

## **Implementing Māori indigenous knowledge (mātauranga) in a scientific paradigm: Restoring the mauri to Te Kete Poutama**

**Daniel Hikuroa, Angela Slade and Darren Gravley**

**Abstract:** Trustees of native land taken under the Tasman Pulp and Paper Company Enabling Act (1954) and used as an industrial waste dump-site for more than 30 years have been battling for decades for the opportunity and means to exercise decision-making authority (manawhenua) over their land and realize their role as guardians (kaitiaki). The Trustees are looking to “science” – the language of the courts, technical reports and resource consents – as the knowledge system to make informed decisions, but to date have not found appropriate or satisfactory methods. With the land due to be returned in 2013, the Trustees are determined to develop and execute a programme that will restore the life-force, the mauri, to their land – known as Te Kete Poutama. Ultimately, to find a solution the restoration plan must involve investigating and successfully navigating integration of science and indigenous Māori knowledge (mātauranga). Herein we propose the Mauri Model (Morgan, 2006) as an integration tool and evaluate its efficacy and utility. We suggest that the Mauri Model affords the opportunity for successful integration of mātauranga with science to produce appropriate, meaningful and positive outcomes.

**Keywords:** Integrating science and mātauranga; kaitiaki; manawhenua; Mauri Model; Te Kete Poutama.

### **Introduction**

The Ngāti Tuwharetoa ki Kawerau tribe places enormous significance upon Te Kete Poutama – a small area nestled adjacent to Ōtukoiro and Tirotirowhetu, encompassing Rotoitipaku (a lake), Waitahanui Pā (fortification), and Te Wai U o Tūwharetoa (a sacred spring), located near Kawerau, in the Bay of Plenty, North Island, New Zealand. The parents of Tūwharetoa, Mawaketaupo and Haahuru, first settled the area establishing Waitahanui Pā after being drawn there by the rising steam from Rotoitipaku (Fox, et al., 1999). The descendants of Tuwharetoa have lived in and been nourished and sustained by Te Kete Poutama for generations – it was a traditional food source, and a resource of paramount economic, cultural, spiritual and social value at local and regional levels. A considerable amount of the prestige (mana) of Ngāti Tūwharetoa ki Kawerau was derived from Te Kete Poutama as a virtue of the wealth of its resources; it provided the means to be confident of being able to demonstrate hospitality (manaakitanga), for example, an abundance of food, warm pools, afforded the opportunity to offer gifts to visitors and/or relatives and the advantage the geothermal activity offered for domestic, health and medical purposes (Fox, et al., 1999).

Until the early 1960s Rotoitipaku was a shallow lake fed by the spring Te Wai U o Tūwharetoa with active hot springs and sinter terraces on its southern shore, and a prominent feature of Te Kete Poutama (Fox, et al., 1999). It was integral for traditional food gathering practices (mahinga kai) of the local Māori residents (tangata whenua), the home for water-borne guardians (kaitiaki) and was the hub for community activity. You would not recognize Te Kete Poutama if you searched for that idyllic scene today. In 1954 the New Zealand Government passed the Tasman Pulp and Paper Company Enabling Act 1954 that essentially gave the Tasman company carte blanche to do everything necessary to construct and operate a pulp and paper mill in Kawerau. In effect, the Act removed the tangata whenua’s manawhenua and therefore ability to act as kaitiaki. Enforcing the Act, Tasman Pulp and

Paper leased the area for the purposes of dumping waste in 1971, with the lease expiring in 2013. Consequently, Te Kete Poutama has become Tasman Pulp and Paper's (now Norske Skog Tasman Limited) primary disposal site for solid paper-mill waste. Over 600,000 m<sup>3</sup> of waste containing toxic material has been dumped on the site (Hikuroa, & Slade, 2010). No longer does the lake teem with wildlife (indeed, there is no longer a lake), no longer do the hot springs provide warmth and relief for weary and aching bones, no longer do the ancestors of Ngāti Tūwharetoa ki Kawerau rest in peace, comforted by the constant companionship of their offspring – the mauri of Te Kete Poutama has been significantly compromised and the mana of the tangata whenua significantly impacted.

## **Mauri**

Mauri – the physical life principle (Marsden 2003, Peet, 2006); the spark of life, the active component that indicates a person is alive (Mead, 2003), the binding force between the physical and the spiritual (Durie, 1998); the capacity for air, water or soil to support life (Marsden, 2003) is a universal concept in Māori thinking. Mauri is found in water, land, forests as well as mist, wind, soil and rocks, and is the force that interpenetrates all things to bind and knit them together (Marsden & Henare, 2002).

Mauri is a concept that permeates all Māori thinking and has been shown to be suitable as a measure of sustainability (Morgan, 2006). Mauri is the binding force that holds together the physical and spiritual components of a being or thing (Morgan, 2006).

When actions impact negatively upon the mauri of something this essential bond is weakened (or broken), and can potentially result in the separation of the physical and spiritual elements resulting in the death of a living thing or alternatively the loss of a thing's capacity to support other life. (Morgan, 2006, p. 171)

When faced with the technical reports and consequent jargon the Trustees of the land could not relate to nor make sense of most of the material contained therein. Therefore, they attempted to reconcile the situation they found themselves in by framing the issue in concepts and terms they understood. Hence, the task they set themselves was to find a way to restore the mauri to Te Kete Poutama.

## **Background**

Environmental assessments have been commissioned by Norske Skog for the Trustees in order to ascertain the magnitude of contamination, the potential environmental hazards and possible restoration options. One report described Lake Rotoitipaku as “one of the worst locations one could contrive for a waste disposal site” (GRML, 2004, p. 1). The waste site is situated in an active geothermal area on highly permeable pumiceous sediments, has active fault traces traversing it and is within 100 m of the Tarawera River at its closest point (GRML, 2004). Groundwater beneath the disposal area contains toxic contaminants at levels exceeding national and international drinking and ecological standards (GRML, 2004). In addition, soil samples show an excess of toxic contaminants above the national and international threshold for agricultural use and ecological protection. Rotoitipaku is no longer a home for fish and eels, geothermal surface features and hot springs have been destroyed. A pond that has formed behind a large embankment that was hastily formed to stop sludge from sliding onto the adjacent property (given the name Te Whariki Toetoe) is suffering ecologically and threatens to engulf Te Wai U o Tūwharetoa. Despite efforts to contain the waste within the primary solid waste disposal area, data from these investigations indicate that the contamination has spread into groundwater, soils and nearby surface waters (GRML, 2004).

Impacts of contamination have focused primarily on how much contaminant is flowing into the Tarawera River relative to the Australian and New Zealand Environment and Conservation Council guidelines (ANZECC). The guidelines provide an authoritative reference for water quality management (particularly for toxic contaminants) and methods for setting limits on pollutant concentration in water. Guidelines are determined based on best current knowledge and are subject to change; indeed, the ANZECC guidelines are currently under revision. Results of monitoring programmes indicate that although contaminants are flowing into the river, the volumes and concentrations are so low that the immediate dilution factor upon reaching the river effectively renders them harmless (GRML, 2004). Whilst the effects to the Tarawera River are of additional concern to tangata whenua and the trustees, the focus of such reports misses entirely the issue at hand – that of restoring the mauri to Te Kete Poutama. Significantly, mauri was only briefly mentioned in two of the sixteen reports – with no discussion or attempt to ascertain the impacts to mauri, nor an investigation of methods to restore the mauri. Proposed Te Kete Poutama restoration options only consider capping with various thicknesses of semi-permeable media suitable for silviculture, and then planting with native flora, selected mainly for aesthetic reasons. The main focus of such restoration options was on meeting ANZECC guidelines of water quality and minimum standards for silviculture with no regard or consideration for what the trustees have been asking for years – restoration of the mauri.

## **Objective**

The objective of this project was to provide the trustees with a pathway for restoring the mauri to Te Kete Poutama. In order to do this we needed to follow a methodology that adhered to kaitiakitanga principles, that was inclusive of matauranga, and that could ‘translate’ the scientific terminology of the reports into a language understood by the trustees. Once we had achieved the latter the trustees could then consider it in a matauranga context. Our role was not to make decisions for the trustees, our role was to provide the trustees with enough information so that they could undertake discussions amongst themselves and make their own, informed decisions.

## **Method**

A Kaupapa Māori methodology (e.g. Smith, 1999, 2006; Kennedy & Cram, 2011) was clearly the ideal approach for this project and was duly employed. A summary of the environmental reports was presented in a series of wananga to the trustees and discussed in a language, manner and format which ensured they understood what contaminants were present, the concentrations, and the health risk they posed. Additionally the authors undertook their own sampling and analysis programme to assess the current chemical state of the water and solid in and around the waste site. Finally, an assessment of the impact upon mauri at Te Kete Poutama was undertaken by the trustees using the Mauri Model framework of Morgan (2006).

The Mauri Model is a decision-making framework that provides a culturally based template within which indigenous values are explicitly empowered alongside Western knowledge (Morgan, 2006). It is designed using analytical hierarchy process principles (Saaty, 1970) and thus is a structured technique for approaching complex issues. Rather than prescribing the ‘correct’ decision, it instead helps decision-makers find one that best suits their goal and their understanding of a problem. The Mauri Model aims to determine the absolute sustainability of proposed actions/activities by assessing impact to mauri, for example the filling a lake with industrial waste completely destroy the mauri of the lake.

## Summary of reports

The reports presented the findings of soil, surface and groundwater surveys that assessed what contaminants were present and their concentrations. The site is contaminated for agricultural use and produce consumption, and all samples analysed exceeded national and international contamination guideline levels for at least one or more contaminants. The main contaminants are dioxins, polychlorinated biphenyls (PCB), arsenic, boron, mercury, antimony, zinc, lead and chromium. Dioxin was found in all soil samples tested, PCB in a third, and the remainder in about 10 per cent of samples. The groundwater is also contaminated. All groundwater samples exceeded maximum concentration limits (MCL) for the drinking water guidelines for manganese, 75 per cent of samples exceeded total ammoniacal nitrogen and a third of samples had boron, arsenic, zinc, and chloride exceeding the MCL levels. The reports have been confined to assessing levels according to health guidelines (e.g. ANZECC guidelines).

Analysis of the chemical data of the project yielded some interesting results. When considering the impact on mauri, for contaminants at Te Kete Poutama, e.g. dioxins and PCB (both proven carcinogens), the level of concentration was irrelevant – the presence of any amount of these toxins have a significant negative impact upon mauri due to the carcinogenic nature of these contaminants. This decision by the Trustees was made based upon the carcinogenic nature of those contaminants combined with the potential for guideline ‘limits’ to change. The shortcoming of the guideline system is that what might be ‘acceptable’ concentrations today might be considered ‘unacceptable’ in the future. Although, some of the contaminants present, e.g. boron and arsenic, are likely partially or entirely derived from the buried geothermal springs. Despite being above guideline ‘limits’ these naturally occurring contaminants were considered ‘safe’ by the trustees. For centuries their ancestors had lived in and around the hot springs and their experientially derived local mātauranga has no record of concern for any geothermal waters. Thus, the ‘guidelines’ approach is inconsistent with the mātauranga informed kaitiakitanga approach of the trustees. For the anthropogenic contaminants – dioxins, PCB, drums of zinc hydrosulphite and sodium dichromate – it is a case of presence or absence that is important, not the concentration, and for the naturally occurring geothermal contaminants their presence is of no concern.

The results obtained from the chemical analyses of trace metals, cations and anions, undertaken by the authors, were similar to those documented in the consultants’ reports. The concentrations of major cations were determined by flame atomic absorption spectroscopy and the anions by ion chromatography analyses were conducted in the School of Environment geochemistry laboratories at The University of Auckland. Due to prohibitive costs no dioxins or PCB’s were analysed by the authors (Hikuroa & Slade, 2010).

## Impact on mauri

An assessment of the impact upon mauri of the dumping of waste was made using the Mauri Model of Morgan (2006). The Mauri Model was created to improve water management processes by making them inclusive of all knowledge sources available and is a decision-making framework that allows integration of disparate pieces of information, including mātauranga (often discounted as anecdotal evidence). It was constructed based around kaitiakitanga principles and assesses the impact of mauri for four well-beings: Environmental, Social, Economic and Cultural. Indicators of the impacts upon mauri of the dumping of waste were determined by the trustees and a brief explanation of each indicator is presented below.

### ***Environmental indicators***

- Anthropogenic contaminants. As mentioned earlier the presence of any concentration of anthropogenic contaminants has a significant negative impact upon mauri.

- Natural contaminants. Derived from buried geothermal springs those naturally occurring elements and compounds are considered benign by the trustees.
- Waste dumped on land. Land no longer accessible – covered in waste.
- Waste filled in Rotoitipaku. The lake has been completely filled in.
- Waste filled in hot springs. The hot springs have been covered by the waste.
- Toxins in waste. The dumping of the waste significantly altered Te Kete Poutama and negatively impacted the mauri. In addition, the presence of contaminants in the waste has a further impact on the mauri.
- Native biodiversity on land. Almost completely destroyed.
- Native biodiversity in lake. Completely destroyed.
- Native biodiversity in hot springs. Likely completely destroyed, but unclear if thermophilic bacteria are still present.

### ***Cultural indicators***

- Mahinga kai. Te Kete Poutama was considered the food basket of Ngāti Tūwharetoa ki Tūwharetoa who also derived considerable mana from the abundance of tuna. Other kai from Te Kete Poutama include koura and kakahi and food-bearing trees.
- Waahi tapu. The waste has buried Moturoa, a small low-lying island that used to lie within Rotoitipaku. The island bore many food-bearing trees and was also used for wānanga.
- Healing – soak in pools. The geothermal pools were revered for their curative and healing properties.
- Healing – drink waters. Small amounts of the waters were consumed as a tonic.
- Healing – geothermal mud. The mud was used for healing bruises, as a poultice and also for treating hakihaki.
- Rongoā. Te Kete Poutama bore many plants that were used for rongoā/medicinal purposes.
- Kokowai. Kokowai was collected from the geothermal muds and clays.
- Severed connection Te Wai U o Tūwharetoa had to Rotoitipaku and Tarawera River. Te Wai U o Tūwharetoa is the spring from which the waters flow that were used to soothe the infant Manaia, who later became Tūwharetoa, the eponymous ancestor of Ngāti Tūwharetoa. The severed connection between Te Wai U o Tūwharetoa, Rotoitipaku and the Tarawera River is not only a physical action, but it also has spiritual ramifications.
- Kaitiaki displaced. The water borne kaitiaki – the taniwha – in the Rotoitipaku has been displaced and lost its connection with kaitiaki in adjacent and nearby waterways.
- Flora collection. Collection of plants for various purposes e.g. toetoe, raupō, harakeke, paopao.

### ***Social indicators***

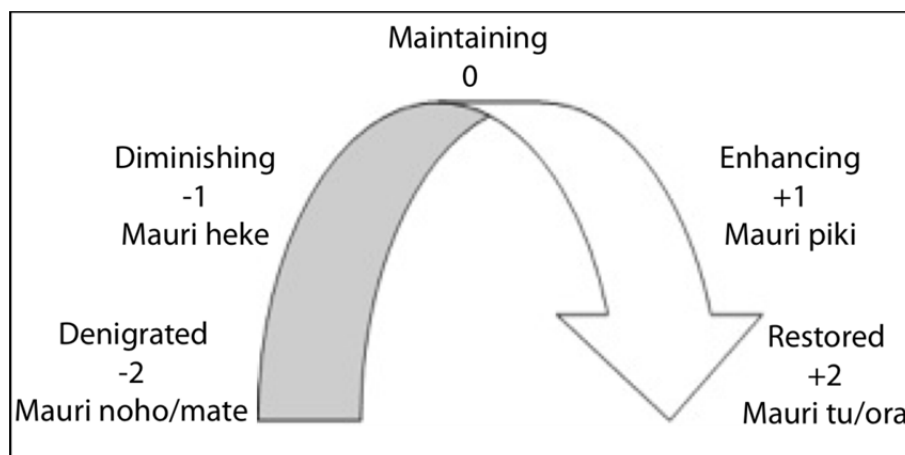
- Swimming. Rotoitipaku and the hot springs were popular swimming/soaking spots. In particular local accounts refer to a unique phenomenon – ‘the bubble’, a plume of turbulent water that flowed intermittently in Rotoitipaku. The objective was to ‘ride’ the bubble. The geothermal waters warmed Rotoitipaku and afforded swimming all year round.
- Hygiene. Specific pools were designated for bathing.
- Fishing camps. At various times of the year families would set up temporary housing around Rotoitipaku to fish.
- Hunting – pigs and deer. Both a social activity and also a means of procuring meat for the table.
- Singe pigs, plucking ducks. These activities were undertaken in the hot springs.
- Flooding neighbouring land. The waste has blocked the natural flow of Te Wai U o Tūwharetoa and created a new body of water on neighbouring land. It is called Te Whariki Toetoe.
- Loss of respect. The trustees feel they have lost some respect as their land has been taken against their will and then contaminated.

### **Economic**

- Cost of restoration. Whilst ultimately the bearer of the cost of restoration has yet to be elucidated, various restoration options will have different impacts upon mauri.
- Food costs. This refers to the additional cost to families who originally would have sourced significant amounts of their food from Te Kete Poutama and who now have to buy food.
- Loss of discretionary decision making for land. This indicator refers to potential losses the trustees may have incurred by not being able to make decisions about their land e.g. building a spa based around the hot springs. It also includes the potential preclusion from undertaking certain activities in the future due to the presence of contaminants.
- De-value land – Te Kete Poutama. This refers to the impact the dumping of contaminant bearing waste to the dollar value of the land.
- De-value – adjacent land. The presence of contaminant bearing waste in Te Kete Poutama may de-value neighbouring land.
- Legal costs. If court proceedings take place – either the trustees challenging Norske Skog or if the trustees are taken to court in the future for polluting waterways or de-valuing neighbouring land.
- Loss of potential earnings. This refers to the potential loss of earnings resulting from possible marketable products derived from unknown geothermal extremeophiles.

### **Assessing impact on mauri**

Assessment of the impact to mauri of each indicator is made on an integer value from -2 to +2, with +2 representing mauri at full potential or fully restored; +1, mauri at partial potential or partially restored; 0, no change; -1, partial degradation; and -2, complete degradation as shown in Figure 1. For example the infilling of Rotoitipaku has completely destroyed its mauri and would score -2.



**Figure 1. A graphical representation of the mauri assessment**

The trustees undertook an assessment of the mauri for the indicators – one was a retrospective for a time before the contaminated waste was dumped, and one for the present day. The results of that assessment are shown below in Table 1.

**Table 1. List of indicators of the impacts of dumping waste**

	INDICATOR	Pre-dumping	Today
ENVIRONMENTAL	Anthropogenic contaminants	2	-2
	Natural contaminants	2	2
	Waste dumped on land	2	-2
	Waste infilled lake	2	-2
	Waste infilled hot springs	2	-2
	Toxins in waste	2	-2
	Indigenous biodiversity on land	2	-2
	Indigenous biodiversity in lake	2	-2
	Indigenous biodiversity in hot springs	2	-2
CULTURAL	Mahinga kai	2	-2
	Waahi tapu (sacred areas)	2	-1
	Healing – soak in pools	2	-2
	Healing – drink mineral waters	2	-2
	Healing – geothermal mud	2	-2
	Rongoa	2	-2
	Kokowai	2	-2
	Te Wai U o Tūwharetoa	2	-2
	Kaitiaki displaced	2	-2
	Flora collection	2	-2
SOCIAL	Swimming	2	-2
	Hygiene	2	-2
	Fishing camps	2	-2
	Hunting – pigs and deer	2	-2
	Singe pigs, plucking ducks	2	-2
	Loss of respect	2	-1
	Flooding neighbouring land	2	-2
ECONOMIC	Cost of restoration	2	-2
	Food costs	2	-1
	Loss of discretion	2	-1
	De-value Te Kete Poutama	2	-1
	De-value adjacent land	2	-1
	Legal costs	2	-2
	Loss of earnings	2	-1
	Mauri Assessment	2	-1.7

## Discussion and conclusions

The results clearly show that as expected the mauri of Te Kete Poutama was at it fullest potential prior to the waste being dumped, and is currently significantly impacted, almost at a state of mauri mate (see Fig. 1). In percentage terms the move from +2 to -1.7 represents a 92.5 per cent negative shift. The trustees found the determination of impact values to be intuitive, straight-forward and easy. In order to provide some insight into the rationale behind the values listed above we will give brief explanation of how values were determined. Rotoitipaku, the hot springs, and most of the surrounding land comprising Te Kete Poutama have been covered with more than 600,000 m<sup>3</sup> of toxic contaminant bearing industrial waste. Therefore any activity that took place in Rotoitipaku and the hot springs, or on land now covered scores a -2. Waahi tapu were ascribed a -1 score as although some have been covered, others remain free from waste– for example Waitahanui Pā, so although waahi tapu

mauri has clearly been diminished, it has not been extinguished. Similarly for all the indicators that ascribed a -1 value, it was felt by the trustees that mauri had clearly been impacted, but not denigrated.

By this process of assessing the impact upon mauri of dumping the contaminated waste we have come part way toward realising the objective the trustees have been asking for decades – restoring the mauri to Te Kete Poutama. We have assessed the impact by the integration of scientific data with matauranga through the Mauri Model process. The trustees can now clearly see how the mauri is being impacted by specific indicators identified during the process, and, more importantly, these findings provide the basis for the planning of physical restorative works. Put simply, if all of the indicators in the analysis that are currently negative can through some rehabilitative process become positive 2, the mauri will have been restored. Therefore, we suggest that the Mauri Model is effective and poses enormous potential and utility for other Māori groups who have similar issues to realise appropriate, meaningful and positive outcomes.

The trustees can now begin the arduous task of planning the restorative works. These are likely to take decades and be enormously complex and gruelling. However ‘equipped’ with the Mauri Model analysis, and also the skills to undertake the process again at any stage to assess progress, the trustees can set off on this journey to restore the mauri, restore their mana, re-establish manawhenua and finally begin to realize their role as kaitiaki.

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## Author notes

Dr Daniel Hikuroa, Tainui, Te Arawa, is the Research Director of Ngā Pae o te Māramatanga, New Zealand's Indigenous Centre of Research Excellence.

E-mail: [d.hikuroa@auckland.ac.nz](mailto:d.hikuroa@auckland.ac.nz)

Dr Angela Slade is a Te Tipu Putaiao Post Doctoral Fellow at the School of Environment, The University of Auckland.

E-mail: [a.slade@auckland.ac.nz](mailto:a.slade@auckland.ac.nz)

Dr Darren Gravley is a lecturer in the Department of Geosciences, University of Canterbury.

E-mail: [darren.gravley@canterbury.ac.nz](mailto:darren.gravley@canterbury.ac.nz)