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**Methodology and analysis tool to  
identify tangata whenua cultural flows  
for the Te Arai river catchment**

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**NIWA Client Report: HAM2010-036  
April 2010**

**NIWA Project: ELF10238**

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# **Methodology and analysis tool to identify tangata whenua cultural flows for the Te Arai river catchment**

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**Dr Gail Tipa  
Dr Charlotte Severne**

*NIWA contact/Corresponding author*

**Dr Charlotte Severne**

*Prepared for*

**Gisborne District Council**

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National Institute of Water & Atmospheric Research Ltd  
301 Evans Bay Parade, Greta Point, Wellington  
Private Bag 14901, Kilbirnie, Wellington, New Zealand  
Phone +64-4-386 0300, Fax +64-4-386 0574  
[www.niwa.co.nz](http://www.niwa.co.nz)

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*Reviewed by:*

D. Roper

*Approved for release by:*

C. Howard-Williams

*Formatting checked*

*A. Bartley*

# 1. Introduction

## 1.1 Background

Māori have, for generations, voiced their concerns at the continual modification and manipulation of the waterways within their tribal territories (Waitangi Tribunal 1984, 1991, 1992, 1995, 1998). Many streams and rivers are degraded as a result of what Māori perceive as inappropriate use and development. Of particular concern is the level of extraction from waterways and the perceived inappropriateness of manipulated stream flows. In the last two decades Māori have become more vocal in seeking greater recognition of their cultural beliefs, values, and practices. The challenge Māori confront is to convey to decision makers how allocative decisions affect their cultural interests since many of the existing methods of assessing flows are dominated by western science techniques which emphasise physical and biological values rather than specifically responding to cultural needs. If the needs of Māori are to be seriously considered and weighed alongside the needs of other populations, and if environmental flow assessments and allocative decision-making are to benefit from the knowledge of whānau, hapū and iwi, new techniques are needed to assess the appropriateness of flows in culturally sensitive ways. This report explores ways in which councils could effectively incorporate the knowledge held within whānau, hapū and iwi to inform the Gisborne District's Regional Water Plan, in particular water allocation provisions.

The Gisborne District Council, Rongowhakata and NIWA project team looked at the Te Arai River catchment for the development of a methodology for assessing how Māori Traditional knowledge or Mātauranga Māori could inform the District's Regional Water Plan. The Te Arai River flows generally north from its origins in rough hill country 20 kilometers north of Nuhaka before veering northeast past the township of Manutuke to reach the Waipaoa River five kilometers from the latter's outflow into Poverty Bay. Although, largely untouched in its upper reaches prior to the Gisborne District supply abstraction, there are further modifications to channel and from abstractions in the lower reaches.

## 1.2 Purpose of the report

The purpose the report is to:

- Describe the methodology that we recommend to collect and analyse data directly related to Mātauranga Māori as defined by tangata whenua that can inform the Gisborne Regional Water Plan, in particular water allocation provisions.

## 2. Mātauranga Māori<sup>1</sup>

Initiatives to document Mātauranga Māori have grown exponentially in the last twenty years, reflecting a parallel increase in its perceived value as a contributor to sustainable management of New Zealand’s natural and physical resources. This trend reflects global changes as locally-distinctive systems of knowledge, belief and practice are seen to represent a richness of basic and practical information about the environment, its components and the relationships among them<sup>2</sup>. For many indigenous communities this knowledge constitutes a major “asset”. Arguably, the call for a responsive regional water plan specific to the Te Arai that are driven by Mātauranga Māori represents a significant new phase in the valuation of Mātauranga Māori regionally. The commitment of Gisborne District Council (GDC) to this innovation is acknowledged. But determining how Mātauranga Māori can inform development of a responsive regional water plan framework is a challenge confronting the project team. It will be necessary to identify explicitly for the GDC, whānau, hapū and iwi how it is possible to accommodate Mātauranga Māori within the regional water plan framework including providing a clear and systematic basis for tracking implementation over time. The data collection phase has to ensure that it can inform the formulation of the regional water plan so that is responsive to and incorporates Mātauranga Māori.

Given the inherent difficulties of defining Mātauranga Māori in absolute terms, the project team did not attempt to define “Mātauranga Māori” before or during the hui to be held with Iwi. It will be for whānau and hapū attending the hui to describe, and in effect define, their relationship with Te Arai. When participants talk of their personal

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<sup>1</sup> Criteria used to define indigenous knowledge include the following - 1. Local: It is rooted to a particular place and set of experiences and is generated by the people living in those places. 2. Oral and Visual transmission: It is transmitted orally or through imitation and demonstration, and also may be acquired through personal observations and experience. The mode of transmission is usually informal, based on participation in a range of customary activities, closely tied to the cultural and ecological context(s) in which it occurs. 3. Practical: It is the consequence of practical engagement in everyday life and is adapted or reinforced by experience, trial and error, and experiment. The lessons learned from these experiences are often accumulated and passed along from one generation to the next. 4. Repetitive: This is a defining characteristic, aiding retention and reinforcing ideas. 6. Dynamic: It changes, being produced as well as transformed, discovered or lost. This represents its practical responsiveness and connection to other characteristics of the surrounding social and physical environment. When the environmental context changes, indigenous knowledge like Mātauranga Māori will usually be impacted. 7. Shared: It is characteristically shared to a greater degree than other forms of knowledge even though its distribution within communities is uneven with some types of knowledge more widely disseminated than others. 8. Fragmentary: It is differentially distributed among community members. 9. Functional: It is organized and oriented toward the pragmatic fulfillment of identifiable goals, which specific to this project include health and well-being. 10. Holistic: It is integrated and situated within broader cultural traditions.

<sup>2</sup> Menzies (2006)

experiences of Te Arai, their interactions, and how this compares with their understandings of Te Arai environment that earlier generations lived and interacted with, they in fact present their Mātauranga that has evolved. Mātauranga Māori is place-based, dynamic, and responsive to ecosystem changes when and where they happen. Environmental knowledge, or more specifically knowledge of Te Arai River, refers to the subset of Mātauranga Māori that is specific to Te Arai environs and the relationship of whānau, hapū and iwi to it. This is broadly conceived as encompassing knowledge of entities (sites, species, eco-regions), components (e.g. soils, waters, geology, climate), the interrelationships among these, and the processes affecting them (including human-made impacts). Because such knowledge is geared toward the practical engagement of it, it is often bound together with resource utilization behaviours. At the same time, vital aspects of it may be intimately associated with spiritual beliefs, notions of health and wellness, social behaviours, and symbolic expressions. Because of the demarcation of environmental knowledge from other kinds of Mātauranga Māori can be somewhat ambiguous and arbitrary. The project team therefore will work with the complete data set rather than applying a filter in an attempt to isolate environmental knowledge

Finally, the utilisation of participatory methods reflects the preference of the Project Team to understand the significance of Mātauranga Māori from the perspective of whānau and hapū as for many, Mātauranga Māori is the time-tested basis for their decision-making. The initial hikoī and the written statements that were provided to Severne & Tipa at the hui confirm the integration of Mātauranga Māori with their total way of life, and their belief that it is their right to have a healthy river that enables them to keep their Mātauranga as an essential part of their culture, organization, spirituality, and identity.

### 3. Overview of the recommended method

In the paragraphs that follow we present steps that would enable Mātauranga Māori to inform a flow assessment process that could be incorporated in the Regional Plan. We describe:

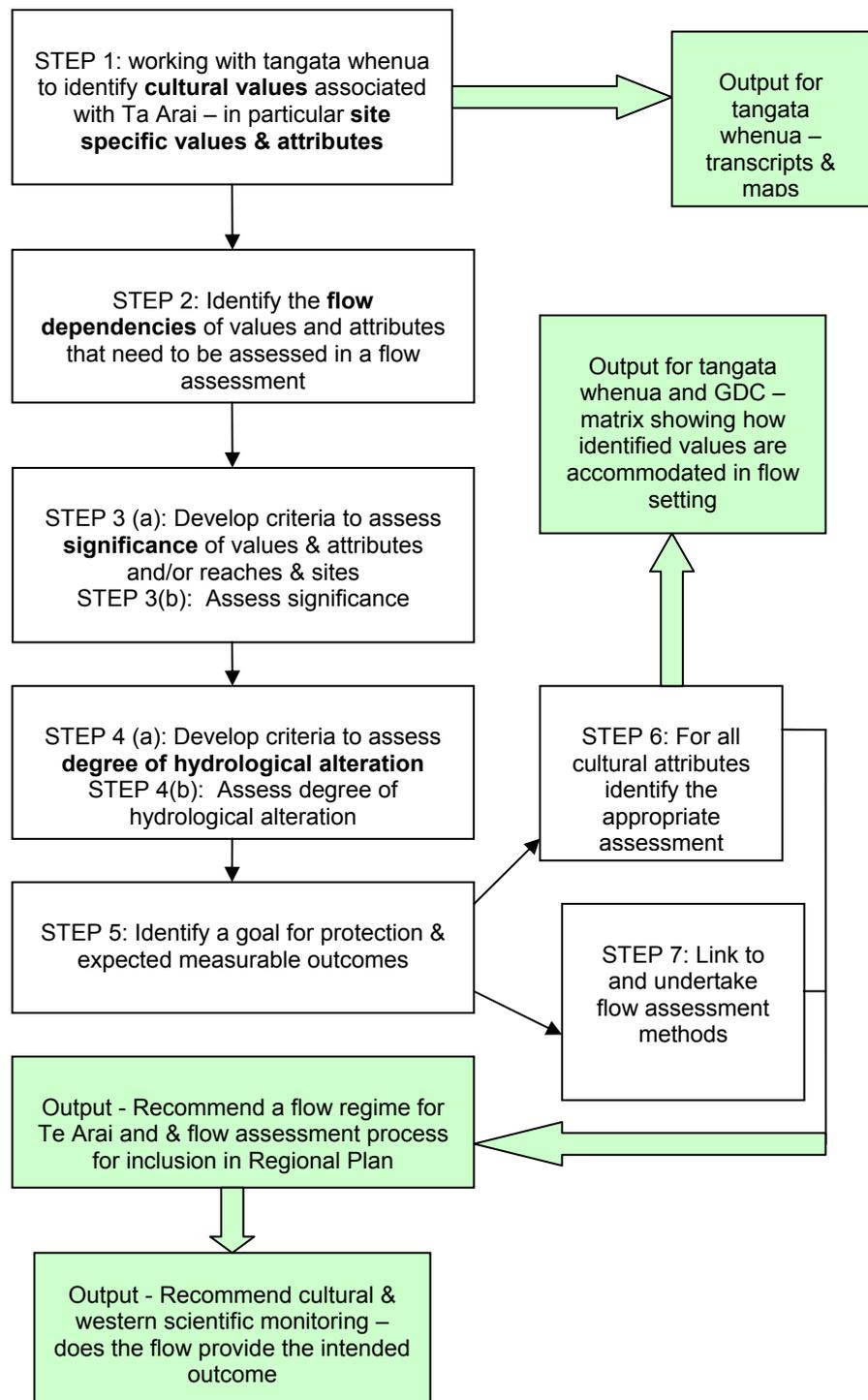
1. a **proposed assessment process** that would enable Mātauranga Māori to inform flow setting;
2. components of existing holistic flow assessment methods that could be useful to recognise and provide for **some** cultural concepts as well as the deficiencies of those same methods with respect to **all** cultural values; and
3. **methods / tools** that can be used by tangata whenua that are easily accommodated within existing flow assessment methods. Please note these are unlikely to be able to be applied within the plan formulation timeframe but their need will be assessed as part of the pilot.

#### 3.1 An assessment process enabling Mātauranga Māori to inform flow setting

The process that we propose for incorporating Mātauranga Maori in setting flows has to meet three basic criteria:

1. it should be grounded in the beliefs, values and practices of tangata whenua to be simple for whānau, hapū and iwi to apply;
2. according to Harmsworth & Tipa (2006), components must be: able to be measured and interpreted by local tangata whenua; cost-effective; repeatable and consistent; useful in a wide range of environments; and practical and tangible;
3. the process with tangata whenua needs to enable links with other flow assessment methods (such as described in the Proposed NES on Ecological flows and water levels) and enable linkages with other stakeholders to be identified and communicated.

The steps in the process that we propose are included in Figure 1 which is followed by a description of each step.



**Figure 1:** A process to incorporate Mātauranga Māori in flow setting & expected outputs.

### 3.2 Identify cultural values associated with Te Arai – especially site specific values

Two aspects are discussed in this section:

*STEP 1: Identify cultural values associated with the river – in particular site specific values - using tangata whenua expert panel.*

- Identifying values.
- The need for tangata whenua to inform site selection.

**Identifying values:** Cultural values, beliefs and practices are to be derived from tangata whenua. A discussion of each value will be followed by an in-depth investigation of the interrelated dimensions of that value. Collectively the values are to describe the breadth of the relationship of tangata whenua with lands and waters within Te Arai catchment, and are likely to reflect an intimate knowledge of the interdependencies and interactions of resources / entities. Importantly, this step enables a critical examination of issues because tangata whenua will be challenged to identify how flows impact the nature and extent of each value, belief and practice they identified. In other words, they have to specify how they assess flow levels, the appropriateness of a particular flow and determine the opportunities afforded them given these flows.

Secondly, spatial data will be mapped. Sites throughout Te Arai are to be identified together with the values associated with each site – in other words, the reasons for determining the site to be of cultural significance - are recorded.

In this facilitated process, qualitative data will be collected as participants will be encouraged to talk about their experiences at each site and how their experiences have changed over time. Data – at different levels of specificity – are derived through the mapping exercise. This is identified in the Figure above as an output for tangata whenua

**Informing site selection:** Scientists undertaking the ecological studies also need to identify sites for their assessments. However, early engagement with tangata whenua enables tangata whenua to help with this selection thus enabling them to link with other flow assessments being undertaken. A series of initial visits will be made to all possible river reaches before confirming the choice of sites to be assessed as part of a flow assessment. In discussions with GDC compromises may have to be made as the number of sites that can be assessed may be restricted by time, budgets or practical considerations e.g. access to Te Arai. However, having Mātauranga Māori – where

feasible - reflected in the sites where flow assessment processes are undertaken will be an important step forward.

Tangata whenua participation in site selection is important because when they receive a report of the flow assessments undertaken they will not need to try and interpret what the recommendation mean in relation to sites and river reaches used and valued by them. Having assessments at sites of significance to them potentially aids communication in an area that is often controversial when plans are being developed.

Across New Zealand, tools are already available and in use to record values, beliefs, practices of tangata whenua. Although we did not ask during our initial visit cultural data that is held in resource inventories, GIS systems and tribal archives could inform this step of the process. We will discuss the availability of data and access to it at the commencement of the project.

Two tools that show how mapping can inform freshwater management have emerged in the last two years:

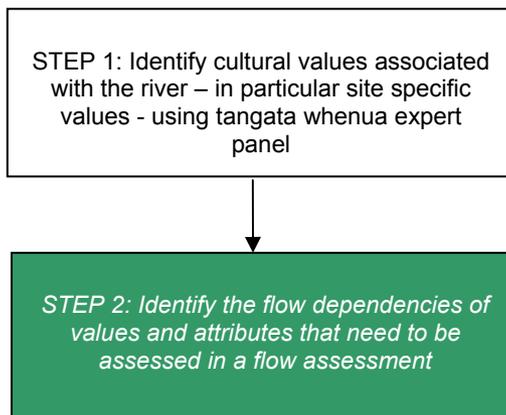
1. Synexe (2009b) promotes cultural mapping of fisher's ecological knowledge. A cultural mapping exercise with tangata whenua *"would enable interview data to be plotted in a visual and concrete form that can later be used for planning purposes.... The outcomes of the cultural mapping exercise...were three sets of comparative maps (past, present and future); spreadsheet of data (including site identification, past and current use, changes in use and patterns over time)"*.
2. Tipa & Nelson (2008) promotes the use of Cultural Opportunity Mapping which requires three distinct tasks to be completed. The first involves preparation of a base map or aerial photograph upon which sites throughout a catchment are identified together with the values of each. Secondly opportunities sought by tribal members (given the nature and extent of the values they mapped) are then recorded. Finally, informants are to identify water related concerns they perceive to impact the provision of cultural opportunities at each site. These are represented as a concept map which they contend is recognized as an effective tool to elicit the belief systems that are used to perceive and analyse situations (El Sawy & Pauchant 1998, Weick 1979, 1995). An example of a concept map is attached as [Appendix 1](#). Mapping opportunities will also enable tangata whenua to identify management actions conducive to their continued association with aquatic

sites. Flow is one of the factors that can be manipulated to provide or deny opportunities.

During interviews one aspect of site specificity that will be discussed with tangata whenua concerns the availability of alternatives / alternative sites and the principle of substitution. For example, if river water is used for bathing, but groundwater pumps are available as an alternative source, a reduced river flow may have different level of impact than if river water was the only available fresh water source. If different sources are available, it is tangata whenua preferences that need to be understood. It is important to acknowledge that some site specific values to tangata whenua cannot be relocated so we will ask questions around this value.

### 3.3 Step 2: Identify the flow dependencies of cultural values and attributes

In order to meaningfully inform flow assessment processes it is imperative that tangata whenua identify not only values, beliefs and practices of significance but also how these are either flow dependent or impacted by changing flows. Table 1 which has only been included for illustrative purpose (as it is derived from South Island data) provides an example of the level of specificity needed to enable practitioners to see how they can link with – and assist – tangata whenua.

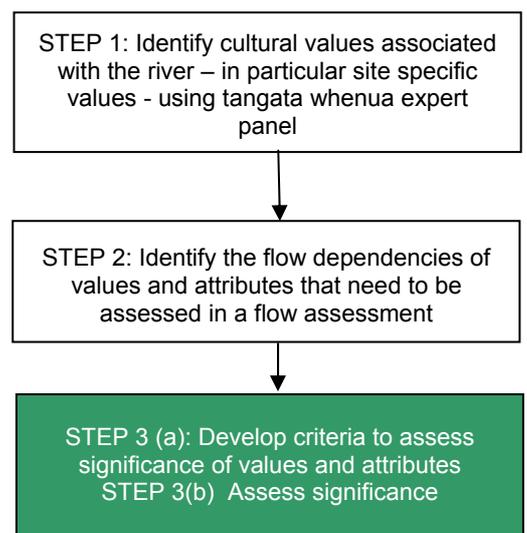


**Table 1:** Attributes and Indicators.

Attributes	Flow indicator / Discriminator	Information Requirements
The bounty gathered river and wetlands i.e. abundance and diversity of species.	Absence / presence key species.	Identify species of significance to Māori usually sourced in catchment.
Needs of species at all stages of life cycle. Habitat. Food sources. Migration.	Temperature, shade, breeding & rearing areas, quality edge habitat, inundated habitats (eel burrows), variety of in stream habitats, flow variability to trigger life cycle stages, no strandings, food availability, competition between species.	Identify how changes in flow will alter habitat for species at all stages of the life cycle.
Accessing and using places and resources.	Legal and physical access, safe access.	Identify where access is required.  Identify how flow alters access.
Ability to use river.	Condition of species.  Compatibility with other users.  Method of fishing.	Identify if preferred methods of fishing will be possible under different flow scenarios.

### 3.4 Step 3: According Significance to River reaches based on their Cultural Values & Attributes

We recommend adopting an approach similar to that proposed in the NES. We plan to identify the criteria by which tangata whenua will accord significance to river reaches and or sites. However, significance or the relative importance of a river to tangata whenua given its values and attributes can only be determined by tangata whenua. As the relative importance of values increases, the consequences of not meeting the goals and objectives of tangata whenua also increase.



We have assumed that the concept of national, regional and local significance will not be acceptable as some river reaches are of significance to particular whānau, hapū and iwi. It is difficult and inappropriate to impose national regional or local significance based on non-cultural criteria. We propose discussing with tangata whenua means of according significance.

In iwi management plans and or in resource inventories whānau, hapū and iwi identify their beliefs, values and uses of resources. They are likely to engage in planning processes to protect these values and the attributes that contribute to that value. There are a number of options that could be discussed e.g.:

1. The **presence of those attributes and values.**
2. Their **condition (i.e. the level of modification).**
3. The ability of whānau to **rehabilitate / restore or reverse** the impacts of an activity.

Assigning significance will be challenging as it implies prioritisation and ranking rivers in a region. However, significance is a concept prominent in RMA and does inform regional planning. We will explore the concept with tangata whenua. But it is always the right of tangata whenua to determine significance and they may decide that all rivers in the region are of high significance.

### 3.5 Step 4 Degree of Hydrological Alteration

The proposed NES for Ecological Flows and Levels uses the degree of hydrological alteration to help in the selection of appropriate ecological flow assessment methods. In order to make the assessment process “accessible” to Māori we recommend distinguishing between low, medium and high hydrological alteration on the basis of the nature of the activity and potential level of impact. Beca (2008) explain that water use can be divided into three categories of increasing hydrological alteration.

**Consumptive use or abstraction** - Water is taken from Te Arai and used for activities such as water supply and irrigation, often with seasonally varying demand. Beca (2008, 10) contend that:

*abstraction of up to 10% of the mean annual low flow (MALF) is barely measurable and therefore unlikely to result in significant biological effects in any stream. Abstraction of up to 20% of MALF is unlikely to result in significant biological effects*

*in lake- or spring-fed streams or in streams with frequent floods and freshes, such as those draining mountainous regions exposed to the prevailing westerly winds. When total abstraction exceeds these limits, the magnitude and duration of low flow may have significant effects on biota.*

**Diversion or large scale abstraction** - Water can be diverted from rivers on a relatively large scale and may be returned to Te Arai downstream or discharged into another catchment. A diversion or abstraction is considered large-scale when it is able to divert more than 90% of the MALF out of a river. With large-scale diversions or abstractions, the quality and amount of habitat at minimum flow will directly affect the biological communities because flows are at the minimum for substantial periods of time.

**Storage** - River flows are modified by storage with potential change to the seasonality of flows, minimum flows, and high flows. Storage regulation can be consumptive (water supply or irrigation) or non-consumptive (hydro-electricity). The potential degree of regulation will depend on the storage volume in the impoundment. Storage regulation can affect all biologically important components of the flow regime.

These criteria require significant discussion with whānau, hapū and iwi before it could be finalised as a possible method of assessment of values to GDC. However, an initial assumption is that tangata whenua will adopt a cautious approach. Therefore this step although included in our recommended method must be considered as “exploratory” with the caveat that it needs to be the subject of further discussion with tangata whenua.

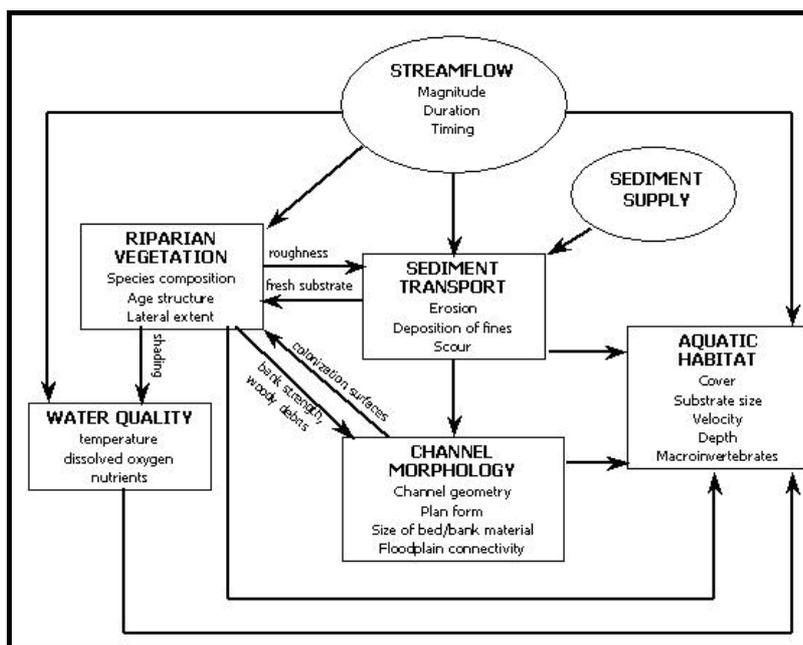
Te Arai is an interesting catchment because the activities that were explained to us at the initial hui and hikoī include diversions for town supply, augmentation from other tributaries to the mainstem Te Arai, inter catchment transfers, surface water takes, and ground water takes.

### 3.6 Step 5 – identifying goals

Having identified values and the opportunities they want to see provided in the catchment we will present, for discussion with tangata whenua, their goals for the Te Arai. This is simply shaping their words and presenting as goals for their consideration.

**3.7 Step 6 & 7 - Linking to other freshwater management issues relating to interactions among riverine functions and processes to sustain health aquatic ecosystems.**

We are aware that Ned Norton (NIWA) has undertaken field work in Te Arai. We propose including a step that explores linkages between cultural values and attributes and the range of flow assessment methods. We have assumed that tangata whenua want to protect the mauri of Te Arai that includes maintaining the functions and processes essential to a healthy working river.



**Figure 2:** Schematic illustration of major interactions among riverine resources and processes (Stamp, Olsen, Allred 2008).

Te Arai ecosystem needs to be defined in a broad sense: Te Arai ecosystem is seen as all components of the landscape that are directly linked to that river, including the source area, the channel from source to sea, riparian areas, the physical and chemical nature of water in the channel, associated groundwater, wetlands, floodplains, the estuary, and the near-shore marine ecosystem (King et al. 1999).

Table 2 is illustrative but represents a summary of how tangata whenua are dependent on function and processes within a healthy river. To reiterate the list of functions and processes in the Table is illustrative. It is for tangata whenua to present their Mātauranga and identify how the respective river functions and processes of the Te Arai system impact tangata whenua values.

**Table 2:** The relationship between river functions and processes & tangata whenua values.

<b>Navigation</b>	Navigation is important for boating, waka ama, waka taua, mokihi. Māori are able to advise where navigation is problematic and describe the nature of the problem.
<b>Riverbank occupation – historic and contemporary</b>	Historically settlements (pa, kainga, nohoanga) were found alongside or on islands in rivers and on adjacent plains. Many whānau still live alongside rivers. These sites can be impacted by both hydrological and morphological processes.
<b>Coastline stabilisation and river mouth dynamics</b>	Coastal environments remain of fundamental importance to Māori. Māori can identify sites along coastlines and rivers and historic patterns of erosion, accretion, and changes they attribute to changing flows.
<b>Harvesting high flows</b>	Land use intensification (especially conversion to dairying) is a major concern, so Māori will be seeking certainty with respect to the impacts of harvesting on long-term river health.
<b>River fisheries</b>	Synexe (2009) describe the value of fishers ecological knowledge which they believe is a akin to Mātauranga Māori and propose tools for collecting data from tangata whenua.
<b>Coastal fisheries</b>	These sites are also highly valued by tangata whenua.
<b>Estuarine and lagoon integrity</b>	Some estuaries (e.g. lowland streams in Canterbury and Otago) may be temporarily closed during summer by a sand bar, which is pushed away during high flows in winter and spring.
<b>Ecosystem integrity</b>	An issue for Māori may be that the key species investigated may not align with the taonga species as defined and prioritised by tangata whenua.
<b>Miscellaneous cultural materials -</b>	Rivers and associated (vegetated) floodplains, wetlands and river mouths provide a multitude of products that are collected by Māori for personal use or semi-commercial uses. Examples include plants (flax, raupo, kiekie), clays, dyes, gravels, sands and rongoa (medicinal species) etc. The relationship between the health of these species and flow requirements is complex as it involves many different species each with its own habitat requirement.
<b>Water quality</b>	Māori believe that the source of contamination is an issue to be managed directly and do not support the strategy of using “dilution as the solution”.
<b>Flood mitigation</b>	In many forums tangata whenua identify the need for floods and freshes to “flush clean Te Arai system”
<b>Health</b>	The long-term interaction of Māori with catchments enables them to identify health concerns.
<b>Wellbeing</b>	River ecosystems continue to serve various functions for Māori living alongside and interacting with rivers, e.g. for drinking, baptism, washing, bathing, but also for fish and the collection of other food, of construction materials, or for recreation. Changes in the flow regime could have an impact on the lives of Māori
<b>Hydrological cycle</b>	Māori can identify what they believe are recharge zones, important wetlands, springs etc and describe the interconnections. They can also advise of the impacts that they believe will result from modified flows.
<b>Salinity and salt water intrusion</b>	Māori have identified changes in lower reaches of rivers, e.g. the Taieri, brackish waters are being experienced further upstream, species composition is changing e.g. tidal mudflats & crabs replacing vegetated riverbanks & eels, salt intolerant plants are dying.

<p><b>Sediment and suspended matter</b></p>	<p>For example the IFIM for the Waitaki considered sediment movement and maintenance of the braided character of Te Arai resulting in a flow regime that incorporates a minimum flow with seasonal variation, flushing flows and a flood flow. In the contrast, the Opihi only has a minimum flow and is one of the most armoured riverbeds in the country. As the changes of river morphology are due to the erosion, transport and settling of sediment, the largest amounts of sediment are transported by Te Arai during high-flows and not at average or low-flow conditions.</p>
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This approach should enable decision-making to be based on an understanding of the role the biophysical environment plays for people and how each of the respective functions relate to the concerns of tangata whenua.

Having stated the importance of river flow, this does not automatically imply that flow assessment processes can safeguard functions and ultimately all the values of tangata whenua. For instance, it does not influence the adjacent land uses that impact a river, although it may mitigate adverse changes in it. Flow assessment processes are also generally not suited as a remedial measure for structural changes in Te Arai, such as embankments that reduce flooding.

We have discussed the respective functions and processes to highlight why they are of interest to tangata whenua and how they can provide information to those undertaking some of the technical assessments. While a healthy functioning system will address some of the needs of tangata whenua there may be other values that are not accommodated by the existing flow assessment methods. Holistic assessment methods that we will assess the need for are described below

*Holistic approaches are essentially processes that allow aquatic scientists from many disciplines to integrate data and knowledge. Each specialist uses methods of her/his choice to develop a n understanding of the flow-ecosystem relationships and then works with the others team members within the overarching purpose of the holistic approach to reach consensus on environmental flows. The output is a description of a flow regime in terms of frequencies timing and duration of different magnitude flows needed to achieve and maintain a specified river condition (King et al. December 2004)*

*Downstream Response to Imposed Flow Transformations* - This is comprehensive holistic assessment that comprises 4 modules:

1. The biophysical module.
2. The second module is the sociological module. The subsistence users of Te Arai who are potentially affected by proposed changes to the flows and water

levels are identified, their use of Te Arai is quantified, and an understanding of how they will be affected by changes to Te Arai is developed.

3. In the third module, modelling a number of scenarios for possible flows and water levels. For each flow scenario, the biophysical and socio-economic impacts are predicted.
4. The fourth module, the costs of mitigating identified effects and/or compensating affected communities for impacts that cannot be resolved are assessed.

Aspects of DRIFT may be relevant to GDC, specifically modules 2 and 3. Scenario building using the information obtained from participatory processes to understand the perspective of those living with and using Te Arai, is integrative and serves to accommodate differing worldviews, knowledge systems and differing values. Scenario building is an integrative step. The trend in setting environmental flows is for these holistic methodologies to be run along with other hydrological based methods, and for more bio diverse, whole ecosystem approaches. The process we propose complement but build on the “socio-economic” focus of DRIFT.

### **3.8 Overview of range of methods to inform each step**

This project will use a range of methods. Understanding when and how each is to be used is imperative if the overall contribution of Mātauranga Māori to a responsive regional water plan framework is to be understood.

Qualitative methods will be used to elicit and analyse data. Qualitative methods are well suited to this project as it seeks to examine complex subject-matter, and as Ritchie (2003) suggests a number of features that necessitated a qualitative approach including:

1. The subject of interest is deeply rooted in the tangata whenua personal knowledge, requiring respectful and responsive questioning to draw out the knowledge.
2. Information is to be collected from “experts,” requiring exploratory and questioning to cover the breadth and depth of the participant’s understanding of the subject.

The qualitative methods utilised will involve conducting hui with tangata whenua – the number will need to be agreed, questionnaires<sup>3</sup>, semi-structured open-ended interviews with key informants, a literature review and informal discussions with many people. These methods are discussed further below.

Quantitative considerations will assume greater prominence as we progress through the proposed steps especially when we require clear definitions of the attributes that will be measured. In other words we will look to move beyond qualitative descriptions to a consideration of how narratives can be transformed into descriptors that enable quantitative measurement that would enable links with other methods of assessment.

*What cannot be measured cannot be managed (Harmon, 2008)*

In summary, qualitative methods explicitly acknowledge the subjectivity of the project to Iwi; and it does not impose authority of the final product (see Lincoln & Guba, 1985; McGrath & Johnson, 2003; Merrick 1999).

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<sup>3</sup> These will be available at hui along with addressed return envelopes. They can taken away from the hui and posted to NIWA once completed.

## 4. Detailed description of proposed methods

### 4.1 Hui and participatory mapping

The project design is heavily reliant on the collection of primary data in the field, principally from hui with tangata whenua.

Given some participants may speak Te Reo as their first language, discussions will be recorded and transcribed by a typist fluent in Te Reo. This will ensure capture of all data presented.

**Our engagement with whānau and hapū living and interacting with the catchment recognises that they are the experts – they understand the Te Arai system, how it is valued and used, and the resources it provides. Whānau will be invited to share their observations during smaller “break out“ small group discussions.**

A semi-structured format will be used to guide the break out group discussions, requiring only the identification of a set of “starter questions” that are to be asked by each facilitator. Administration of the hui will be flexible and open-ended, allowing the respondents more freedom to answer in their own words and permitting the facilitator to follow up interesting lines of inquiry with spontaneous questions. In consideration of the pros and cons of the hui format, it has the advantages of eliciting culturally appropriate information as well as supplying leads for new questions that otherwise might be completely unanticipated by the project team, but it will require a more complicated, time-consuming analysis process.

At each hui, participants will be invited to identify those individuals unable to attend the hui who they believed should be interviewed. Again a semi-structured open-ended interview technique, with the same starter questions, will be used. Realistically no more than 6 interviews and be undertaken.

As stated previously graphically representing the interests of Iwi on maps and aerial photographs involves preparation of a base map or set of aerial photographs upon which sites will be identified by Iwi, together with the values associated with each site. This technique has been used successfully in environmental conservation (Puginier, 1999).

GDC need to accept that this style of mapping differs from conventional digital mapping in terms of accuracy because it is concerned with memories and observations in specific areas.

Capturing the diversity of knowledge within the iwi/hapū/whānau is important and hopefully the groups will comprise kaumatua, pakeke, resource users, tangata kaitiaki, etc. Using the aforementioned mapping methodology also will recognise that visual depictions, especially maps, are an important tool for communicating with hapū and whānau. Literature review

## **4.2 Literature review**

An examination of the available literature will be undertaken as part of the project, primarily:

- to understand the historical association that tangata whenua have with Te Arai so that any loss and/or change articulated during the hui is able to be placed in context;
- to provide a more comprehensive understanding of: the range of cultural activities undertaken; the dependence of these activities on healthy aquatic ecosystems of Te Arai River; and the changes to the aquatic ecosystem that they have been observed over time; and
- to understand the aspirations of tangata whenua.

Information sources could include reports, statutory plans, Iwi plans, evidence, submissions, archived maps and photos. Online-electronic sources were accessed to obtain broader information related to the topics of waterbodies in the Te Arai Catchment.

## **4.3 Informal interactions**

It must be noted that the formal methods described here were augmented by many instances of informal discussion, as is the case in most qualitative research.

#### 4.4 Domain, centrality and cluster analyses

Concept maps are not to serve only as a descriptive purpose. Three analytical tools enable the identification of the key issues, that if addressed, are likely to deliver the outcomes sought by, hapū and iwi. Developing responses to these cultural issues may require a reorientation of management practices. The analyses proposed include:

1. *Domain analysis*: Analyses each concept and calculates how many concepts are immediately related to it. This enables us to identify which concepts are the best elaborated or have a high density of links around them. This provides an idea of the concepts that are key issues and warrant further investigation.
2. *Centrality analysis*: This analysis is similar to the domain analysis, but it calculates the results using more than one “level” (i.e. not just the concepts immediately linked to a specific concept) to include also those which link through them. This provides guidance in discovering the centrality of the concept to the whole concept map rather than just its immediate vicinity.
3. Finally, we propose a *cluster analysis* of the concept map to create more manageable sets of concepts. Cluster analysis attempts to define mutually exclusive sets within the concept map. Having identified clusters we will “explore”<sup>4</sup> each of the clusters to provide greater specificity of the provisions that are needed in the regional plan.
4. Using the themes and the concepts maps we will recommend a flow regime for Te Arai. Accompanying this will be a matrix that explicitly shows how the values and attributes identified by tangata whenua informed the assessment process and are reflected in the flow regime.
5. The third output is design and production of a resource for tangata whenua. Maps and transcripts from hui will be returned to tangata whenua. All will be checked for accuracy, i.e., locations and place names. This validation is an important step in ensuring the spatial information is appropriately mapped. These inaudible snippets will be clearly marked in the transcripts.

The raw data physically written on the set of topographical maps (NZMS260, Land Information New Zealand) and aerial photographs will be stored electronically and made available to tangata whenua. All maps were checked for accuracy, i.e. locations and place names, and crossed referenced with the transcript from the relevant break

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<sup>4</sup> The software we use, Decision Explorer (by Banxia) includes “explore”

out group for information that may have not been directly written onto the physical set of maps in front of each group.

To conclude, by utilising a range of methods for data collection, analysis and presentation of outputs we are confident that the findings presented will be a fair and accurate interpretation of the Mātauranga Māori and raw data collected from tangata whenua.

## 4.5 Outputs

It is important to note that the analysis will result in five distinct outputs being produced:

1. A summary report - Throughout the analysis process, themes will be identified, refined and linkages among the themes recorded. These will be discussed with GDC. A list of themes will inform one of the building blocks of the regional water plan framework, that incorporates Mātauranga Māori with western science.

To ensure that interpretations of the interviews are grounded in the data, we plan to convene regularly “catch-ups” of project team members with the project manager from GDC. This mechanism will enable team members to question and challenge aspects of the analysis and in effect facilitated continual reflection on the process.

The key stage of the analysis process will require the team to summarise themes and their key relationships. This effectively reduces the amount of material and began to give clarity to the essence of the data (Ritchie et al., 2003).

2. The second output requires a separate and distinct form of data. The data will be reanalysed with a focus on the identification of spatially specific flow related values and issues. We will develop a concept map to illustrate the perspectives of tangata whenua. The diagrams are similar to influence diagrams (e.g., Howard & Matheson, 1981), cognitive maps (Tolman, 1948), concept maps (Novak 1991), mind maps (Buzan, 1991) and causal-loop diagrams (e.g., Sterman, 2000). These terms reflect the same basic notion of mapping out relationships among identifiable concepts. Visual representations make findings accessible to a broader audience (Novak, 1991) and

allow a range of analyses to be undertaken to inform the subsequent stages of the plan's formulation

We chose to use the term “concept map” because it consistently refers to the representation of knowledge structures or patterns of thought in graphical form, and its application is flexible enough to permit unique representational forms that best capture the thoughts of tangata whenua being mapped (e.g., Novak, 1991). The maps are developed through review of the concepts extracted from the transcripts. The concept maps developed through this project are intended to be used for analytic and descriptive purposes.

3. Using the themes and the concepts maps we will recommend a flow setting process for the GDC to inform the regional plan.
4. Using the themes and the concepts maps we will recommend flow needs to be addressed when setting the flow regime for Te Arai. Accompanying this will be a matrix that explicitly shows how the values and attributes identified by tangata whenua informed the assessment process and the extent to which they can be reflected in the flow regime.
5. The third output is design and production of resource for tangata whenua. Maps and transcripts from hui will be returned to tangata whenua. All will be checked for accuracy, i.e., locations and place names. This validation is an important step in ensuring the spatial information is appropriately mapped. These inaudible snippets will be clearly marked in the transcripts.

The raw data physically written on the set of topographical maps (NZMS260, Land Information New Zealand) and aerial photographs will be stored electronically and made available to tangata whenua. All maps were checked for accuracy, i.e. locations and place names, and cross referenced with the transcript from the relevant break out group for information that may have not been directly written onto the physical set of maps in front of each group.

To conclude, by utilising a range of methods for data collection, analysis and presentation of outputs we are confident that the findings presented will be a fair and accurate interpretation of the Mātauranga Māori and raw data collected from tangata whenua.

#### **4.6 Limitations of this process and the methods**

The process relies heavily on the relationships established and maintained by the GDC, and the experiences of Te Kūwaha (NIWA's Māori Environmental Research team) and Tipa & Associates with whānau, hapū and iwi when undertaking research projects where the involvement of tangata whenua is integral.

#### **4.7 Conclusion**

From the enthusiasm at the initial hui and hikoi we are confident that tangata whenua want to engage in a participatory process and rich data of value to GDC during the regional planning process can be collected.

The project team wishes to record its thanks to all Iwi participants and to the members of GDC who attended the initial hui and hikoi.

We believe that whānau and hapū will be the primary beneficiaries of an integrative and responsive flow setting process for the regional water plan framework. Dissemination of the pilot in Te Arai will help raise their awareness of the links between tangata whenua values and flow setting processes. Early engagement in the formulation of statutory plans is recognised as best practice. The methods that we recommend we believe will aid communication between tangata whenua and the GDC.

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