	1	1	2	3	0	9	21	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Hopkins	3	3548		126	a,b,c,d,f,h	BDo, WB, B-FT, CT, NZPO, BS, PS		3	1	1	2	3	0	10	16	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Dobson	3	2007		187	a,b,c,d,f,h	BDo, WB, B-FT, CT, NZPO		3	1	1	2	3	0	10	16	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Twizel	1	<1000		115	a,b,c,d,f,h	BDo, B-FT, B-BG, NZPO		1	1	1	2	3	0	8	22	Regional	C. Woolmore, DoC database, 1994 survey	Not known
Upper Ohau	1	111		149	a,d,f,h	SCG, B-FT	B-FT	1	1	1	1	2	1	7	30	Regional	C. Woolmore, DoC database, 2008 survey	Not known
Lower Ohau	1	322		182	a,b,c,d,f,h	BDo, B-FT, CT, B-BG, NZPO, PS		1	1	1	2	3	0	8	22	Regional	C. Woolmore, DoC database, 2008 survey	Not known
Ahuriri	3	4353		2524	a,b,c,d,f,h	BDo, WB, B-FT, BBG, CT, BS, PS, NZPO	BS (15%), B-FT (>5%)	3	1	2	2	3	3	14	9	**National**	C. Woolmore, DoC database, 1994 survey	Not known
Waitaki - Lower	3	8104		6136	a,b,c,d,f,h	B-FT, B-BG, BDo, NZPO, PS	B-FT (8%); B-BG; BDo	3	3	3	2	3	3	17	1	**National**	Sanders 2008	100%
Blue duck river	3		90	150	a,e,h	BD	BD (10%)	3	3	1	1	1	**3**	12	11	**National**	Hypothetical fantastic blue duck river	100%
Colour coding	Orange cells - less reliable data, including expert based estimates																	
	Red typeface - data checked by Expert Panel and may have been adjusted																	

Appendix 10A-5
Other factors relevant to the assessment of significance for birdlife (Step 9)

General
While the assessment of braided rivers is relatively simple, the subsequent comparative evaluation against important single channel rivers is more challenging. This is because single channel rivers typically contain much less species diversity and a much lower presence of 'threatened or at-risk' species. As a result even the most important single channel rivers will score lower than even 'average' or regionally important braided rivers across the range of attributes and most indicators. However, given the importance of some single channel rivers to the blue duck it was decided that a decision criterion related to the final indicator, species strongholds, was warranted, i.e., rivers that are considered a stronghold for blue duck or any other threatened or at risk species for that matter are considered to be of national importance. Some threatened and at-risk species are extremely difficult to survey, e.g., Australasian bittern because of its secretive habits and cryptic plumage, and grey duck because it is very easily confused with the predominant mallard duck. No attempt has been made to include the bittern in any evaluation in this case study although it is likely to be present on most of the rivers but extremely low numbers, e.g., ones and twos. Grey duck has been excluded from total bird counts even thought it may be present in significant numbers in some back country catchments – where confirmed it is included in presence of threatened or at risk species. Where verifiable survey data are available then it should be considered for inclusion. There are some rivers and streams that flow extensively through wetlands, e.g., the Whangamarino in the Waikato. We have considered these to be primarily wetlands in their own right and consider they should be dealt with separately. In Canterbury the closest example of this sort of 'mix' is Hart's Creek, a tributary of Te Waihora/Lake Ellesmere – it has been excluded from our evaluation.

Appendix 10A-6
Future data requirements for birdlife

Data need
Whole river surveys of nationally important (e.g., Rakaia particularly), and some regionally important rivers
Update many upper Waitaki river surveys, e.g., Ahuriri
Include New Zealand pipit on list of species to be surveyed for on all braided rivers
Enter Ministry of Works 1956 list of rivers (i.e., make into electronic list) or link directly to the REC or similar, but as agreed nationally.

Part B: Native birds in Tasman District: Application of the River Values Assessment System (RiVAS)

Peter Gaze (Department of Conservation)
Trevor James (Tasman District Council)
Ken Hughey (Lincoln University)

10.4 Introduction

10.4.1 *Purpose*

This part of the chapter presents the second application of the River Values Assessment System (RiVAS) to native birdlife, in the Tasman District, undertaken in July 2010. A briefing workshop was held in Richmond on 26th June 2010 to apply the overall method to multiple values in Tasman District rivers. This Tasman bird report needs to be read in conjunction with the method (Hughey et al. Chapter 3, herein) and with the first native bird application (Part A of this chapter).

In applying the method to native birdlife in Tasman District the Expert Panel first appraised themselves of the Canterbury Region application to see if any further development of the system was necessary. One significant change was suggested, trialled and then rejected – namely to restrict the number of species in the 'threatened or at risk[16]' categories to only those most under threat (This made no significant difference to the results and it was agreed by the panel that it was more informative, subject to other conditions, to list all 'threatened and at risk' species that are confirmed present subject to the provisos in Hughey et al. (Part A, herein)). As a consequence only brief summary information is given in section 10.5 of this chapter – other key relevant information is contained in Hughey et al. (Part A, herein).

One other relatively minor change, and one appropriate to all value applications, was the suggestion of providing a short section on 'regional context related to the value'. This section is now included in Step 1 of the method application below.

10.4.2 *Preparatory step: Establish an Expert Panel and identify peer reviewers*

The Expert Panel for the native birdlife application in the Tasman District comprised Peter Gaze (DoC) and Trevor James (TDC), advised by Ken Hughey (Lincoln University) who managed the case study. Credentials of the Expert Panel are provided in Appendix 10B-1.

10.5 Application of the method

10.5.1 *Step 1: Define river value categories and river segments*

River value context for native birdlife in Tasman

Most Tasman rivers are single channel and have their headwaters in catchments largely dominated by native forest – in these catchments the rivers are dominated by single channel bird fauna, typically in this region by the endangered blue duck. The lower sections of these rivers typically (except in NW Nelson and Abel Tasman National Park) run through intensively developed farmland and into estuarine or lagoon systems. In these sections of single channel rivers the birdlife is dominated by shags and waterfowl. There are few braided rivers in Tasman, with the only notable

16 This phrase is used here as an all-encompassing term for the range of bird species defined to be, and listed as, at some conservation management risk in New Zealand, as listed in Miskelly et al. (2008). We use this listing of species as appropriate for the purposes of this report.

one being the Matakitaki, a tributary of the Buller – this river, not surprisingly, has a more diverse fauna than the others. The Buller is an enormous river with only the mid-upper reaches within Tasman District. It is a highly diverse system including both braided and single channel catchments – as such it appears appropriate to split this river into geographically discrete units: a similar argument also exists for several other systems, e.g., the Motueka.

River value categories

There is a distinction, typically, between the birdlife of braided rivers and that of single channel rivers. The former is typified by a community of birds that includes gulls and terns, waders, shags and a variety of waterfowl – multiple species are considered 'threatened or at risk'; the latter is typified by waterfowl and shags with far fewer species threatened or at risk, Despite this distinction it is proposed to treat all rivers primarily in the same way, except where distinctive indicators for the prime attributes (see steps 3 and 4 below) can be identified and used appropriately.

River segments

Work in advance of the Expert Panel meeting to collate existing data, indicated that expert knowledge primarily held by the Department of Conservation[17], but also by TDC on occasions, would be the primary data source. While considerable data exist on blue duck in the region there is little or no formal survey information for most rivers. For the purposes of this analysis we generally consider catchments as a whole (except the West Coast rivers which are combined, and the Buller which is divided on a catchment basis).

Following a preliminary scanning exercise some rivers within the TDC region were excluded from further assessment. Criteria considered as part of this preliminary scanning were that the river or stream has:

- No known or suspected presence of breeding threatened or at risk species;
- A very small amount of habitat (e.g., less than 3km for a single channel river) of very low quality;
- Very low numbers (e.g., less than 100 and no breeding 'threatened or at risk' species) of native riverine birds; and/or
- Little or no flow at critical times, e.g., during the breeding season.

Table 10-1 lists the rivers not included in this assessment.

Table 10-1
Rivers not included in the assessment of native birdlife values

Rivers not considered in this analysis	Totally unknown	Birdlife values less than local significance
Abel Tasman NP rivers		Yes
All lowland streams in Tasman and Golden bays with highly developed catchments		Yes

Unlike Canterbury rivers, those of Tasman typically have large lagoon and/or estuarine systems attached – these parts of the system are excluded from analysis and a separate evaluation of all lagoons, estuaries, etc., is required.

Other Considerations

Related to the above, an important feature of many surveys and much evidence presented in hearings is associated with total bird numbers of a river. We note the imprecision of the survey data,

17 Note that this resource includes occasional surveys undertaken by individuals, consultants and NGOs (e.g., community groups, Forest and Bird, the Ornithological Society of NZ).

but again reiterate it is the best available information. Note the following, again consistent with the Canterbury report:

- Some species are particularly difficult to find, e.g., crake and bittern, and until a reliable survey method is found, are excluded from this analysis. Equally, threatened and at risk species such as grey duck are present, but difficult to identify correctly – they too are excluded from that part of the analysis dealing with threatened and at risk species. At least one other species identified as 'threatened or at risk', i.e., NZ pipit, is not considered as it is mostly not recorded (for some unknown reason) in surveys.

Outcomes

Use whole catchments as the primary data set and populate with existing river bird survey data and/or Expert Panel considerations, except as already noted for the Buller (subdivided) and for the West Coast rivers (combined).

Ignore the presence of swamp species such as bittern and marsh crake until reliable survey data become available.

Do not include NZ pipit until routinely required within the standard survey method, and then record appropriately.

Do not include grey duck.

10.5.2 ***Step 2: Identify attributes***

Attributes, i.e., the facets of the birdlife river value. The same attributes as used by Hughey et al. (Part A, herein) for Canterbury were considered here.

10.5.3 ***Step 3: Select and describe primary attributes***

The same six primary attributes used by Hughey et al. (Part A, herein) are used here.

10.5.4 ***Step 4: Identify indicators***

The same indicators used by Hughey et al. (Part A, herein).

10.5.5 ***Step 5: Determine indicator thresholds***

Thresholds are applied to an indicator to determine high, medium and low relative importance for that indicator. Thresholds are defined by real data (e.g., for recreational fishing <1,000 angler days per annum = relatively low importance, or Expert Panel judgements) for each indicator and were identified by the Expert Panel. Because native birdlife is comparatively data rich (c.f. some other river values), this step was informed by 'hard' data (albeit much from Expert Panel assessment for this region) for five of the six indicators.

10.5.6 ***Step 6: Apply indicators and indicator thresholds***

Most indicators were assessed using Expert Panel based quantitative survey data (see Appendix 10B-2) - this step involved entering data from the relevant data sources (primarily the experts). Data were kept in their original format (e.g., *actual area* of habitat, *number* of birds). This assisted the Expert Panel when evaluating the data, and helps achieve process transparency.

10.5.7 ***Step 7: Weighting of primary attributes***

The Expert Panel reviewed the six primary attributes and considered whether some made a relatively greater contribution to birdlife as a whole. Initial thoughts were that they made an equal contribution. The decision was reached, as per the Canterbury (Part A, Herein) application to keep weightings equal.

Outcome

Equal weighting

As a consequence of this decision it was decided for Canterbury to introduce a 'species stronghold' criterion into the decision support system for defining priorities, i.e., if a river contains 5% or more of a population of a 'threatened or at risk' species then it is of national importance – such a criterion is consistent with decisions made for national water conservation orders. In the case of Tasman no species on any river reaches this criterion, however, it should be noted that blue duck is being managed to establish 50 breeding pairs at one of 8 selected sites nationally. If successful, it will then rise to more than the 5% threshold and the river will jump to national significance.

10.5.8 ***Step 8: Determine river significance***

Step 8a: Rank rivers

The spreadsheet in Appendix 10B-3 was used to sum the indicator threshold scores for each river. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. This provided the list of rivers ranked by their significance scores.

Step 8b: Identify river significance

Using the ranked list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores. As per the Canterbury report the following criteria were applied to defining importance within the Appendix 10B-3 evaluation:

National significance:

Criterion 1: *Species strongholds* – if any river contained one or more species with over 5% of the total population(s) then = 3, and automatic national significance. We chose 5% as this level has been used in a number of Water Conservation Order decisions as being a threshold for national importance (despite the fact that the World Conservation Union (IUCN) uses a 1% level for international significance); or

Criterion 2: total score is 15 or more then national significance.

Regional significance:

Those rivers in the table not defined as nationally or locally significant, and scoring 11-14.

Local significance:

Sole criterion: *Number of 'threatened or at risk' species present* = 0 and all other indicator columns (i.e., 1-5) are 2 or less then automatic local significance; or if the total score <11 = local significance.

Translation of these functions to rivers is shown in Appendix 10B-3.

The Expert Panel assessed the output from this process against the results of existing assessments and other relevant considerations, including:

1. Sites of Special Wildlife Interest for braided rivers in Canterbury – O'Donnell and Moore (1983);
2. Existing Water Conservation Orders associated with birdlife;
3. Existing planning documents, including Regional Plans under the RMA; and
4. Reference to MfE Waters of National Importance work.

It is acknowledged that, owing to the judgmental nature of this exercise, rivers close to the threshold points could 'swing either way', and that in time the Wangapeka is likely to be of national significance for blue duck but is not currently.

Outcome

A list of rivers ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 10B-3 (columns highlighted in green).

Rivers identified as significant at the national, regional and local level - see Appendix 10B-3.

Rivers in the Tasman Region not listed have either low value to birdlife dependent on rivers or streams or are of unknown value.

10.5.9 ***Step 9: Outline other factors relevant to the assessment of significance***

Perhaps the most telling other issue concerns the 'state' of the survey data – apart from blue duck little is formally known about the birdlife of Tasman rivers, especially those on the Tasman plain, i.e., the mid to lower Motueka and the lower Waimea, but also the Matakitaki and Maruia in the Buller catchment. As a consequence, and unlike for Canterbury, there is little quantitative data available and this needs to be noted. Despite these comments we are of the view that our assessments are likely to be 'reasonably accurate' at least as far as diversity is concerned, if not in terms of absolute numbers.

Outcome

Notes have been made in Appendix 10B-2 and 10B-3 about data sources.

10.5.10 ***Step 10: Review assessment process and identify future information requirements***

In order to rectify the situation identified in step 9 some formal survey work on the river sections identified is considered important – this could be undertaken in a relatively informal way by cooperation between DoC, the Council and the Ornithological Society of NZ.

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Appendix 10B-1
Credentials of the Expert Panel members and peer reviewers

The Expert Panel comprised three members. Their credentials are:

Peter Gaze is a technical support officer with Department of Conservation in Nelson. He has lived in the study area for many years and is familiar with the birdlife of these rivers through the work of the department as well as that of the Ornithological Society.

Trevor James is a resource scientist with the Tasman District Council, where he is responsible for surface water quality and aquatic ecology monitoring, reporting on the State of the Environment, and advising consents and planning staff on specific issues and options. He has a total of 13 years experience in this role including seven years at West Coast Regional Council. Prior to this he worked for environmental consultants mostly in the field of contaminated site assessment and remediation as well as biological waste treatment. He has a strong interest in ornithology and improving the lot of all aquatic ecosystems. RiVAS projects he has been involved in include whitewater kayaking, swimming, native fish and river-nesting birds.

Ken Hughey is Professor Environmental Management at Lincoln University. His expert knowledge of river birdlife spans the period 1981-2009, including his PhD thesis (habitat needs of birds of braided rivers), multiple river bird surveys in almost all regions of the South Island, expert evidence at multiple hearings and published research papers (e.g., Hughey 1997, 1998, Duncan et al., 2008). Ken is overall project manager of the river values project. Selected references:

Duncan, M.J., Hughey, K.F.D., Cochrane, C.H., Bind, J. 2008. River modelling to better manage mammalian predator access to islands in braided rivers. In: Sustainable Hydrology for the 21st Century, Proc. 10th BHS National Hydrology Symposium, Exeter. 487-492.

Hughey, K.F.D. 1997. The diet of the wrybill (*Anarynchus frontalis*) and the banded dotterel (*Charadrius bicinctus*) on two braided rivers in Canterbury, New Zealand. Notornis 44: 185-193.

Hughey, K.F.D. 1998. Nesting home range sizes of wrybill (*Anarynchus frontalis*) and banded dotterel (*Charadrius bicinctus*) in relation to braided riverbed characteristics. Notornis 45: 103-111.

Appendix 10B-2
Surveyed or Estimated native bird numbers on rivers in the Tasman District.

Guilds	a) Open water divers	b) Deep water waders	c) Shallow water waders		d) Dabbling waterfowl	e) Torrent specialists	f) Aerial gulls & terns			g) Swamp birds	h) Riparian birds	Total	Source of information	Notes
Examples	Shags	Stilts, oystercatchers, herons etc	Banded dotterel	Others	Shoveller, teal, scaup, paradise shelduck	Blue duck	Black-fronted tern	Black-billed gull	Other	Bittern, Pukeko	Swallow, kingfisher			
Waimea	10	120	20	10	0	0	10	0	0	10	20	200	Blue duck surveys; otherwise expert opinion	Including black-fronted dotterel
Mid Motueka	11	22	0	0	28	0	0	1	0	0	25	130	Expert opinion based on habitat; and Gaze 2010	
Lower Motueka	12	7	0	0	7	10	23	0	0	20	15	155	Blue duck surveys; otherwise expert opinion; and Gaze 2010	
Upper Motueka	0	24	7	0	41	4	1	19	0	0	25	134	Blue duck surveys; otherwise expert opinion; ; and Gaze 2010	
Aorere	100	60	20		0	14	0	0	0	20	20	234	Blue duck surveys including Studholme (2000); otherwise expert opinion	

Upper Buller	20	20	20	0	0	5	50	80			50	245	Blue duck surveys; Steffens (2007) and expert opinion	Does not including the Fyfe and Matakitaki tributaries
Matakitaki	20	40	60	0		5	30	50			50	255	Blue duck surveys; Steffens (2007) and expert opinion	
Takaka	50	50	20	0	0	20	0	0	20	0	15	175	Blue duck surveys incl. Studholme (2000); otherwise expert opinion	
Fyfe	10	0	0	0	0	10	0	0	0	0	10	30	Butler and Steffens (2010) and expert opinion	
Wangapeka	2			0		35						37	Butler and Steffens (2010) and expert opinion	
West Coast Rivers	50	0	0	0	0	10	0	0	0	0	25	85	Studholme (2000) and expert opinion	
Whanganui Inlet rivers	10	0		0		0	0	0	0	0	10	20	Expert opinion based on habitat	Counts based on a typical single river, boundary being too far up to include exposed mudflats
Riwaka	5	0	0	0	0	2	0	0	0	0	10	17	Studholme (2000) and expert opinion	
Maruia	20	20	20	0	0	0	0	0	0	0	0	60	Expert opinion based on habitat	

Appendix 10B-3
Significance assessment calculations for birdlife (Steps 1 and 5-8)

	PRIMARY ATTRIBUTES							SCORING OF PRIMARY ATTRIBUTES									
	Step 6A: Apply indicators and thresholds							**Step 6B**: Apply indicators and thresholds						**Step 8**: River significance			**Step 9** - issues
River	1. Relative distinctiveness (Subjective)	2. Amount of Habitat (Objective) - measured in area for braided rivers and distance for single channel rivers. Note that while some braided rivers also have single channel reaches it is the dominant habitat that is recorded		3. Numbers (Obj)	4. Foraging guilds (Obj)	5. Number of 'threatened or at risk' species present (Obj)	6. Proportion of 'threatened or at risk' species present with a significant (>1% or >5%) proportion of their total populations (Obj/Subj)	1. Relative distinctiveness of habitat	2. Amount of Habitat	3. Numbers (ranked with SBBG removal adjustment)	4. Foraging guilds	5. Number of 'threatened or at risk' species present (Obj)	6. Species strongholds	Sum Weights 1	Rank1	Overall evaluation of importance	
	INDICATORS							**INDICATOR THRESHOLDS**									
	1= Habitat type or species assemblage widely represented elsewhere in NZ; 2= Habitat type or species assemblage rarely represented elsewhere in NZ; 3= Habitat type or species assemblage not represented in other regions in NZ	ha for braided river birds	km for mainly single channel bird rivers	Number adjusted by removing SBBGs	Ranges from 0-8, i.e., a= open-water divers; b= deep water waders; c= shallow water waders; d= dabbling waterfowl; e= torrent specialists; f= aerial hunting gulls and terns; g= swamp specialists; h= riparian wetland birds	Principally: blue duck (BD), black stilt (BS), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-billed gull (B-BG), pied stilt (PS), NZ pied oystercatcher (NZPO), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); NZ dabchick (DC)	Principally: blue duck (BD), black stilt (BS), wrybill (WB), banded dotterel (BDo), black-fronted tern (B-FT), black-billed gull (B-BG), pied stilt (PS), NZ pied oystercatcher (NZPO), white-fronted tern (W-FT); red-billed gull (R-BG); Caspian tern (CT); southern crested grebe (SCG); NZ dabchick (DC) - note that where surveys are based only on part sections then expert assessment is used to estimate proportionality.	1= low; 2= medium; 3= high	1=<5000ha and/or <10km; 2=5000-9999ha and/or 10-30km; 3= >10000ha and/or >30km	1=<1000 individuals; 2= 1000-4999 individuals; 3= >5000 individuals	1-4 = low = 1; 5-6= medium = 2; 7-8= high = 3	1=1; 2-3= 2; 4 or more = 3	0= no species with >1% of the total population; 1= 1 at 1-4.9% = low; 2= 2 at 1-4.9% = medium; 3= 1 or more > 5%, or 3 or more 1-4.9% = high	Standard		**DSS**: If column 6, of Step 6B, (threatened spp >5%) = 3; or total score is 15 or more = national importance; if all columns 1-5 are 2 or less and column 6 is 0; or the total score <10 = local; otherwise regional	Data source - note that for the Canterbury area the best source of data is the Department of Conservation via A. Grant. He has compiled a relatively comprehensive and up-to-date set of survey data incorporating DoC, ECan and other surveys.
Waimea	1	239		<200	a,b,c,f,g,h	B-FT, BDo, NZPO, PS, NZP, BD		1	1	1	3	3	0	9		Local	Bird values mostly in plains reaches; lower river part of planned river park and attached to Waimea Estuary which is very important
Mid Motueka	1	200		<200	a,b,c,f,h	B-FT, B-BG, BDo, NZPO, PS		1	1	1	2	3	0	8		Local	See Gaze 2010
Lower Motueka	3		100	c.200	a,b,c,e,f,g,h	B-FT, BDo, NZPO, PS, BD		3	3	1	3	3	0	13		Regional	See Gaze 2010
Upper Motueka	1		100	c.250	a,b,c,e,f,h	B--FT, B-BG, Bdo, NZPO, PS, BD		1	3	1	3	3	0	11		Regional	Includes down to Wangapeka; See Gaze 2010
Aorere	3		100	c.250	a,b,c,g,h	BDo, NZPO, PS, BD		3	3	1	2	3	0	12		Regional	Possibly SI fernbird

Upper Buller	3	1679	c.1000	750	a,b,c,d,e,f,h	BDo, BD, B-FT, B-BG, NZPO, PS	B-FT, BD?	3	3	1	3	3	1	14		Regional	Blue duck? Maybe 30 birds max which might be >1% of popn; might be significant on an eco region basis c.f. REC
Matakitaki	2	c.150		c.500	a,b,c,d,e,f,h	BDo, BD, B-FT, B-BG, NZPO, PS		2	1	1	3	3	0	10		Regional	
Takaka	3		100	c.200	a,b,c,e,f,h	BDo, BD, PS	BD?	3	3	1	2	2	1	12		Regional	We have not included banded rail because not in river; or red-billed gull for same reason
Fyfe	2		c.20	10	e	BD		2	2	1	1	1	0	7		Local	One of rare types with no introduced salmonids; managed as part of Wangapeka blue duck programme
Wangapeka	2		c.100	c.100	a,e	BD	BD(3%)	2	3	1	1	1	1	9		Local	Being managed for blue duck to get to 50 pairs as one of 8 selected sites nationally - if successful then it will rise to more than the 5% threshold and therefore will jump to National significance; assumed a national popn of 1500 but check latest recovery plan and adjust
WestCoast Rivers	1		c.100	c.100	a,e,h	BD		1	3	1	1	1	0	7		Local	Farewell Spit south, excluding tributaries of Whanganui inlet - the Big would score most of this itself
Whanganui Inlet rivers	1		c.30	<100	a,d,h	Nil		1	2	1	1	0	0	0		local	
Riwaka	1		25	20	a,e,g,h	BD		1	2	1	2	1	0	7		Local	
Maruia	1		50	<100	a,b,c,h	BDo,PS		1	3	1	2	1	0	8		Local	Check for breeding terns upstream and feeding downstream
Colour coding	Orange cells - less reliable data, including expert based estimates																
	Red typeface - data checked by Expert Panel and may have been adjusted																

Chapter 11
Natural Character

Preamble

Marlborough District had for some time been considering investigating further the natural character and its importance to the area. It was opportune therefore, when the method was developed, for the District to partner this project. However, there are geographic features of the District which in many ways make it challenging to undertake a task and for the output from that exercise to be readily transferable to other regions. Notably the District is heavily dominated by the Wairau Valley system. Because of this dominance the natural character assessment tool developed, when applied to Tasman District, was found to have several shortcomings. These shortcomings have been discussed with the principal author of the Marlborough study and changes were thus made in undertaking the assessment for Tasman. These changes have not however, been explicitly addressed in the Marlborough report (Part A of this chapter). Thus, the two reports presented differ, but only slightly and the modifications made for Tasman are noted in the text of that report (Part B of this chapter). Another deviation from the method in general, was the decision to use the 1-5 raw indicator scores as the threshold scores as well (rather than 1-3 or 0-3 as used in most other applications). In the Tasman application we compared 1-5 with a conversion to 1-3 (i.e., 1-2=1, 3=2, and 4-5=3) and found no 'significant' differences in final results.

Finally, natural character is a matter dealt with in Section 6, Matters of National Importance, of the Resource Management Act (1991), i.e., "6(a) The preservation of the natural character of the coastal environment (including the coastal marine area) wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development". This recognises that all rivers have natural character and protecting it is nationally important. However, rivers have variable quality of natural character and ranking its relative value will assist in identifying inappropriate use and development as well as help inform priorities for management action. As a result of this, the ranking system has been modified to reflect a 5-point scale from 'very high' to 'very low'. The Tasman District Council case study thus represents the up-to-date method that should be used in future applications.

Part A: Natural Character: Application of the River Significance Assessment Method to Marlborough District

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Val Wadsworth (Marlborough District Council)
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Peer reviewed by: Peter Hamill and Michael Stevens

11.1 **Introduction**

11.1.1 ***Purpose***

This section relates to the values associated with natural character and applies the method for significance assessment outlined in Hughey et al., (herein). Its purpose is to provide a case study of how to apply the method using natural character values in the Marlborough District.

11.1.2 ***Establishment of an Expert Panel***

The Expert Panel for the natural character significance assessment in the Marlborough District comprised Neil Deans of Fish and Game Nelson Marlborough Region, Val Wadsworth, Marlborough District Council (MDC) Surface Water Hydrologist, Brin Williman MDC's Engineer Hydrologist, Pere Hawes Environmental Policy Team Leader at MDC and Allan Rackham and James Bentley, Landscape Architects from Boffa Miskell Ltd.

Peer Reviewers were: Peter Hamill, MDC Freshwater Ecologist and Dr Michael Stevens, Landscape Architect with Vivian Espie.

Credentials of the Expert Panel and Peer Reviewers are provided in Appendix 11A-1.

11.2 **Application of the method**

11.2.1 ***Step 1: Define River Value Categories and River Segments***

Definition of 'natural character'

The Expert Panel discussed the concept of natural character and more specifically its meaning under the Resource Management Act 1991 (RMA). The RMA considers as a matter of national importance *'the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development'*.

The Expert Panel agreed that there is no authoritative definition of natural character in the legislation. The Expert Panel accepted that natural character is a term used to describe the naturalness of river environments and that it has both ecological and landscape connotations. A workable definition has been adopted by a number of landscape architects and other resource management practitioners and was accepted by the Expert Panel. This definition states that:

'Natural character is a term used to describe the naturalness of river environments. The degree or level of natural character within an area depends on:

1. *The extent to which natural elements, patterns and processes occur; and*
2. *The nature and extent of modifications to the ecosystems and landscape/ riverscape.*

The highest degree of natural character (the greatest naturalness) occurs where there is least modification. The effect of different types of modification upon the natural character of an area varies with the context and may be perceived differently by different parts of the community'.

Furthermore, there is no clear definition relating to the term and its application within a river channel. There is also no clear definition relating to rivers 'and their margins' within the RMA. A definition within Environment Bay of Plenty's Regional Water and Land Plan conclude that a river/ riparian margin is:

> *A strip of land of varying width adjacent to the bed of a stream, river, lake or wetland, which contributes or may contribute to the maintenance and enhancement of the natural functioning, quality and character of the stream, river, lake or wetland; and the natural character of the margins of streams, rivers, lakes and wetlands.*

The Expert Panel concluded that, for the purposes of this study, a river and its margins can differ for every river, but generally includes the river banks and riparian edge, and in some cases part of the land beyond the riparian edge.

The natural character of rivers and their margins may be affected by structural modifications (i.e., the construction of groynes, stop banks or bridges), alteration of the river channel due to adjacent land uses or riparian land management, changes in appearance resulting from modified flows (in the most extreme case a dewatered river channel), or by longer-term effects of flow regime changes such as vegetation encroachment onto riverbeds etc.

The Expert Panel concluded that the separation of *natural elements, patterns and processes* is helpful in natural character analysis and evaluation as it enables the assessor to combine considerations of both appearance and underlying ecology. Natural elements incorporate all key river elements, such as the water, bed and banks, as well as particular attributes occurring within the river environment, such as geological formations, native vegetation and fauna. Natural patterns consider the appearance of rivers and take the outline of the channel and the riparian edge into account, as well as the effects of patterns created by humans on adjacent land, such as vineyards or shelterbelts. Natural processes include river dynamics, such as erosion, freshes and floods, and regeneration process of riparian vegetation. Bridges, stopbanks and groynes are examples of built modifications that may be in or close to the river bed. Roads, structures and buildings occurring further from the river on adjacent land may have effects on the natural character of the riverscape/ landscape surrounding a water body.

Of the attributes relating to the assessment of a river's natural character the following groupings were considered helpful (refer to "Riverscape and Flow Assessment Guidelines" (BML, 2009) outlining findings from the Water Allocation Programme (WAP) Research 2003-2009:

- Shape of river bed and channel;
- Riparian vegetation;
- River flow;
- Water Quality; and
- Man-made structures in and adjacent to the riverbed.

The degree of natural character can conceptually be determined through both subjective and objective assessment criteria. While most of the above can be an objective measure of the degree of biophysical naturalness, the Environment Court has recently acknowledged a level of credibility regarding a subjective approach. For example, the Long Bay – Okura[18] decision outlines an approach of aesthetic naturalness which now recognises that subjective evaluations are relevant to assessments concerning aesthetic value.

Choice of rivers in Marlborough District

In order to reduce the number of rivers for the test study with the Expert Panel, only higher order rivers of the River Environment Classification system (REC)[19] in the region were chosen. This included

18 Long Bay – Okura Great Park Society Inc, Auckland Regional Council, Landco Ltd and SB & LA Singleton v. North Shore City Council Decision A78/2008

19 The REC system developed by NIWA (National Institute of Water and Atmospheric Research Ltd.) essentially groups rivers into classes at a variety of details and classes, therefore rivers of the same class have similar physical, biological and economic values. Specifically, the REC organises information about the physical characteristics of New Zealand's rivers (for example, their climate, the source of flow for the river water, the geology of the catchment and catchment land cover, e.g. forest, pasture, urban) and maps this information by river segment (and order) for New Zealand's river network – over 425 thousand kilometres of river [www.maf.govt.nz]. For Marlborough, the REC

all rivers in the 5, 6 and 7 order categories which captured all principal rivers in the Marlborough District. The selection of higher order rivers meant that specific areas of the region were underrepresented in the study, such as those in the Marlborough Sounds. To improve the robustness of the methodology and the representativeness across the region a number of smaller order streams and rivers were added, (i.e., orders 2, 3 and 4 streams and rivers). This would capture the potential diversity of smaller streams and rivers in the Marlborough Sounds and within the drier mountainous environments in the south of the region. Since this is a pilot study it was considered desirable to test a range of river types and sizes to ensure applicability of the process across the country.

Due to the length and diversity of some rivers (noticeably the Wairau, Awatere and Pelorus rivers), it was concluded that these should be sub-divided into individual river segments. This meant that the Expert Panel had a total of 38 streams/ rivers/ segments which were assessed as part of this exercise.

Survey data

Due to a lack of data, it was generally difficult to quantify the degree of natural character. There were, however, several attributes that were more amenable to quantification, such as water allocation resource consents, which removes an element of subjectivity. Data used to inform the decision of the Expert Panel included the River Environment Classification system (REC), developed by NIWA (as mentioned above), the Land Cover Data Base (LCDB) by Terralink, current and historical aerial photographs, Google Earth and water quality, river management information and water allocation resource consent information provided by MDC.

It was acknowledged that this data would not provide answers, although it proved to be useful in assisting qualitative decisions on natural character.

11.2.2 ***Step 2: Identify Attributes***

Attributes which related to the natural character of rivers were discussed during the Expert Panel workshop and were broadly clustered around three components of a river's morphology, namely the river channel, the riparian edge and the wider landscape context. Under the RMA, only the term 'rivers' is interpreted. Under this interpretation a river means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity generation, and farm drainage canal).

The three river attributes concluded by the Expert Panel contribute in determining a river's degree of natural character. This 'grouping' into 'attribute clusters' enabled the panel to focus on particular parts of a river: The following three attribute clusters make up the riverscape:

1. River Channel: This includes the wetted surface and exposed gravel bars within the active channel, which is regularly covered by freshes and floods.;
2. Riparian Edge: This includes the river banks and floodplains often containing riparian vegetation. Attributes such as extent of exotic and native vegetation present will be considered, as will level of human modification; and
3. Wider Landscape Context: This considered the river in its wider landscape setting and looked at land use and broader geomorphic qualities that contribute to the river's natural character. It is acknowledged that the wider landscape, particularly its land use is integral in assessing a river's degree of natural character.

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system includes rivers with an order range of 1-7, where 1 includes all river sources and 7 being only the lower Wairau River segment at its mouth.

Outcome

All attributes are outlined within Appendix 11A-2.

11.2.3 *Step 3: Select and describe Primary Attributes*

From the list of attributes identified within Step 2 and outlined within Appendix 11A-2, primary attributes were selected to represent the 'core' elements of a river's natural character. This selection was based on:

1. Simplicity: The primary attributes are organised into their relative 'attribute cluster grouping'. From this eight primary attributes were identified within the three attribute clusters;
2. Experience: Research literature was limited, so pragmatic opinions based on the experience of the Expert Panel's knowledge of rivers in the region were used to determine the validity of the primary attributes. Overlays of aerial photographs of rivers (where these existed) were also used to quantify changes of the morphology of a river over time;
3. Many of the attributes outlined in Step 2 overlapped in some way with other attributes. Refinement of the list was made through the workshop identifying key attributes and their collective contribution to natural character.

Outcome

Eight primary attributes have been identified and are described in Appendix 11A-2.

11.2.4 *Step 4: Identify Indicators*

Using the SMARTA criteria, one indicator for each primary attribute was identified. Due to the relative lack of existing data, indicators were based on the interpretation of available data and the experience and knowledge of the Expert Panel. An expert judgement was then formed.

Outcome

Indicators assessed against SMARTA criteria are contained within Appendix 11A-3.

11.2.5 *Step 5: Determine Indicator thresholds*

For each primary attribute's indicator (the Expert Panel's evaluations), thresholds were identified. The Expert Panel agreed on a single five-point ranking system for all primary attributes.

The five-point scale ranks each primary attribute's degree of natural character on a continuum from (1) heavily modified to (5) overwhelmingly natural, based on natural elements, natural patterns and natural process described earlier. The higher the number, the greater the degree of natural character.

1	2	3	4	5
Very Low levels of natural character due to Very High levels of modification	**Low levels of natural character** due to High levels of modification	**Moderate levels of natural character** due to moderate levels of modification	**High levels of natural character** due to Low levels of modification	**Very High levels of natural character** due to Very Low or no levels of modification

Each primary attribute was considered individually, so for example, for *Water Quality*, the thresholds were:

1= Very highly contaminated or permanently discoloured water displaying very high levels of human-induced changes to the water quality with limited life supporting capacity (e.g., within polluted urban/ industrialised areas or intensive farming);

2= Water usually displaying high levels of contamination mainly from adjacent diffuse sources from land use activities (agricultural leaching, etc.);

3= Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or at some times;

4= Water displaying relatively high levels of water quality with small or rare amounts of impurities caused further upstream (e.g., by occasional stock crossing or forest harvesting); and

5= Highly natural water quality displaying no human induced changes.

Outcome

The thresholds are identified within Appendix 11A-2.

11.2.6 *Step 6: Apply Indicators and Indicator Thresholds*

The outcome of this stage is contained within Appendix 11A-4 and involved the Expert Panel systematically assessing each of the identified rivers within the Marlborough Region. A degree of natural character was allocated to each of the eight primary attributes. Objective and subjective data were used in the workshop and included the Council's GIS data, REC, LCDB, aerial photographs and the personal experience of the rivers of the area by members of the Expert Panel. This data assisted the group to make an informed judgement on the degree of natural character for each of a river's primary attributes.

Data not available during the meeting included hydrological statistics and historical aerial photographs of some rivers. However, this deficiency was overcome by the panel's familiarity with Marlborough's rivers. If this approach to natural character assessment is adopted in other areas, familiarity and a degree of hydrological and ecological understanding are essential.

Points of refinement

The criteria describing each primary attribute were refined during the assessment. This clarification of terms avoids potential confusion and further debate of the terminology used in the assessment. Specific terms included:

1. Water Quality: The perception of water quality is heavily influenced by visual indicators such as colour and clarity. These do not necessarily override other important aspects, such as contamination from sewerage or agricultural run-off. Furthermore, turbidity and discolouration can be caused by natural processes, such as flood flows or high tannin content and can influence visual perceptions.
2. Exotic flora/ fauna in the river channel: For the purposes of this assessment, this includes vegetation such as Lagarosiphon, Egeria, Didymosphenia, and fauna such as trout and salmon. The Expert Panel considered that good ecological knowledge is required to ascertain the difference between native and exotic algal growth during periods of extended low flow.
3. Riparian Vegetation: The use of the term vegetation includes lichen/moss, grasses, herbs, shrubs and trees. Therefore a high country river with native grasses and areas of bare rock might be as natural as a river flanked by mature native beech. No or limited riparian vegetation does not necessarily mean a low degree of natural character. The degree of natural character is determined by the ratio of native and exotic vegetation and the context of the overall environment.
4. Location of Riparian Vegetation: When assessing riparian edge vegetation, for the majority of single channel rivers this would prove to be a straightforward case. This proves more complicated when a braided river is considered, as islands and encroachment of vegetation into the river channel would not necessarily be regarded as riparian vegetation, due to their in-channel location. The Expert Panel considered that trees and shrubs within a braided or non-braided river channel be considered as riparian vegetation and that while there was disagreement between the workshop participants, this report recommends that River Channel vegetation focus on aquatic vegetation, such as submerged and emergent macrophytes.

5. Timescale: The Expert Panel considered this during the assessment process, however did not specifically confront a definitive time-period [i.e., pre-human change, pre-European change or pre -twentieth century change] for assessment. The Expert Panel did, however, consider that the main emphasis relating to time tended to be focused towards land cleared for agricultural purposes [i.e., arrival of Europeans and subsequent land use] and specific flood and energy projects carried out during the twentieth century up until today [i.e., stop-banks, diversions, hydro schemes].

11.2.7 ***Step 7: Weight the Primary Attributes***

The Expert Panel reviewed the eight primary attributes to consider whether some made a greater contribution to natural character as a whole.

Due to the natural weighting of the eight primary attributes into the three primary cluster groups, no further weighting was deemed appropriate, i.e., the cluster 'river channel' contains a total of 5 attributes of the 8, etc.

11.2.8 ***Step 8: Determine River Significance***

Step 8a: Ranking rivers

The spreadsheet contained within Appendix 11A-4 calculated the indicator threshold or 'total score' for each river based on the natural character scoring for the eight primary attributes. This scoring resulted in a minimum score of 8 and a maximum score of 40. For Marlborough, the range of natural character extended from 16 through to 40.

Step 8a: Identify river significance

Each attribute cluster is naturally weighted: River channel (x5 attributes), Riparian edge (x2 attributes) and landscape context (x1 attribute). A consequence of this weighting is that where a river scores highly for the river channel attributes; it generally scores high 'in total'.

Adding up the total scores and applying thresholds is a useful approach for determining a river's natural character rating. However, for assessing a natural river's significance requires not only consideration of its natural character, but also its importance compared to other rivers in the region or nation. This means that other matters need to be considered that may have a bearing on a river's significance in a regional or national context. The Expert Panel agree that this determination of significance should be undertaken as a separate exercise to the previously described natural character ranking for rivers that were rated as having 'high natural character'.

To give some guidance, the Expert Panel have put forward suggested thresholds for importance. The Expert Panel has applied then here but notes that they can only really be confirmed after a national level application:

Long Rivers with very high natural character (e.g.: Nationally Significant):

Natural character rating: The river scored consistently very highly for each attribute (example 35-40 scoring for very high). The Expert Panel also considered that a river's length should also be taken into account, suggesting that rivers within this 'very high' category should also be at least 50 kilometres in length. Length may not be the only attribute to consider in determining a river's significance after degree of natural character (refer to Step 9 below), but it provides a starting point for such an analysis.

Significance assessment: As stated above, for rivers in this category, it would be necessary to calibrate them against rivers nationwide using nationally agreed criteria and terms.

Rivers with high natural character (e.g.: Regionally Significant):
Rivers in this category would include the remaining rivers that scored between 35 and 40 and that are shorter than 50km. Furthermore, this would include rivers in the 'high' category scoring from 29 and 34 with a length greater than 20 kilometres.

Rivers with high to moderate natural character (e.g.: Locally Significant):
Rivers in this category would include all remaining rivers scoring from 29 and 34 which are shorter than 20 kilometres in length. It is unlikely that they are nationally or regionally significant in terms of their natural character. However, they may be important for other values.

Rivers with moderate, low and very low natural character (e.g.: not significant):
Rivers in these categories have moderate, low and very low natural character scores (below a score of and including 28). These rivers do not provide significant values in terms of their natural character.

Outcome

A list of rivers ranked by a scoring system from highest to lowest, which represents a significance ranking list. This is a separate study that will need to be determined following other regions' natural character assessment.

11.2.9 ***Step 9: Outline other factors relevant to the assessment of significance***
The significance of a river for its natural character may be influenced by a number of factors. The first factor, significance thresholds, outlines potential criteria that may be used to determine a river's significance:

1. Significance thresholds: Rarity, uniqueness or scarceness: The rarity/scarceness of a river at a national scale. This would require consideration of the river and its natural character in comparison with other rivers, not only in the region but on a national scale. Quantifiable measures regarding its scale would also be required.

   Integrity: This would be a measure of the river's wholeness and intactness. This would require an assessment of all the river's attributes which express its value at local, regional or national scale, based on nationally agreed criteria.

   Scale/number: The assessment of natural character can be scale dependant. Quantifiable data to include a rivers length, breadth, number of interconnecting tributaries (or lower ranking order streams) and size of catchment can influence a river's significance.
2. Quantitative GIS data: Need to experiment with objective and quantitative data to assess their usefulness and appropriateness. It is envisaged that there will be significantly more data available for a specific river where modification has occurred, such as for hydro developments or stop banks.
3. Makeup of Expert Panel: It is highly desirable that the following people are included on the Expert Panel:
   - Landscape Architect who is experienced with the concept of natural character and its statutory application;
   - River engineer who is highly familiar with the specific region's rivers. Skills in geomorphology or also critical;
   - Hydrologist, familiar with the territorial area;

	- Aquatic Ecologists/ conservationist (e.g., from DoC, Fish and Game) familiar with the ecology of the region's rivers.
4. Assessment research:	The Expert Panel undertook the assessment based on the current (and historic) make-up of the river and did not take into account approved (and not yet realised) or proposed activities to rivers.
5. Segmentation of rivers:	Many rivers within this study have been split at logical 'break points' based on their natural character. It was considered more appropriate to rank each river's segment rather than 'average' its degree of natural character where significant changes in natural character are apparent along a particular rivers course.

Natural character assessment requires knowledge of river processes. For example, a naturally empty channel in an ephemeral stream may appear visually similar to a dewatered channel resulting from a diversion. However, the consequence of the dry channel on the river's natural character will be very different. It is important that natural character is assessed differently from visual amenity or landscape assessments as naturalness does not always equate to attractiveness.

11.2.10 ***Step 10: Review Assessment Process and Identify Future Information requirements***

The assessment of the natural character of rivers has illustrated the lack of quantifiable data available. The data that is available greatly assist with indicator measurement; however, it is considered that additional data to further support the assessment would be desirable. This desirable data would include:

- Historical and up to date aerial photographs of all rivers within a territorial boundary;
- River flow data relating to all rivers;
- A current district-wide landscape assessment to assist with land-typing and land use change.

Appendix 11A-1
Credentials of the Expert Panel

Neil Deans BSc(Hons) Dip P&RM. Neil is the Manager of Nelson/Marlborough Fish and Game and through fulfilling this role also has intimate knowledge of Marlborough's river systems. He is also the Immediate Past President of the New Zealand Freshwater Sciences Society and is Resource Management Coordinator for Fish and Game New Zealand at a national level.

Pere Hawes BSoc Sci MRRP. Pere is the Manager of the Environmental Policy team at the Marlborough District Council. He has over 10 years of experience developing regional policy statement and regional plan provisions, including water plans. Through this work he has dealt with the application of RMA Section 6(a) to water resources in both Otago and Marlborough in a planning context.

Val Wadsworth NZCE (Civil). Val is the Marlborough District Council's Surface Water Hydrologist and as such has an extensive knowledge of Marlborough's river systems.

Brin Williman B.E., M.E., CPEng. Brin is Rivers and Drainage Engineer for Marlborough District Council and as such has intimate knowledge of Marlborough's rivers and their geomorphological features; especially those rivers that have been changed by diversions, gravel extraction, bank edge erosion protection, stop-banking and other river control works, and dams. Brin is also a member of NZ Hydrological Society

Allan Rackham DipLA MPhil FNZILA. Allan is a consultant landscape architect with 37 years of experience. He was managing director of Boffa Miskell (2000-2006) and head of landscape architecture at Lincoln University (1983-1985). He has appeared as an expert witness in many significant Environment Court and other hearings on river natural character including several W.C.Os and major water allocation projects. He led the MfE EPI investigations of coastal natural character and was author of the landscape sections of the MfE Flow Guidelines report. He has led the FRST funded perceptual values component of the NIWA water allocation research (2003-2009) and advised several regional councils on natural character issues in RPS and water plans.

James Bentley BA(Hons) DipLA CMLI. James is a Senior Landscape Architect with 10 years of experience and has been involved in a wide range of projects including undertaking landscape and visual assessments, plan changes and peer reviews for large scale infrastructure works, notably hydro dams and wind farms. James is currently working on the Marlborough District Landscape Study, which is essentially a review of the Regional and District Plans, therefore James is familiar with the rivers of Marlborough. James has written and given evidence at a number of hearings in New Zealand, including acting on behalf of the Department of Conservation for the Mokihinui Hydro Proposal, which amongst other issues, focused on RMA Section 6(a) and (b) components. James also peer reviewed the landscape and visual component of the Patea Re-consenting Hydro Scheme AEE in South Taranaki.

Peer Reviewers

Peter Hamill BSc PGDipSci. Peter is an Environmental Scientist at the Marlborough District Council, with 13 years of experience in the management and monitoring of freshwater resources in Marlborough. In his current position he is responsible for the management on monitoring of aquatic ecosystems for the Council. In this role Peter has worked in many of Marlborough's rivers and therefore has an in-depth knowledge of the varied types and forms of waterways found in the District. He is the author of 'Marlborough's Freshwater Flora and Fauna – A Field Guide'. He is also a member of the Marlborough District Council's Landscape working group that is responsible for the promotion of positive landscape outcomes for the district.

Dr Michael Stevens has postgraduate research qualifications in landscape architecture and a PhD in environment-behaviour studies. His specialisations include environmental perception, environmental experience, landscape and visual impact assessment, and the social sustainability of the built environment. He is familiar with the range of tools that can be applied to the survey and analysis of user behaviour in open space settings, and is skilled in the application of qualitative research techniques. In the course of his PhD research he developed a multi-dimensional cognitive mapping technique for investigating the environmental experience of recreational landscapes.

Michael is familiar with the range of tools that can be applied to the survey and analysis of user behaviour in open space settings and is skilled in the application of qualitative research techniques.

Michael has a particular interest in the natural character of coastal and rural landscapes, and the impact of development and land use change on natural character and landscape character generally. He has a broad knowledge of rural production systems and agricultural landscapes, and an appreciation of the changing patterns of rural landscapes in response to social, cultural and economic factors, and technological innovations.
A knowledge of landscape perception theory derived from academic research and field experience in landscape and visual impact assessment qualifies Michael to give expert witness evidence on coastal and rural landscape development issues before the Environment Court, a role to which he is able to bring a high degree of objectivity, critical analysis and rigour.

Appendix 11A-2
Assessment Criteria for Natural Character (Steps 2-5)

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
Step 2: Identify attributes and Step 3: Select and describe primary attributes		*Step 3: Select and describe primary attributes*	*Step 4: Identify indicators*	*Step 5: Determine significance thresholds*	
River Channel	**Channel shape**	Modification to cross section (e.g., slope-banks) and long section (e.g., cut through meanders). This also includes changes to a river bed width (e.g., narrowing of the channel), which is commonly undertaken in modified rivers with valuable land adjacent. Changes to the bed sediment should also be taken account of in this attribute.	Aerial photographs, river cross sections, changes in river width/ length and water allocation resource consents (where available). Judgement from Expert Panel was also required due to limited available data for all rivers.	Judgement made on a five-point scale: 1= Very Highly modified river, (i.e., straightened and channelised, often with concrete or rock fill banks) often within an urban context; 2= A highly modified channel shape or width but with semi natural reaches or channel shapes in some areas; 3= A river displaying a patchwork with moderate natural channel shape in places together with many human influences such as long stretches of stopbanks, groynes; 4= A highly natural river displaying occasional pockets or individual minor modifications to its channel shape (i.e., small stopbanks or groynes); 5= A very highly natural river with no or very few modifications to its channel shape.	Regional council, NIWA or other water quality data [i.e., GIS data]. Aerial photography.

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	Degree of modification of flow regime	Hydrological information on a river's low, median and mean flows assist in determining natural character. Substantial flow that appears to fit the nature and scale of the channel may suggest a higher degree of natural character. Dewatered bed or 'misfit' flows suggest upstream diversions, which reduce natural character.	Change to natural flow regime. % Flow rate modification (would show low flows). Would need to know the flow data for each river. Expert Panel judgement based on quantitative data available.	Judgement made on a five-point scale: 1= Very highly modified or diverted flow/ water-take (e.g., large-scale dams; take averaging 50% or more of median flow) 2= Highly modified or diverted flow (e.g., small-scale dams, irrigation or flood channels); 3= Moderately modified or diverted flow (e.g., several irrigation takes taking a moderate proportion of MALF); 4= Relatively low levels of modified or diverted flow (e.g., few irrigation takes taking minor proportion (<5%) of low flow); 5= Highly natural flow regime with no modifications to the flow pattern.	Regional council, NIWA or other water quality data
	Water Quality	Perception of the water quality, especially its clarity, colour, etc.	Information from council or other parties. Also judgement from Expert Panel taking account of visual and biological aspects where they apply, particularly water clarity, nutrient content, temperature, salinity and faecal coliforms.	Judgement made on a five point scale: 1= Very highly contaminated or permanently discoloured water displaying very high levels of human-induced changes to the water quality with limited life supporting capacity (e.g., within polluted urban/ industrialised areas or intensive farming); 2= Water usually displaying high levels of contamination mainly from adjacent diffuse sources from land use activities (agricultural leaching etc); 3= Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or at some times; 4= Water displaying relatively high levels of water quality with small or rare amounts of impurities caused further upstream (e.g., by occasional stock crossing or forest harvesting); 5= Highly natural water quality displaying no human	

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
				induced changes	
	Exposed riverbed	Extent of the exposed bed appropriate for river type (and flows) would assume higher natural character than one with unexpected areas of exposed bed not relating to flows.	Not all river types have exposed areas; depends on flow regime and nature of the channel. Furthermore, difficult to judge for a braided river.		
	Bed material substrate	Exposed bed material appropriate for river type (i.e., size, geology for type of flow)	Visible geological make up of the river substrate/ bed. Expert Panel judgement.		
	Exotic 'aquatic' flora and fauna within the river channel	Presence of aquatic flora and fauna within the river channel (including waterweeds, pest fish (which include trout and salmon), the eggs and fry of pest fish, and the invasive alga, e.g., didymo) can reduce the natural character of the river. This does not include vegetation on 'islands' within the river channel. This is contained under 'riparian vegetation'. Algal bloom may be evident in some rivers due to seasonal low flows. Expert ecological judgement will be required to assess extent and may have a bearing on the degree of naturalness of this primary attribute.	Expert Panel judgement, looking at volume, variety.	Judgement based on a five-point scale: 1= River system choked with exotic aquatic flora and fauna; 2= Large areas of introduced flora and fauna (including pest fish) evident (in approximately 75% of river); 3= Occasional stretches (some quite long) of introduced flora and fauna evident within waterway (approx. 50% of river); 4= Small, often isolated pockets of introduced flora and fauna evident(less than 20% of total river), however river displaying very high levels of naturalness; 5= No evidence of introduced flora or fauna within the water channel.	
	Structures and human modifications	Including dams, groynes, stopbanks, diversions, gravel extractions which may affect the level of natural	Expert Panel judgement based on knowledge of river, assisted by aerial	Judgement based on a five-point scale: 1= River channel completely modified or artificial (i.e., dam/ weir/ flood defence structure);	

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	within the river channel	character of the river channel.	photos, council GIS, REC and LCDB. Linear measurement/ % proportion of human modification.	2= Significant parts of the river channel have been affected or encroached upon by human intervention (i.e., a suburban/ highly managed agricultural land, including: gravel workings, part-channelisation); 3= Occasional 'reaches' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, pylon footing); 4= Limited human intervention (i.e., occasional bridge abutments/ power pole within the river channel); 5= Overwhelmingly natural with no/ very limited evidence of human interference.	
Riparian Edge	**Vegetation cover in the riparian edge**	Dominance of native communities in natural patterns (the presence of exotic species in natural patterns will reduce natural character but is of higher naturalness than the absence of such vegetation (unless this is natural) or the presence of planted vegetation). This includes all bankside vegetation as well as vegetation within 'islands', such as those within braided river systems. Vegetation comprises all types, including grasses, remnant scrub, shrubs and trees. In some instances, the natural elements and patterns indicate limited vegetation (i.e., high country rivers), where native grasses or herbs are the only form of vegetation in the area.	Proportion of native vegetation against other vegetation. Extent to which river processes have generated natural vegetation patterns. Expert Panel judgement based on REC (LCDB) and aerial photographs to assist in determining vegetation cover.	Judgement based on a five point scale: 1= Complete absence of vegetation due to human-induced changes (or limited presence (in pockets) of exotic vegetation such as occasional willow, gorse or buddleia); 2= Exotic vegetation with complete absence of native species within a pastoral/ semi urban setting; 3= Predominantly exotic vegetation in natural patterns (i.e., willows/ gorse) and/ or patches of remnant indigenous vegetation; 4= Fragmented areas of native and exotic vegetation in natural patterns. Predominance of native vegetation; 5= Overwhelmingly indigenous vegetation with no or few introduced species.	River Environment Classification system (REC), developed by NIWA (good)

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	Extent of exotic flora	Proliferation of exotic flora.	% of exotic vegetation on REC (LCDB)		
	Structures and human modifications in the riparian edge	Include bridges, roads. All potentially impact on the naturalness of a river. An absence of human modifications. However minor, structures particularly if constructed from natural or local materials may not influence natural character greatly, but will have a localised effect. The scale and nature of modifications will influence the effect on natural character.	Expert Panel judgement with potential to base it on LCDP and REC GIS layers. Linear measurement/ Number of structures.	Judgement based on a five-point scale: 1= Major modification to the riparian edge (i.e., dam/ weir/ flood defence structure); 2= Significant parts of the riparian edge have been affected by human intervention (i.e., a suburban/ highly managed agricultural land, including: gravel workings, part-channelisation, marinas); 3= Occasional 'pockets' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, boathouses); 4= Limited human intervention (i.e., occasional bridge/ power pole/ jetty); 5= Overwhelmingly natural with no/ very limited evidence of human interference.	River Environment Classification system (REC), developed by NIWA (good); Aerial photos LCDP (good)
Wider landscape character	**Character modifications**	Broader scale landscape modification beyond the immediate river margin, leaching from agricultural land, intensification of land use all impact on natural character. Protected natural areas such as reserves, parks and estates managed by DoC indicate a higher natural character. Catchment modifications if ecologically or visually linked to the waterway.	Expert Panel judgement based on intensification of land use adjacent to river (includes more distant views beyond the river banks). Expert Panel to rank from indigenous bush to urban scenarios. Use of LCDB and Landscape Assessments to inform decision.	Judgement based on a five-point scale: 1= Heavily modified landscape (urban or highly intensive setting) with limited vegetation; 2= Suburban/ highly managed agricultural landscape; 3= Settled pastoral landscape with areas of commercial forestry and pockets of indigenous vegetation; 4= Fragmented indigenous and rural landscape; 5= Overwhelmingly indigenous landscape with no or very little human modification.	District or regional wide Landscape Assessments

Appendix 11A-3
Assessment of indicators by SMARTA criteria

Primary attributes	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Channel Shape	Yes	Expert judgement. Overlay of aerial photos or earlier maps, where available	Potential data available	Known to influence river's naturalness	Potential data available	Not known
Degree of modification of flow regime	Yes	Current minimum flow/ natural MALF- would show low flows	Data available for most rivers in proportion to river's use	Known to influence river's naturalness	Data usually already available	Not known
Water Quality	Yes	Information from councils or other parties.	Potential data available	Known to influence river's naturalness	Data already available	Not known
Exotic 'aquatic' flora and fauna within the river channel	Yes	% of native vegetation within 50m buffer from waterway – LCDB	Data available	Known to influence river's naturalness	Data available	Not known
Structures and human modifications within the river channel	Yes	Number of structures within waterway (dams) including dams, bridge abutments etc – water allocation resource consents and regional council GIS database available where possible.	Councils often hold such data	One main indicator of natural character	Data available	Not known
Vegetation cover within the riparian margin	Yes	% of native vegetation within 50m buffer from waterway – LCDB	Data available	One main indicator of natural character	Data available	Not known
Structures and human modifications within the riparian margin	Yes	Number of structures along the waterway edges or % of modified banks, e.g., stopbanks – regional council GIS database available?	Councils often hold such data	One main indicator of natural character	Data available	Not known
Character modifications	Yes	% of native vegetation in LCDB or REC*	Data available	Known to influence rivers naturalness	Data available	Not known

Appendix 11A-4
Glossary of Terms

Attributes	Characteristics of a river (e.g., river bed morphology, riparian vegetation). In this research, there are attribute clusters (such as the three elements that form a riverscape: river channel, riparian margin and wider context) and eight primary attributes (that sit within the attribute clusters) which Include, channel shape, water quality, extent of native flora and fauna etc.)
Aquatic vegetation (In-stream flora)	Plants growing in the water (e.g., *Lagarosiphon*, didymo)
Braided River	Where the river flows in multiple interconnected and often shallow channels divided by deposited material
Indicator	A way to measure state of level of each of the listed attributes within the riverscape.
Landscape Context	The wider landscape through which the river passes
MALF	Mean Annual Low Flow
Riverscape	The term riverscape is used when referring to a river landscape. Thus use of this term implies more than visual concerns and embraces natural character and amenity attributes and includes the river channel, the riparian edge and the wider landscape in which the river is located.
River Channel	The actual wetted area of the river, including the watercourse and associated gravel areas within the river channel.
Riparian Edge	The river banks and area between the river channel and wider landscape often containing riparian vegetation which is influenced by the river
Riparian Vegetation	Plants within the riparian edge and including those colonizing 'islands' within rivers (such as braided rivers)
Single Channel (or thread)	Where the river generally flows in a single channel (as opposed to a braided river)
Values	The quality ascribed to an attribute
Wetted area (watercourse)	The actual water covered part of a river channel
Wider Landscape Context	Can vary from landscape to landscape, but generally comprises the immediate landscape surrounding the river. Can extend from riparian edge from 50m to more than 500m/ 1km although dependant on river.

Appendix 11A-5
Significance assessment calculations for natural character (Steps 1 and 5-8)

		River name and Project ID number																																		
		Rai/Pelorus					Sounds			Wairau & South tribs to Waihopai												Northbank				Southern Valleys & Plain								Awatere		
Attribute cluster	Primary attribute	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Upper Pelorus	Lower Pelorus	Rai	Wakamarina	Kaituna	Kenepuru	Graham River (Sounds stream)	Waitohi (excl Urban Picton)	Tuamarina	Wairau (Source to Bull Paddock Stream)	Wairau (Bull Paddock Stream to Branch)	Wairau (Branch to Waihopi)	Wairau (Waihopai to SH1)	Wairau (SH1 to mouth)	Branch (above weir)	Branch (below weir)	Wye	Leatham	Waihopai	Avon	Goulter	Top Valley	Onamalutu	Waikakaho	Omaka (above Tyntesfield Gorge)	Omaka (Gorge to Opawa conf)	Opawa (Omaka confl to Roses overflow)	Opawa (lower below Blenheim)	Opawa Loop	Spring Creek	Taylor River (above dam)	Taylor (Dam to Opawa confl)	Awatere (Source to Castle River)	Awatere (Castle River to Medway)	Awatere (below Medway)
River channel	River Shape	5	4	4	4	3	4	4	5	2	5	5	3	3	3	5	3	4	5	2	5	5	5	5	4	5	3	3	3	3	4	4	1	5	5	4
	Flow regime	5	4	3	5	4	5	5	3	3	5	4	3	3	1	5	1	5	5	2	5	5	5	5	4	5	4	1	2	1	4	4	4	5	5	3
	Water Quality	5	3	2	5	2	4	4	5	2	5	5	5	4	3	5	5	5	5	4	4	5	5	5	4	4	4	4	2	3	4	4	3	5	4	4
	Absence of exotic flora/ fauna	5	5	4	5	3	5	4	5	2	5	4	4	4	4	5	5	5	5	4	4	5	4	4	4	5	3	3	1	1	2	4	2	5	4	2
	Structures/ human modification	5	4	3	4	3	4	4	3	2	5	4	3	2	4	5	3	4	5	3	4	5	4	4	3	5	3	4	4	2	3	4	2	5	5	3
Riparian edge	Extent of native flora	5	3	3	5	3	4	4	5	2	4	3	3	3	3	5	4	4	5	3	4	5	3	3	3	4	2	2	2	2	3	3	3	4	4	3
	Structures/ human modification	4	3	3	4	3	4	4	4	2	4	4	4	2	2	5	4	3	5	4	4	5	4	3	3	4	2	2	3	2	2	4	2	4	5	4
Wider Landscape	Landscape character	4	2	2	4	2	4	4	5	2	4	3	3	2	2	3	3	4	3	3	4	5	3	3	3	4	2	2	3	2	3	3	2	4	4	3
	TOTAL	38	28	24	36	23	34	33	35	17	37	32	28	23	22	38	28	34	38	25	34	40	33	32	28	36	23	21	20	16	25	30	19	37	36	26
	Significance Thresholds	N			R		L	L	R		N	R				R		L	R		L	R	L	L		R						L		N	N	

Notes:

Scoring for each Primary attribute:

1= Very highly modified (very low degree of natural character)
2= Highly modified (low degree of natural character)
3= Moderately modified (medium degree of natural character)
4= Low degree of modification (high degree of natural character)
5= Very Low or no modification (very high degree of natural character)

Significance thresholds:

N	Nationally significant	(35-40 and longer than 50 kilometres in length)*
R	Regionally Significant	(remaining 35-40 rivers shorter than 50 kilometres in length and those scoring from 29-34 with a length greater than 20 kilometres)
L	Locally Significant	(remaining 29-34 rivers)
	Not significant	(rivers 28 and below)

* River taken from source: Only three rivers (all segments of rivers) meet this threshold: Upper Pelorus (to Pelorus Bridge), Upper Wairau (to Bull Paddock Stre and Upper Awatere (Source to Medway)

Part B: Natural character in Tasman district: Application of the River Values Assessment System (RiVAS)

Debs Martin (Royal Forest and Bird Protection Society)
Neil Deans (Nelson-Marlborough Fish and Game)
Sue Brown (Federated Farmers)
Barbara Stuart (NZ Landcare Trust)
Martin Doyle (Tasman District Council)
Ken Hughey (Lincoln University)

11.3 Introduction

11.3.1 *Purpose*

This section presents the second application of the River Values Assessment System (RiVAS) to natural character (the first was a trial application in the Marlborough District – see Deans et al. Part A, Herein) in the Tasman District, undertaken during July-September 2010. The full method is outlined in Hughey et al. (Chapter 3, Herein) – this Tasman natural character report needs to be read in conjunction with the method and with Part A of this chapter.

11.3.2 *Process*

In applying the method to natural character in Tasman District the Expert Panel first appraised themselves of the Marlborough DC application to see if any further development of the system, within a different context, was necessary. Several modifications were discussed and subsequently accepted, namely:

- During the Tasman application it became clear that context was very important. The rivers of Tasman are subject to significantly different climatic, geomorphological, vegetation and hydrological influences to those of Marlborough. Consequently it is proposed that important and relevant context information be included in all applications of the method, not just for Natural Character.
- Geographically Tasman is an extremely diverse District. The approach used in this exercise has therefore distinguished between river reaches in public administered lands and those in private ownership and has often lumped together many similar smaller rivers flanking certain catchments. Lumping categories inherently runs the risk of 'averaging' scores when some of those rivers or tributaries within such groups may have a dam, or water take, for example, and others don't. Wherever possible, we have identified where these have occurred by way of a comment in the appropriate cell in the spreadsheet. The only alternative is to separate all these out. We have left an example of this problem in the form of a difference of view in respect of the lower Aorere channel shape (site 14). While we agreed that the river above Rockville is relatively unmodified (scoring 4), below Rockville it scores a 3. In the Marlborough application such cases were separated out into different reaches, while in Tasman they tended to be lumped together. Marlborough has the benefit however, outside the Sounds, of having far fewer rivers. In both regions, smaller rivers which lacked data or personal knowledge of the panellists were excluded from the analysis. Neither of these regions have many highly modified streams by comparison with more intensively farmed or urbanised regions, however.
- There was considerable discussion around the merits or otherwise of developing 'significance' scores for natural character. Ultimately the group was convinced by the argument that natural character in terms of section 6(a) of the RMA 1991 recognises that the protection of the natural character alongside water bodies (vis-a-vis, forests), is a matter of national importance

irrespective of 'value'. The point of the principle is to direct the appropriateness of development in those sites to the level of natural character which the water body (and its margin) holds. The relative ranking of natural character will also help guide decisions about resourcing and management effort. As a consequence 'national importance', 'regional importance', or 'local importance' has little meaning or utility compared for section 6(c) values where it is a requirement and does have utility.

- There was broad agreement around the primary attributes but some further work was needed on some indicator significance thresholds, specifically in terms of:
  - Channel shape - where a score of 5 was changed from "A very highly natural river with no or very few modifications to its channel shape" to "A very highly natural river with no modifications to its channel shape" – this was agreed because a score of 5 should apply an environment of pristine natural character;
  - Character modifications - where a score of 4 was changed from "Fragmented indigenous and rural landscape" to "Fragmented indigenous and rural landscape including a few areas of commercial exotic forestry" – this was agreed upon as the existing definition was too narrow.
- The Expert Panel was concerned also about the criteria used to assess relativity, in particular the inclusion of a distance criterion in the Marlborough evaluation. For Tasman and other applications this criterion is removed. It is a scale issue and comes down to the proportional effect of some alteration to natural character on the whole of a particular water body;
- Finally there was further discussion around the 1-5 scale used only for the natural character value (all others use 1-3 to reflect the local, regional, national importance range). It was agreed that consideration of the components of natural character requires consideration of matters on a 5 point scale, which would therefore be retained. Having said this, a comparative evaluation of converting 4-5 to 3; 3 to 2 and 2-1 to 1 made very little difference and might be used at a later date for other purposes[20].

11.3.3 *Preparatory step: Establish an Expert Panel and identify peer reviewers*

The Expert Panel for the natural character application in the Tasman District comprised Debs Martin, Neil Deans, Sue Brown, Barbara Stuart and Martin Doyle; advised by Ken Hughey (Lincoln University) who managed the case application. Credentials of the Expert Panel are provided in Appendix 11B-1.

11.4 Application of the method

11.4.1 *Step 1: Define river value categories and river segments*

River value context for natural character in Tasman

The natural character of rivers in Tasman District is highly diverse due to large variations in rainfall, geology and land use. All of the main rivers begin in pristine national or forest parks. Most rivers – with the exception of some on the western coast - flow through channels which have been altered to some degree, and all are surrounded by farmland in their lower reaches. Untouched natural landscape is apparent in at least some part of the upstream vista for most reaches of all rivers. Water quality, especially clarity, is often exceptional in the public conservation estate. These extensive tracts of Tasman rivers have very little, if any, sign of human modification.

To the south are the mid and upper sections of the large Buller catchment which flows through alluvial flats in the upper section, then through intermittent gorges of incised rock. Large tracts of the upper watershed are contained with two separate National Parks. Flows are large and relatively unaltered by man.

20 For example within the FRST funded C09X1003 research project entitled: Integrated Valuation and Monitoring Framework for Improved Freshwater Outcomes, which runs from 2010-2013 and which draws extensively from this project work.

Smaller streams feature throughout the District, and some, like those within Abel Tasman National Park, flow through largely unmodified indigenous vegetation to the sea. Short rivers on the west coast are largely contained within Kahurangi National Park, and this dominates their natural character.

The Takaka catchment is known for its diverse geology, with karst features dominating in the mid and lower reaches. The marble geology has resulted in Te Waikoropupu Springs, the largest in NZ. A large hydro reservoir was built in the Cobb tributary and flows in the lower reaches are greatly modified by hydro power operations.

The Richmond Forest Park headwaters of the eastern stretch of the Motueka produce river water of exceptional clarity. The western side largely drains from Kahurangi National Park (including resurgence through the marble on the Arthur Range and is pristine in nature. Forestry and farming dominate land-use through the central band of the catchment right to the sea.

Richmond Forest Park provides a backdrop to forestry and farming on the eastern side of the District, and these land-uses set the natural character for the Waimea River, which becomes increasingly modified down its length, particularly in shape and river flow.

River segments

Based on the above it was decided to clump rivers as appropriate (typically smaller catchments flowing directly to the sea through pastoral or native vegetation dominant habitats), and to split where appropriate (e.g., in large catchments with multiple land uses and land tenures, and where also there were major geographical differences. This rationale kept the application manageable, i.e., ultimately 43 units were evaluated by the Expert Panel.

11.4.2 ***Step 2: Identify attributes***

Attributes, are the facets of the natural character river value. The same attributes as used by Deans et al. (Part A, herein) for Marlborough were considered here.

11.4.3 ***Step 3: Select and describe primary attributes***

The same eight primary attributes used by Deans et al. (herein) are used here and appear as part of Appendix 11B-2 and 11B-3.

11.4.4 ***Step 4: Identify indicators***

The same indicators used by Deans et al. (herein) are used here and appear as part of Appendix 11B-2 and 11B-3.

11.4.5 ***Step 5: Determine indicator thresholds***

Thresholds are applied to an indicator to determine very high, high, medium and low and very low relative importance for that indicator. Thresholds are defined by real data, e.g., for native bird habitat distinctiveness: 1= low; 2= medium; 3= high. Threshold data result from the following assessment:

1. Habitat type or species assemblage/presence widely represented elsewhere in NZ;
2. Habitat type or species assemblage/presence rarely represented elsewhere in NZ; and
3. Habitat type or species assemblage/present not represented in other regions in.

11.4.6 ***Step 6: Apply indicators and indicator thresholds***

Most indicators were assessed using Expert Panel based survey data (see Appendix 11B-3) - this step involved entering data from the relevant data sources (primarily the experts).

11.4.7 *Step 7: Weighting of primary attributes*

The Expert Panel reviewed the eight primary attributes and considered whether some made a relatively greater contribution to natural character as a whole. In the case of natural character, it was considered that all attributes chosen made an equal contribution. The decision was reached, as per the Marlborough (Deans et al. Part A, herein) application to keep weightings equal.

11.4.8 *Step 8: Determine river importance*

Step 8a: Rank rivers

The spreadsheet in Appendix 11B-3 was used to sum the indicator threshold scores for each river. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. This provided the list of rivers ranked by their relative importance scores.

Step 8b: Identify river importance

Using the list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores.

Each of the 8 attributes was ranked in relative importance from 1 to 5, with a score of 5 signifying the most natural character. The highest possible score a river or reach can obtain is 40, and the lowest is 8, and the range of scores is therefore 32.

To obtain relativity between scores, they were graded into 5 classes, the middle classes spanning a score of 8. The two classes at the end of the scale range over 4 numbers which reflects both the extreme nature of these scores and that it's not possible to get below 8 or greater than 40.

Midpoints for each class were calculated beginning with the 'average' class centred on the mid-point value of 24 which is ½ way between the lowest possible score of 8 and the greatest score of 40.

The arithmetic requires that one class should have a range of 9, and this was applied to the middle class to prevent biasing either end.

Thus, consistent with the above and as per the modifications made to the Marlborough approach the following criteria were applied to defining relative importance within the Appendix 11B-3 evaluation:

Total score	Degree of naturalness	Relative natural character ranking
37-40	Most natural	Very high
29-36		High
20-28	Average	Moderate
12-19		Low
8- 11	Least natural	Very low

11.4.9 *Step 9: Outline other factors relevant to the assessment of importance*

In future applications team membership should include a landscape architect/landscape ecologist or equivalently qualified expert experienced with natural character.

11.4.10 *Step 10: Review assessment process and identify future information requirements*

No matters arose in relation to this work.

References

Deans, N., Wadsworth, V., Williman, B., Hawes, P., Rackham, R. and Bentley, J. (herein). *Natural Character: Application of the River Significance Assessment Method to Marlborough District*.

Hughey, K., Booth, K., Deans, N., and Baker, M-A. (herein). *Chapter 3, A significance assessment method for river values*.

Appendix 11B-1
Credentials of the Expert Panel members

The Expert Panel comprised five members, and the facilitator Ken Hughey. Their credentials are:

Neil Deans BSc (Hons); Dip P&RM. Neil is the Manager of Nelson/Marlborough Fish and Game and has a national Resource Management Coordinator role. He is intimately familiar with many water bodies throughout the country, having undertaken field work from Stewart Island to Northland over a 25 year career. He has written or presented many papers, articles and reports on freshwater fisheries, wildlife, outdoor recreation and conservation here and overseas. He is the Immediate Past President of the New Zealand Freshwater Sciences Society and has provided advice to many national projects, including Water Conservation Orders on the Buller and Motueka; a review of the Dairying and Clean Streams Accord; is on the Waimea Water Augmentation Committee; advised on National Environmental Standards for Ecological Flows and Plantation Forestry; been involved with the integrated catchment management research project on the Motueka River; is on the Advisory Board for Lincoln/Canterbury Universities Waterways Centre and helps oversee Canterbury's Land Use and Water Quality Project. He has been heavily involved in the recent collaborative processes of the Land and Water Forum.

Sue Brown is chair of the dairy section of Golden Bay Federated Farmers.

Barbara Stuart is the Top of the South representative for New Zealand Landcare Trust. She has encouraged and assisted in the setting up of many landcare groups across the region to address water quality issues and has a wide knowledge of Tasman District Council rivers.

Debs Martin has worked for Royal Forest & Bird Protection Society of NZ (Inc) for the past 6 years as a Field Officer in the Top of the South Island. She has a Masters degree in Geography (1st class honours) from Canterbury University. Some of her post-graduate research focussed on the geomorphologies of braided river systems. Along with a past history as a raft guide, Debs has a broad knowledge of both the rivers and the flora and fauna within and alongside.

Martin Doyle NZCS (Water Science), Grad Dip (Hydrology). Through his role as Co-ordinator of Environmental Monitoring for Council, Martin has collected water flow and water quality information from Tasman rivers for 30 years, and is the principal analyst of hydrological data for Council. He also holds district wide responsibility for flood warning. Through work or personal pursuits he has waded through or travelled alongside considerable reaches of most rivers in the district.

Ken Hughey is Professor of Environmental Management at Lincoln University. His expert knowledge of multiple aspects of freshwater management spans the period 1981-2010. Ken is the project leader of the river values work and has co-authored many of the reports and conference papers concerning this work.

Appendix 11B-2
Assessment Criteria for Natural Character (Steps 2-5)

Attribute clusters	**Attribute (primary attributes in bold)**	**Description of Primary Attributes**	**Indicators**	**Indicator Significance Thresholds**	**Data Sources (and reliability)**
Step 2: Identify attributes and Step 3: Select and describe primary attributes		*Step 3: Select and describe primary attributes*	*Step 4: Identify indicators*	*Step 5: Determine significance thresholds*	
River Channel	**Channel shape**	Modification to cross section (e.g., slope-banks) and long section (e.g., cut through meanders) .This also includes changes to a river bed width (e.g., narrowing of the channel), which is commonly undertaken in modified rivers with valuable land adjacent. Changes to the bed sediment should also be taken account of in this attribute.	Aerial photographs, river cross sections, changes in river width/ length and water allocation resource consents (where available). Judgement from Expert Panel was also required due to limited available data for all rivers.	Judgement made on a five-point scale: 1= Very Highly modified river, (i.e., straightened and channelised, often with concrete or rock fill banks) often within an urban context; 2= A highly modified channel shape or width but with semi natural reaches or channel shapes in some areas; 3= A river displaying a patchwork with moderate natural channel shape in places together with many human influences such as long stretches of stopbanks, groynes; 4= A highly natural river displaying occasional pockets or individual minor modifications to its channel shape (i.e., small stopbanks or groynes); 5= A very highly natural river with no modifications to its channel shape.	Regional council, NIWA or other water quality data [i.e., GIS data]. Aerial photography.

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	Degree of modification of flow regime	Hydrological information on a river's low, median and mean flows assist in determining natural character. Substantial flow that appears to fit the nature and scale of the channel may suggest a higher degree of natural character. Dewatered bed or 'misfit' flows suggest upstream diversions, which reduce natural character.	Change to natural flow regime. % Flow rate modification (would show low flows). Would need to know the flow data for each river. Expert Panel judgement based on quantitative data available.	Judgement made on a five-point scale: 1= Very highly modified or diverted flow/ water-take (e.g., large-scale dams; take averaging 50% or more of median flow) 2= Highly modified or diverted flow (e.g., small-scale dams, irrigation or flood channels); 3= Moderately modified or diverted flow (e.g., several irrigation takes taking a moderate proportion of MALF); 4= Relatively low levels of modified or diverted flow (e.g., few irrigation takes taking minor proportion (<5%) of low flow); 5= Highly natural flow regime with no modifications to the flow pattern.	
	Water Quality	Perception of the water quality, especially its clarity, colour, etc.	Information from council or other parties. Also judgement from Expert Panel taking account of visual and biological aspects where they apply, particularly water clarity, nutrient content, temperature, salinity and faecal coliforms.	Judgement made on a five point scale: 1= Very highly contaminated or permanently discoloured water displaying very high levels of human-induced changes to the water quality with limited life supporting capacity (e.g., within polluted urban/ industrialised areas or intensive farming); 2= Water usually displaying high levels of contamination mainly from adjacent diffuse sources from land use activities (agricultural leaching, etc.); 3= Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or at some times; 4= Water displaying relatively high levels of water quality with small or rare amounts of impurities caused further upstream (e.g., by occasional stock crossing or forest harvesting); 5= Highly natural water quality displaying no human induced changes	Regional council, NIWA or other water quality data

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	Exposed riverbed	Extent of the exposed bed appropriate for river type (and flows) would assume higher natural character than one with unexpected areas of exposed bed not relating to flows.	Not all river types have exposed areas; depends on flow regime and nature of the channel. Furthermore, difficult to judge for a braided river.		
	Bed material substrate	Exposed bed material appropriate for river type (i.e., size, geology for type of flow)	Visible geological make-up of the river substrate/ bed. Expert Panel judgement.		
	Exotic 'aquatic' flora and fauna within the river channel	Presence of aquatic flora and fauna within the river channel (including waterweeds, pest fish (which include trout and salmon), the eggs and fry of pest fish, and the invasive alga, e.g. didymo) can reduce the natural character of the river. This does not include vegetation on 'islands' within the river channel. This is contained under 'riparian vegetation'. Algal bloom may be evident in some rivers due to seasonal low flows. Expert ecological judgement will be required to assess extent and may have a bearing on the degree of naturalness of this primary attribute.	Expert Panel judgement, looking at volume, variety.	Judgement based on a five-point scale: 1= River system choked with exotic aquatic flora and fauna; 2= Large areas of introduced flora and fauna (including pest fish) evident (in approximately 75% of river); 3= Occasional stretches (some quite long) of introduced flora and fauna evident within waterway (approx. 50% of river); 4= Small, often isolated pockets of introduced flora and fauna evident(less than 20% of total river), however river displaying very high levels of naturalness; 5= No evidence of introduced flora or fauna within the water channel.	
	Structures and human modificati ons within the river	Including dams, groynes, stopbanks, diversions, gravel extractions which may affect the level of natural character of the river channel.	Expert Panel judgement based on knowledge of river, assisted by aerial photos, council GIS, REC and LCDB. Linear measurement/ %	Judgement based on a five-point scale: 1= River channel completely modified or artificial (i.e., dam/ weir/ flood defence structure); 2= Significant parts of the river channel have been affected or encroached upon by human intervention (i.e., a suburban/ highly managed agricultural land,	

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	channel		proportion of human modification.	including: gravel workings, part-channelisation); 3= Occasional 'reaches' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, pylon footing); 4= Limited human intervention (i.e., occasional bridge abutments/ power pole within the river channel); 5= Overwhelmingly natural with no/ very limited evidence of human interference.	
Riparian Edge	**Vegetation cover in the riparian edge**	Dominance of native communities in natural patterns (the presence of exotic species in natural patterns will reduce natural character but is of higher naturalness than the absence of such vegetation (unless this is natural) or the presence of planted vegetation). This includes all bankside vegetation as well as vegetation within 'islands', such as those within braided river systems. Vegetation comprises all types, including grasses, remnant scrub, shrubs and trees. In some instances, the natural elements and patterns indicate limited vegetation (i.e., high country rivers), where native grasses or herbs are the only form of vegetation in the area.	Proportion of native vegetation against other vegetation. Extent to which river processes have generated natural vegetation patterns. Expert Panel judgement based on REC (LCDB) and aerial photographs to assist in determining vegetation cover.	Judgement based on a five point scale: 1= Complete absence of vegetation due to human-induced changes (or limited presence (in pockets) of exotic vegetation such as occasional willow, gorse or buddleia); 2= Exotic vegetation with complete absence of native species within a pastoral/ semi urban setting; 3= Predominantly exotic vegetation in natural patterns (i.e., willows/ gorse) and/ or patches of remnant indigenous vegetation; 4= Fragmented areas of native and exotic vegetation in natural patterns. Predominance of native vegetation; 5= Overwhelmingly indigenous vegetation with no or few introduced species.	River Environment Classification system (REC), developed by NIWA, (good)
	Extent of exotic flora	Proliferation of exotic flora.	% of exotic vegetation on REC (LCDB)		
	Structures and human modificati	Include bridges, roads. All potentially impact on the naturalness of a river. An absence of human modifications. However minor, structures particularly if	Expert Panel judgement with potential to base it on LCDP and REC GIS layers. Linear	Judgement based on a five-point scale: 1= Major modification to the riparian edge (i.e., dam/ weir/ flood defence structure); 2= Significant parts of the riparian edge have been	River Environment Classification system

Attribute clusters	Attribute (primary attributes in bold)	Description of Primary Attributes	Indicators	Indicator Significance Thresholds	Data Sources (and reliability)
	ons in the riparian edge	constructed from natural or local materials may not influence natural character greatly, but will have a localised effect. The scale and nature of modifications will influence the effect on natural character.	measurement/ Number of structures.	affected by human intervention (i.e., a suburban/ highly managed agricultural land, including: gravel workings, part-channelisation, marinas); 3= Occasional 'pockets' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, boathouses); 4= Limited human intervention (i.e., occasional bridge/ power pole/ jetty); 5= Overwhelmingly natural with no/ very limited evidence of human interference.	(REC), developed by NIWA, (good); Aerial photos LCDP (good)
Wider landscape character	**Character modifications**	Broader scale landscape modification beyond the immediate river margin, leaching from agricultural land, intensification of land use all impact on natural character. Protected natural areas such as reserves, parks and estates managed by DoC indicate a higher natural character. Catchment modifications if ecologically or visually linked to the waterway.	Expert Panel judgement based on intensification of land use adjacent to river (includes more distant views beyond the river banks). Expert Panel to rank from indigenous bush to urban scenarios. Use of LCDB and Landscape Assessments to inform decision.	Judgement based on a five-point scale: 1= Heavily modified landscape (urban or highly intensive setting) with limited vegetation; 2= Suburban/ highly managed agricultural landscape; 3= Settled pastoral landscape with areas of commercial forestry and pockets of indigenous vegetation; 4= Fragmented indigenous and rural landscape including a few areas of commercial exotic forestry; 5= Overwhelmingly indigenous landscape with no or very little human modification.	District or regional wide Landscape Assessments

Appendix 11B-3
Significance assessment calculations for natural character (Steps 1 and 5-8)

River name and Project ID number			Attribute cluster: River channel – Primary attribute: River Shape	Flow regime	Water Quality	Absence of exotic flora/ fauna	Structures/ human modification	Riparian edge: Extent of native flora	Structures/ human modification	Wider Landscape: Landscape character	TOTAL (1-5 scale)	Significance
Upper Buller	1	South of mainstem - above road ends/in CL	5	5	5	5	5	5	5	5	40	Very high
	2	North of mainstem - above road ends/in CL	5	5	5	5	5	5	5	5	40	Very high
Mid Buller	3	Mainstem Rotoiti to TDC boundary	4	4	4	4	3	4	3	4	30	High
	4	Maruia	5	5	4	4	4	4	4	4	34	High
	5	Matakitaki	4	4	3	4	4	3	3	4	29	High
	6	Mangles	5	4	3	4	4	3	3	4	30	High
	7	Gowan	4	5	5	4	4	4	4	4	34	High
	8	Hope	4	3	4	4	4	5	3	4	31	High
	9	Owen	4	4	4	4	4	3	3	4	30	High
	10	Matiri	4	2	4	4	4	4	4	4	30	High
West Coast	11	Rural coastal (including Whanganui Inlet)	4	4	4	5	4	3	4	4	32	High
	12	Protected (CL & covenants) land rivers	5	5	5	5	4	5	5	5	39	Very high
Upper Aorere	13	Upper Aorere: Includes Quartz Range, Mainstem & tributaries to Browns Hut (Clark confluence), Nth Tributary CL	5	5	5	5	4	5	5	5	39	Very high
Lower Aorere	14	Mainstem Reach sea to Browns Hut	3, 4	5	4	4	4	4	4	4	29	High
	15	Lowland Aorere Tributaries (farmland)	4	4	3	4	2	3	2	4	26	Moderate
Takaka	16	KNP rivers from Parapara to Rangihaeta	5	4	5	5	4	5	4	5	37	Very high
	17	Streams coastal and rural from Parapara to Rangihaeta, west side	4	4	3	4	2	3	2	4	26	Moderate
	18	Upper Takaka KNP incl. Above Cobb reservoir	5	4	5	5	4	5	4	5	37	Very high
	19	Te Waikoropupu Springs and river	4	1	3	3	3	3	3	3	23	Moderate
	20	Motupipi	3	2	2	3	2	2	2	2	18	Low
	21	Takaka eastern tributaries up to and including Waitui at confluence	4	3	4	4	4	4	4	4	31	High
	22	Takaka mainstem below Waitui confluence. to sea	3	1	3	3	3	2	2	3	20	Moderate
	23	Takaka mainstem below powerhouse and lower Cobb below reservoir to Waitui confluence	3	1	3	3	3	3	3	4	23	Moderate
Abel Tasman NP rivers	24	Including Wainui and all in NP	5	5	4	5	5	4	4	5	37	Very high
	25	Marahau & Otuwhero outside NP	4	4	4	4	4	2	3	3	28	Moderate
Riwaka	26	Upper - boundary native vegetation	5	5	5	5	5	5	5	5	40	Very high
	27	Lower - bound is native vegetation	3	3	4	4	3	3	2	3	25	Moderate
Motueka	28	West Bank-Arthur Range exotic forestry	4	4	3	4	4	3	3	3	28	Moderate
	29	West Bank-Arthur Range to but not including Wangapeka - native forest	5	5	5	5	5	5	4	5	39	Very high
	30	Upper Wangapeka (in NP)	5	5	5	4	5	5	5	5	39	Very high

	31	Lower Wangapeka (includ Sherry) and Tadmor	4	4	4	4	4	3	3	3	29	High
	32	Upper Motueka above Blue Glen	5	5	5	4	5	5	5	5	39	Very high
	33	Motueka mainstem from Blue Glen to Wangapeka confluence	3	3	4	4	4	2	2	3	25	Moderate
	34	Motueka mainstem from Wangapeka confluence to sea	3	4	4	4	4	3	3	3	28	Moderate
	35	Mid Motueka tributaries - above Dove and including Blue Glen and Motupiko	4	3	4	4	3	3	3	3	27	Moderate
	36	Lower Motueka eastern tributaries - including Dove to the sea	4	3	4	4	3	3	2	3	26	Moderate
Moutere	37	Moutere tributaries and coastal streams on Moutere-Waimea plain	2	2	3	3	2	2	2	2	18	Low
	38	Moutere mainstem to top of 'NZ Company Ditch' from sea	1	2	3	3	1	2	2	2	16	Low
Tasman Bay Springs	39	Motueka-Richmond, e.g., Pearl Ck, Neimans	3	3	4	3	2	3	2	2	22	Moderate
Waimea	40	Upper eastern tributaries in native forest, including CL	5	4	5	5	5	5	5	5	39	Very high
	41	Mid - eastern foothills in production/farm	4	3	4	4	3	3	3	3	27	Moderate
	42	Mid - Moutere gravels = Wai-Iti	3	3	3	3	2	3	2	2	21	Moderate
	43	Lower Waimea from Wairoa gorge down	2	2	4	4	2	2	2	2	20	Moderate

Key to rankings:

Total score	**Relative importance ranking**
37-40	Very high
29-36	High
20-28	Moderate
12-19	Low
8- 11	Very low

[i] From Canterbury Strategic Water Study
[ii] Average Annual Rainfall (mm) over irrigable area (nearest rainfall site)
[iii] From Canterbury Strategic Water Study. Some areas assigned by expert opinion
[iv] with 1 being low risk and 5 being high risk (expert assessment)
[v] Bypass solution ranking from % of irrigable area (maps from CSWS)
[vi] Socio-economic benefit -ranking 1 (low) - 3 (high) Expert assessment
[vii] Irrigated area and size of resource cubed, reliability soil moisture and alternative supply +50%, remainder aggregated. Weighting for irrigable area and size of resource only applies if Soil Moisture deficit is >1, otherwise they receive a 50% weighting.
[viii] National - irrigated area 3, size of resource 3, soil moisture deficit 2 or greater. Local - resource size = 1, irrigated area = 1 or no soil moisture deficit. Remainder regional
[ix] Expert opinion and various prefeasibility studies
[x] Average Annual Rainfall (mm) over irrigable area (nearest rainfall site)
[xi] From GIS
[xii] with 1 being low risk and 5 being high risk (expert assessment)
[xiii] Alternative supply ranking from expert opinion
[xiv] Socio-economic benefit -ranking 1 (low) - 3 (high) Expert assessment
[xv] Irrigated area and size of resource cubed, reliability soil moisture and alternative supply +50%, remainder aggregated. Weighting for irrigable area and size of resource only applies if Soil Moisture deficit is >1, otherwise they receive a 50% weighting.
[xvi] National - irrigated area 3, size of resource 3, soil moisture deficit 2 or greater. Local - resource size = 1, irrigated area = 1 or no soil moisture deficit. Remainder regional