The Institute for Governance and Policy Studies, School of Government at Victoria University of Wellington

POLICY Quarterly

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FOCUS ON
Fresh Water

The Institute for Governance and Policy Studies, School of Government at Victoria University of Wellington

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TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

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Editorial

In the last three years, fresh water has surged up the national policy agenda. It is no longer a partisan issue: 82% of New Zealanders now say they are extremely or very concerned about the state of New Zealand's waterways. Issues of declining water quality and over-allocation pervade the policy discourse and rumbles of disaffection reverberate down ministry corridors.

The unease of voters and policymakers is well founded. Government data estimates that 60% of New Zealand's rivers and lakes are now unswimmable, while most regions have at least one river or aquifer that is either fully or over-allocated, or likely to become so in the next one to five years. On the 20th anniversary of its world-famous catchcry, New Zealand can no longer claim to be 100% pure.

So what is to be done? Although technology may offer some opportunities to address issues of declining water quality and over-allocation, it is the human component of water management that is likely to determine the relative security of New Zealand's water future. How we design our governance systems, incentivise behaviour change and adapt to increasingly variable water availability will shape our social, economic and environmental prospects.

In this issue of *Policy Quarterly* we map New Zealand's water policy landscape, tracing its history across different world views to lay the foundations for a range of possible governance futures. In doing so we focus on explicating the economic, political and legal challenges associated with water management in New Zealand with a view to showcasing a variety of perspectives that could help policymakers set a course towards the achievement of a desirable, sustainable and secure future.

As Catherine Knight explains, New Zealand's freshwater history has repeatedly seen the prioritisation of short-term economic goals that have rarely accounted for the long-term environmental – or even economic – costs imposed on many regions and catchments. It helps explain why today most waters in rural streams, rivers, lakes and estuaries are dominated by agricultural run-off, while, as Kalyan Chakravarthy, Frances Charters and Thomas Cochrane explain, most urban waterways have poor water quality, degraded habitat and impaired ecological health.

Given this, it is noteworthy, as Guy Salmon writes, that the present government, through its reform programme, Essential Freshwater, aims to do far more than just 'limit future degradation'. It boldly states: 'At the election the Government won a mandate, and we now carry a duty, to improve the quality of our rivers … We're not going to keep kicking the can down the road and leave the hard issues for future generations.'

Although this is undoubtedly an admirable objective, Anne Salmond, Gary Brierley, Dan Hikuroa, Betsan Martin and Eric Crampton all eloquently argue that tinkering at the policy margins is not going to deliver the reform needed to correct the long-running adverse effects of overuse and land use and industry intensification. To be successful, the Essential Freshwater programme must stimulate long-term changes in beliefs and norms, rather than simply prioritise the short-term acceptability of potential policies.

As argued by several contributors, to achieve longer-term policy efficacy the government must tackle the issues around ownership and develop a governance framework that creates and reinforces the behaviours and values needed to solidify and extend the public good. Only by weaving together knowledge from te ao Māori, economics, law and science will we build a governance framework that takes us proudly into the 22nd century.

The difficulty of doing this well can be shown by Canterbury's water management process, which is examined in detail in this issue. Canterbury, which has gone through a decade of reform and investment, has arrived at an outcome that has satisfied some, but has left others feeling disenfranchised and cut out of the collaborative process. Understanding both the weaknesses and strengths of this process could help inform priorities when designing and implementing effective water policy across New Zealand in the future.

There are also policy lessons that can be gathered from international experience. Policy tools, such as water footprinting, have helped identify efficient use patterns in certain situations, but, as explained by Chris Perry, have not always been effective. Other tools, like economic policy instruments and innovative technologies for urban water systems, have helped stimulate more effective behavioural and technical change.

In New Zealand, there is no escape from the fact that as our population and economy expand, the need and demand for water will continue to increase, and so will competition. Climate change will only exacerbate this as water variability and the frequency of extreme weather events intensify.

This issue of *Policy Quarterly* serves as a checkpoint for how far we've come and where we could go. Whether or not the Essential Freshwater programme offers a fresh start for fresh water, there can be no debate that designing and implementing dynamic policy that prioritises governance and incentivises behaviour change is a prerequisite for a sustainable and secure future for New Zealand.

Mike Joy and Julia Talbot-Jones
Guest Editors
31 July 2019

Catherine Knight

A POTTED History of Freshwater Management IN NEW ZEALAND

Abstract

This article traces the history of freshwater management in New Zealand from the earliest laws to protect newly introduced trout and salmon from pollution in the 1860s through to what an increasing number of New Zealanders today consider as a 'freshwater crisis' – a consequence of the failure of government to respond adequately to the unprecedented speed and scale of land use intensification and its impacts over the last few decades. Two themes are highlighted by this history: the tension between the protection and use of our water (and land) resources; and the tendency of government to intervene only when serious environmental damage has become evident.

Keywords waterways, freshwater management, environmental administration, environmental history

Catherine Knight is a writer and environmental historian. She is a Senior Associate at the Institute for Governance and Policy Studies, Victoria University of Wellington and Honorary Research Associate at the School of People, Environment and Planning, Massey University. She has published four books relating to New Zealand's environmental history. Catherine works as a policy and communications consultant at KHM Consulting, based in the Manawatū.

This article traces the history of freshwater management in New Zealand from the earliest laws to protect newly introduced trout and salmon from pollution in the 1860s through to what an increasing number of New Zealanders consider today as a 'freshwater crisis' – a consequence of the failure of government to respond adequately to the unprecedented speed and scale of land use intensification and its impacts over the last few decades.

The history of the management of fresh water in New Zealand is characterised by two themes. The first is the ever-present tension between the need for environmental protection on the one hand, and the desire to protect the interests of industry on the other. When freshwater pollution issues first came to the fore in the late 19th century, the industry that government sought to protect was alluvial goldmining;

in the mid-20th century, it was the so-called 'wet industries' – meatworks, dairy factories, wool scours and piggeries; in recent decades, it has been agriculture.

A second feature of this history – related to the first – is the tendency for government to intervene only when serious damage has been done. No matter how well evidenced the likelihood of damage may be, there are few instances of government taking proactive or strategic action to prevent it from happening. This is because, politically, there is generally less risk in dealing with damage after it has occurred – because the need for action is self-evident and only limited political leadership is required to convince the public that intervention is necessary.

> ... the government demonstrated that economic development was paramount, even at the cost of a river or two.

Early legislation and early pressures on rivers, streams and lakes

The first legislation to afford any protection to rivers, streams and lakes – though only indirectly – was the Salmon and Trout Act introduced in 1867. As the name of the law suggests, the central concern was introduced species of trout and salmon, not indigenous species, which were largely ignored.[1] The law provided for the 'preservation and propagation' of salmon and trout, and enabled the governor (the equivalent of today's governor-general) to restrict angling for these fish. It also allowed for the making of regulations to prevent lime 'or any other matter or liquid deleterious to fish' being discharged into rivers or streams in which salmon or trout were present. It is not clear whether any such regulations were ever made, but the provision is evidence that the link between a range of pollutants and the well-being of fish was well accepted as early as the 1860s.

While the motivation of acclimatisation and angling groups was to protect introduced species, which competed with their more diminutive indigenous cousins for food and habitat, these groups were for a long time the only voice raised against the unmitigated pollution of the country's rivers, streams and lakes, and continue to be an influential lobby today, in the form of the national body Fish and Game New Zealand. Indeed, the first complaints made about pollution of rivers and streams were made by acclimatisation societies, in relation to the impacts of goldmining activity, which was clogging up rivers and streams with tailings, a problem particularly evident in Otago.[2]

The Fisheries Conservation Act 1884 and its subsequent amendments allowed for regulations to be made prohibiting the discharge of refuse from some industries into waterways; the initial act excluded goldmining waste, however, because the government considered the industry too pivotal to the fragile economy to risk antagonising. In its subsequent amendments to the act, too, the government was anxious not to impede industry and was careful to keep its powers to regulate reigned in.

Meanwhile, from the late 1800s, a cocktail of other substances was beginning to foul rivers, streams and lakes. Early sewerage systems disposed of human effluent without any treatment, either into the sea or, in the case of inland towns such as Palmerston North, Taupo and Hamilton, into rivers or lakes. This was mandated under the Public Works Act 1876, under which rivers were not simply *seen* as drains, they *were* drains. 'Drain' was defined to include both artificial channels and 'every natural watercourse, stream, and river not navigable' (Public Works Act 1876, s165). It was not until the worldwide bubonic plague scare of 1900 that towns began to introduce some rudimentary treatment of sewage. Industries too, including meatworks, dairy factories and sawmills, simply disgorged their effluent into the nearest stream or river. In fact, such industries were generally sited next to waterways quite deliberately for this purpose.

The Waters Pollution Act 1953 and the Pollution Advisory Council

There were a number of failed attempts to introduce legislation dealing with the pollution of waterways in the first half of the 20th century, including the ill-fated Pollution of Water Bill of 1912. Each time, the government pulled back in the face of the vigorous industry lobby.[3] Finally, in 1953, the Waters Pollution Act was enacted. This established a Pollution Advisory Council within the Marine Department.[4]

While the enactment of this legislation and the establishment of the Pollution Advisory Council undoubtedly represented progress, the council was rendered practically toothless for some years. Strong lobbying by the meat and dairy industries was successful in limiting the council to an advisory role, merely able to receive complaints and undertake investigations, with no powers to enforce change. Instead, it relied on the cooperation of industry to take measures to reduce water pollution.

It took another decade before the government gave the council some teeth, by making regulations allowing its officials to enter land, request information or issue permits for discharges to waterways (Roche, 1994, pp.119–20). The 1963 regulations also provided for the council to classify water bodies according to their current and potential uses. The classifications ranged from A to D – 'A' indicating the highest standard for water quality, suitable for town water supply, through to 'D' for rivers suitable for agriculture, industrial water supplies and 'general recreation' (ibid.; McLintock, 1966).

Once rivers and other water bodies were classified, all discharges into them were registered by a permit, which set out the conditions under which the discharge could be made in order to maintain the prescribed standard in the 'receiving waters' (McLintock, 1966). However, there was strong opposition from industry to significant constraints being placed on them through the permit system. In reality, many of the permits issued were 'temporary' ones, merely reflecting the current practices at the time. Over time, the conditions of permits were made more stringent (Russell Howie, personal communication, 13 February 2016).

The establishment of the Pollution Advisory Council was a positive step – albeit a modest one – towards better managing water pollution. However, at the same time, the government demonstrated that economic development was paramount, even at the cost of a river or two. One river that fell victim to this 'pragmatism', only a year after the Waters Pollution Act was introduced, was the Tarawera River, on the banks of which the Tasman Pulp and Paper Mill operated. The Tasman Pulp and Paper Enabling Act 1954 allowed the Tasman Pulp and Paper Company, in which the government had an interest, to take water from, and discharge industrial waste into, the Tarawera River. The legislation also gave the company immunity from prosecution for pollution or nuisance under any other acts (Roche, 1994).[5] Infamously, the river became known as the 'black drain' – discoloured by the chemical effluent spewed out by the paper mill.

The Water and Soil Conservation Act 1967 and wild and scenic rivers legislation

In 1967 the Water and Soil Conservation Act put in place a single consenting system to regulate water use, including discharges, the culmination of a number of years of work to consolidate the myriad laws relating to water use. This act carried across the 1953 Waters Pollution Act's classification system for receiving waters, and established a process to obtain water rights to dam, divert, take, use and discharge to water. It became an offence to discharge any waste into water bodies unless it was expressly consented (by way of a permit). The act also declared that all rights to water belonged to the Crown.[6] While the 1953 act dealt only with water discharges, the 1967 act recognised that water quality was affected not only by discharges, but also by extraction and other uses such as diversion, because these uses reduced flows and made rivers more susceptible to water quality degradation. By expanding the mandate of regulatory authorities to control extractive uses, the act served to strengthen their capacity to manage waterways and their water quality.

In 1972 the responsibility for water quality was transferred from the Marine Department to the regional catchment boards established under the Soil Conservation and Rivers Control Act 1941.[7] Catchment boards continued to focus their attention on discharges from factories and other 'point source' discharges such as sewage treatment plants.

> The Resource Management Act has proved effective in bringing point source discharges ... under better control. However, the growing magnitude of diffuse discharges ... was unforeseen ...

By the 1980s water clarity was visibly improving in many of New Zealand's rivers. Industrial and sewage discharges were subjected not only to primary treatment, but also to the more sophisticated 'secondary treatment', which removed suspended solids and sediment and oxygen-depleting substances. Catchment boards were monitoring discharge sources more closely than any regulatory authority in the past, and the threat of penalties motivated most dischargers to improve the treatment of effluent.

In 1981 another piece of legislation was added to the freshwater management arsenal. The wild and scenic rivers legislation, modelled on the United States legislation of that name, was enacted as an amendment to the Water and Soil Conservation Act 1967, after sustained lobbying from the canoeing and rafting fraternity, concerned about the loss of New Zealand's 'wild rivers', especially to hydroelectricity schemes.[8] This legislation enabled the creation of water conservation orders, and in 1982 the Mōtū River, in the Bay of Plenty, became the first river to have a water conservation order sought over it – a reaction to a government proposal to build a hydroelectric scheme on the river. Since then 12 more water conservation orders have been made over rivers and lakes.

A weakness in the water conservation order system is that it is ad hoc, requiring an applicant who is sufficiently motivated and resourced to undertake the potentially lengthy, expensive and resource-intensive process.[9] There is no mechanism for systematically identifying and protecting rivers deemed worthy of protection.[10] Instead, the impetus for protection comes from groups or organisations making applications on a river by river basis. But few non-governmental organisations have the funds or resources necessary to make the commitment of time and money required for a successful application. Of the 13 water conservation orders made since 1982, most have been initiated by Fish and Game (or its predecessors, the acclimatisation societies), an organisation that is comparatively well funded through licence fees collected from its members. Therefore, there has been a strong emphasis on protecting rivers for their recreational fishing values. Rivers that are valued for other reasons, such as for their unique ecology, scenery or other recreational opportunities, tend to be less well represented (Parliamentary Commissioner for the Environment, 2012).

The Resource Management Act 1991 and the growing menace of diffuse discharges

With the enactment of the Resource Management Act in 1991, the scope of regulators to manage water quality was again extended, to encompass the ability to control the use of land. The management of water quality had by this time been transferred from the catchment boards to regional councils, which subsumed and replaced catchment boards under the Local Government Amendment Act of 1989. As

was the case under the 1967 act, under the new act, all discharges of pollutants to water were, by default, prohibited, unless consent for the discharge was granted. Even when granted, the legislation allowed for conditions to be imposed on the consents, which the applicant was bound by. Failure to comply with conditions meant a breach of the law that could lead to financial and other penalties.

The Resource Management Act also empowered councils to develop statutory plans for the management of land and water, intended to reflect community expectations for acceptable water-quality standards and create more transparency around how these standards were set and managed. The new legislation was designed to give the new regime a more proactive, forward-planning focus, as opposed to the more reactive management of pollution characteristic of both the Waters Pollution Act and the Water and Soil Conservation Act.

The Resource Management Act has proved effective in bringing point source discharges – that is, discharges from specific sources such as factories or sewage treatment plants – under better control. However, the growing magnitude of diffuse discharges – run-off from land – was unforeseen when the Resource Management Act was introduced (though perhaps should not have been, because catchment managers were observing the effects of nutrient leaching by this time, and the OECD was warning about the impacts of agricultural intensification as early as 1981 (Knight, 2016; OECD, 1981)).[11] As the primary regulator under the act, regional councils were hampered too by the legislation's permissive approach to land use: as long as there is no specific rule prohibiting certain land uses in a district or region, all forms of land use are permitted.

One rare instance in which government has taken highly interventionist (and expensive) measures to restore a water body is Lake Taupō. In the late 1990s, regional council monitoring found that water quality in the lake was declining, resulting in increased algal growth and decreased water clarity, primarily due to increased concentrations of nitrogen flowing off farmland in the surrounding catchment. After years of discussion and negotiation, in 2007 central government, Waikato Regional Council and Taupō District Council committed $80 million to create a scheme to reduce nitrogen flowing into the lake by 20%. This would be achieved by purchasing nitrogen from landowners through a nitrogen-discharge trading system; placing 999-year covenants on properties to ensure nitrogen reductions into the future; the implementing of land use controls to secure the gains made when landowners opt to change from pastoral to lower-intensity land uses such as forestry; and free advice and assistance to farmers and other landowners to help reduce nitrogen levels (Ministry for the Environment, 2017).

While the measures taken to try to halt or minimise further degradation of Lake Taupō are laudable, it is hard to avoid the conclusion that the catalyst for such bold, expensive and innovative intervention is the value of the lake as an asset for tourism. Lake Taupō is New Zealand's largest lake, and is the 'jewel in the crown' in terms of its value for the tourism industry, principally as a destination for fishing and boating. Other lakes, such as Lake Horowhenua near Levin, are similarly or more severely degraded, and despite their being highly valued by hapū, iwi or local communities, no such interventions are offered. This is likely to be in part due to their limited value to tourism.

It is interesting to note that the very first Waitangi Tribunal case relating primarily to a river was sparked by the proposal to divert the outflow from the Rotorua Waste Water Treatment Plant from its outlet at the time to Lake Rotorua to the Kaituna River. The reason? Lake Rotorua and its adjoining lake, Lake Rotoiti, were renowned worldwide for their trout fishing, and it was widely feared that further degradation of the lake would jeopardise that reputation, affecting the tourism industry (Waitangi Tribunal, 1984). There was no such concern for the Kaituna River among authorities, a river which had historically been used as a drain for the discharge of effluent from freezing works, dairy factories and other sources (Waitangi Tribunal, 1984) – though the Ngāti Pikiao claimants took a very different view, one which eventually prevailed.[12]

As this article is being written, the government is contemplating wholesale changes to the resource management system, beyond the usual tinkering with the Resource Management Act.

Conclusions

As this article is being written, the government is contemplating wholesale changes to the resource management system, beyond the usual tinkering with the Resource Management Act. But the issue of freshwater degradation will not be resolved by legislative change, or even institutional change, alone. Mindsets will need to change. The pioneering mentality still looms large in New Zealanders' interactions with the environment: in particular, the belief that the right to use land as a person wishes is an inviolable property right remains strong (Knight, 2018, p.215). Even today, when the extent of damage from land use intensification is beyond doubt, there is reluctance on the part of regional councils to regulate land use. This deep-seated devotion to private property rights will need to be supplanted by a stronger consciousness of the public good and, with it, a deeper recognition of the social contract. Only then will New Zealand be able to fully resolve freshwater degradation.

1 Initially, indigenous freshwater fish were viewed as of value only as food for these exotic species, particularly trout (McDowall, 2011, p.45). For instance, in 1869, the curator of the Christchurch Acclimatisation Gardens observed that 'our streams are already stocked both here and in Tasmania with a little native fish, for which the trout has shown a great partiality, and being of sluggish habits, and devoid of teeth, probably in some respects superior to the minnow' (*Otago Witness*, 3 April 1869).

2 For instance, by the end of the 1880s, the Otago Anglers' Association was complaining of the poor fishing in many of the district's rivers and streams, which it attributed to pollution of rivers and streams by tailings. The Shag River, or Waihemo, of northern Otago, was an early casualty – a once popular fishing river reported to be spoilt by mining by 1889 (*Otago Daily Times*, 28 September 1889).

3 For more discussion of this see Knight, 2016, p.84.

4 The council comprised the secretary of marine, government appointees from the Agriculture, Health and Works departments as well as from the Department of Scientific and Industrial Research, plus four local authority and two industry representatives.

5 In 2009 the mill gained a further 25-year consent to discharge effluent into the river (*New Zealand Herald*, 13 August 2013).

6 Local water rights were granted by regional water boards (the catchment authorities that existed under the Soil Conservation and Rivers Control Act 1941), whereas Crown water rights were granted by the national authority.

7 This devolution occurred as a result of a 1971 amendment to the act (Roche, 1994, p.128).

8 For more discussion of this see Knight, 2016, pp.194–201.

9 The longest time taken for a water conservation order to be approved was 17 years, for the Mohaka River in the Hawke's Bay. Only two successful applications have been lodged since 1991, partially a consequence of the costly and resource-intensive nature of the water conservation order application process. One of those applications – the Rangitata – cost the applicant (Fish and Game) over half a million dollars, comprised mainly of fees for lawyers, planners and scientists (Parliamentary Commissioner for the Environment, 2012, p.61).

10 As the New Zealand Conservation Authority puts it in its 2011 discussion paper *Protecting New Zealand's Rivers*, 'WCOs have primarily been used to protect rivers under threat. They have not been used to protect a representative range of rivers' (New Zealand Conservation Authority, 2011, p.30). The New Zealand Conservation Authority is an independent conservation body set up to advise the minister of conservation and the director-general of conservation.

11 In its first review of New Zealand's environmental policies, the OECD cautioned: 'The kind of intensive pastoral farming practised in New Zealand almost inevitably results in a high level of nutrients (mainly nitrogen and phosphorus) in inland waterways and lakes, and in some situations this has already contributed to their eutrophication.' The report went on to warn that moves to introduce greater use of nitrogenous fertiliser in order to support more intensive farming 'would lead to increased leaching of nitrates [and] as greater numbers of livestock compact the soil, lead to accelerated run-off and associated damage to waterways' (OECD, 1981, p.47).

12 For more discussion of this, and other related Waitangi Tribunal cases, see Knight, 2016, pp.246–7.

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Guy Salmon

Freshwater Decline
the need for precaution and polluter pays in agriculture

Abstract

Regional councils set objectives in 1992 to maintain and improve freshwater quality. Since then water quality in most agricultural areas has deteriorated. Proposals for freshwater reform need to understand the reasons for this long divergence between stated intentions and actual results.

A key driver has been the accretion over time of farmer entitlements to damage freshwater resources. This accretion has been overseen by regional councils, contrary to their own stated objectives. Councils' lack of precautionary action, and primary reliance on encouraging good management practices within existing livestock-based land uses, has allowed limits to be overshot. Livestock numbers will now have to reduce in many areas. Councils are unlikely to deliver such an outcome without major changes to the policy framework.

A government which has both economic and environmental goals needs policy instruments which can decouple agricultural value creation from environmental impacts. This requires an ability to apply the polluter pays principle, to drive eco-efficiency, innovation and land use change. Six major barriers exist to implementing polluter pays, which should be addressed if the pastoral export economy is to escape being hard-wired in pollution-intensive mode

Keywords good management practices in livestock production, farmer entitlements, multi-level governance, New Zealand regional councils, freshwater quality problems, polluter pays principle

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Over the 30 years since regional councils were established, the desire and intention to maintain and improve freshwater quality has become increasingly salient. This is apparent in a series of reforms initiated by central government, and in the regional councils' own stated policy objectives. It is apparent also in the sentiments expressed by farming leaders, and in several published surveys of public opinion. Despite this, the measured states of ecological health and human health (for recreation and mahinga kai) have not generally improved. Instead, degraded freshwater quality is an issue in most of New Zealand's urban and rural areas, outside the conservation estate. While some of the most degraded water bodies are in urban areas, these make up only a small fraction of the total extent of degraded fresh waters.

Most waters in streams, rivers, lakes and estuaries are today dominated by agricultural run-off (Howard-Williams et al., 2011). Larned et al. conclude: 'Legacy effects, continued agricultural intensification and urban growth, and projections of future intensification … all highlight the need for continual improvements in land use management, to limit future water-quality degradation' (Larned et al., 2016, p.25). It is noteworthy that the present government, through its reform programme Essential Freshwater, aims to do far more than just 'limit future degradation'. It boldly states: 'At the election the Government won a mandate, and we now carry a duty, to improve the quality of our rivers … We're not going to keep kicking the can down the road and leave the hard issues for future generations' (Ministry for the Environment and Ministry for Primary Industries, 2018, p.4). This document further promises: 'In five years there will be a noticeable improvement in freshwater quality' (p.6). If the ministers' reform programme is to succeed, it is important to understand the reasons for the evident difficulty in limiting the adverse effects of agricultural land use intensification over the last 30 years. As a result, this article focuses on the dominant influence on rural freshwater quality, which today is agricultural land use.

The accretion of farmer entitlements

In New Zealand, legal property rights in land do not include rights to erode the soil, to drain wetlands, to take fresh water for irrigation, nor to pollute water bodies. The fact that these things are happening, often on a grand scale, is because they have been allowed to happen by the regional councils, to whom, under our freshwater management system, very extensive discretions and powers of control have been devolved.

Councils have functions, and must follow processes, prescribed under the Resource Management Act 1991 (RMA). In particular, they have responsibilities to set out their high-level strategic objectives and policies through regional policy statements, and their more detailed objectives, policies and rules in regional plans; in the case of certain activities allowed in the plans, they may issue consents, with specific conditions, to take, use or discharge into water. These consents confer legal rights in water for up to 35 years and may then be renewed.

In New Zealand, legal property rights in land do not include rights to erode the soil, to drain wetlands, to take fresh water for irrigation, nor to pollute water bodies. The fact that these things are happening … is because they have been allowed to happen by the regional councils …

Within this framework, regional councils may be viewed as producing two types of products. The first category may be described as *statements of good intentions*. This includes, notably, policy objectives; limits on the taking of water, and on discharges into water; and targets (limits which are to be met at a date in the future). The second category of council product may be described as *entitlements*. This includes: consents; rules which establish permitted activities; certificates of compliance; grandparented (see below) nutrient discharge allocations for water bodies; and, arguably, non-complying practices that are informally allowed to continue for protracted periods as a result of council decisions, or through a lack of commitment to compliance enforcement.

The key point about how the system works in practice is that these two types of products are quite commonly not aligned with each other. Statements of good intentions are important for councillors' political purposes as they align with expressed wishes of the electorate and, in most regions, are necessary for councillors to win election. Entitlements, on the other hand, are of disproportionate importance for a small sub-section of the electorate comprising agricultural water users – those engaged in the taking of water or discharging contaminants into water. Water users seek certainty of entitlements as a basis for their borrowings and ongoing investments in their businesses. They oppose any reduction in entitlements which may affect the value of their land. These motivations are perhaps inevitable; but the regulatory system is clearly failing when councils take decisions to create entitlements which are not in alignment with their own policies, limits and targets.

In 1992, as required by the Resource Management Act, every regional council consulted the public in its region and published a regional policy statement. Every regional policy statement contained strategic objectives to maintain or improve freshwater quality. Since 1992, long-established and conspicuous adverse trends in water quality have made it clear that

these objectives have not been delivered on in agricultural areas in most regions. This is partly because regional plans, developed to implement the councils' stated objectives, generally placed the main emphasis on 'education', that is, encouraging voluntary uptake of good management practice by farmers. This is a doctrine which, in intensively farmed areas, has not proved to be consistent with the objective of improving water quality (see next section). But of particular significance is the fact that many councils went further, to allow activities and practices to become established and to persist which they must have known were inconsistent with achieving their stated objectives. In doing so, they established accretions to the bundle of rights and entitlements which are assumed and relied upon by farmers. Five main routes to council-established accretions of farmer entitlements may be identified:

(1) *By introducing rules which create certain permitted activities, and by issuing certificates of compliance which then protect those activities against future rule changes.* In many regions experiencing dairy industry growth, permitted activity status was extended to allowing stock access to waterways and unlimited fertiliser application. Fortunately, Fonterra took an initiative to secure fencing of larger dairying streams in 2001 and some councils followed suit in their plans, but intensive sheep and beef farming still does not require fencing in a number of council plans, and national stream fencing regulations announced in 2017 have never been gazetted. Unlimited fertiliser application continues to be an accreted farmer entitlement in most parts of New Zealand outside Canterbury. The role of certificates of compliance is to convert permitted activities into a legal entitlement attached to an individual property, essentially equivalent to a consent. The certificates have been in high demand in many regions because they protect property owners against any new rules which may be introduced by way of a proposed plan.

(2) *By delaying the establishment of any form of limits, and in the meantime issuing consents which cumulatively overshoot the needed limits.* Most councils established no meaningful limits on issuing water consents during the first 20 years of the RMA, although, according to a 2008 study by the New Zealand Business Council for Sustainable Development based on council staff appraisals, most catchments were close to fully allocated, or over-allocated, by that date. Canterbury was the most conspicuous example of consents overshooting needed limits. A 'gold rush' for water for irrigated dairying starting from the early 1990s had led to unrestrained consent issuance for water takes; the council subsequently refused to agree to environmentalists' requests to seek powers for a moratorium on further consenting; and dramatic drops in groundwater levels occurred during the irrigation season, with parallel effects on lowland stream flows. In 2006 came the announcement of the Programme for the Restoration of Lowland Streams, which failed, and a strategy was advanced for building water storages which could take pressure off the aquifers without curbing farming activity. However, the combination of these policies with unlimited fertiliser application as a permitted use led to a widespread and rapid build-up of groundwater nitrates in irrigated farming areas. This rise is ongoing despite the recent introduction of limits and targets. (Parliament dismissed the council in 2010 and commissioners were appointed, in what has been so far an only partially successful effort to bring water management under control.)

(3) *By protecting some or all existing land and water users once recognised limits have been overshot by the proposing of rules creating grandparenting arrangements.* Grandparenting involves the conferring of an exclusive privilege to pollute water (or emit greenhouse gases) at or near existing levels on a politically powerful group. It thereby defers – for a decade or more, with likelihood of renewal – any need to take responsibility for the resulting environmental impacts. In the absence of statutory authority to auction, or progressively charge for, rights to use or take water, grandparenting by regulatory fiat has become the default allocation strategy adopted by regional councils. To provide a genuine, second-best solution to the need to allocate responsibilities for meeting limits while providing for a transition, any grandparenting should include a binding exit strategy which clearly signals to land users the imperatives of early change, including, for many, the need for a change of land use. This, however, is far from the minds of most regional councils which propose grandparenting arrangements. For example, an 80-year period to achieve water quality targets is embodied in Waikato's PC 1 proposal, which is accordingly very modest in the demands it makes of its major source of nutrient contamination, the dairy industry, targeting only the most egregious 25% of polluters for reductions in the coming decade, while locking in entitlements for the other 75% to continue their present levels of pollution.

(4) *By excessively protracted delays in taking compliance enforcement action against*

Since 1992, long-established and conspicuous adverse trends in water quality have made it clear that these objectives have not been delivered on in agricultural areas in most regions.

non-complying practices. While not strictly speaking an entitlement, an ability to rely on non-enforcement of consent conditions created something akin to it for dairy farmers in some regions for many years. Most councils have significantly improved their compliance monitoring and enforcement activity in recent years, but some disturbing reports still come to light. For example, in Waikato in October 2018, 20 years after dairy shed effluent management rules were first introduced and 11 years after the current plan provisions came into force, it was reported that grossly undersized effluent storage, likely to lead to pollution incidents, still existed on 19% of the region's 4,500 dairy farms, that only 76 of 432 high-risk farms asked to upgrade had complied, and that at the current rate of progress it would take 27 years for them to comply (Farmers Weekly, 2018).

(5) *By introducing payments for good environmental practice (which effectively confer a right to bad practice on those farmers not being paid to desist)*. There is a long-established practice, predating the establishment of regional councils, of entitling the farming of highly erodible land while encouraging soil erosion plantings with grants. This combination has the unwanted effects of displacing private forestry investment and slowing down the rate of land protection to the rate at which public funds are made available. Under this policy, retirement of highly erodible land from pastoral use will take many decades.

Attempted restraint of the accretions process

In 2014 the regional plan ('One Plan') of the Horizons Regional Council (Manawatū–Whanganui) entered into force after years of debate and litigation. For the first time, some farmers were required to obtain intensive land use consents, to ensure that the plan's freshwater limits were met. It soon became apparent that the council's primary concern was to ensure that existing intensive farming businesses were not forced by these limits into de-intensifying or changing land use. Environmentalists contended that many consents were being issued illegally, and that a council resolution which appeared to direct officers to do this was also illegal. In 2017 the Environment Court upheld these claims, saying:

> Economic consequences for private individuals are an inevitable corollary of regulation in the public interest. That is not a reason to manipulate or pervert plan implementation … The potential environmental impact of the activities in question is very significant … The declarations are required to protect the integrity of the One Plan and the community's confidence in Council decision-making. ([2017] NZEnvC37, para 182)

The council revoked its resolution and stopped illegally issuing consents. But having already apparently committed, in its earlier consents, too much of the known, total allowable envelope of nitrogen discharges, the council was unable to consent a further 118 operating dairy farms and 60 commercial vegetable growers, who have simply continued to operate without consents. An independent report commissioned by the council estimated the impact on farms of the One Plan continuing in force, assuming an uncontroversial updating of a technical table in the plan. The report said:

> nitrogen losses would drop by over 200 tonnes[/yr] (40%) and milk production by over 700 tonnes over 20 years (5%). However, some farms would still struggle to remain financially viable … It is possible that some of the affected farmers would consider amalgamating and others to change their existing landuse away from dairying. (Parminter, Ridsdale and Bryant, 2018, p.7)

It appeared that such a combination of outcomes would be politically unacceptable to the council, which in April 2019 announced that it would simply change the plan to achieve its original intention, 'water quality improvement within the means of most farmers'.[1] Litigation over this could well take years to resolve. The experience suggests that, notwithstanding the views of the Environment Court, the real power lies with the regional council, even if it is only a power to delay.

Many councils have shown that politically driven delays in introducing or enforcing limits are a key to the accretion process, since, once land use intensification has been allowed to occur, even if it damages freshwater resources it becomes extremely difficult to reverse. Indeed, the significance of allowing accretions to become established becomes clearer when the psychology and politics of trying to reverse them later are brought into focus. Kahnemann (2011) has shown that risk aversion is asymmetrical: people are more willing to act to avert a loss than to achieve again. Olson (1971) has shown that in the pursuit of public goods, power is also asymmetrical: the common good of large latent groups is poorly incentivised compared to the strong incentives which can operate in small groups, such as those with vested interests at stake. It is the combined force of these two well-known tendencies of human behaviour that makes the ongoing accretions issue so critical in the operation of limits-based governance.

… once land use intensification has been allowed to occur, even if it damages freshwater resources it becomes extremely difficult to reverse.

Various technical devices may then be used which purport to create win-wins for both freshwater limits and farm profitability, and it is the promise of these devices that is commonly relied upon to justify non-regulatory approaches by councils. Some devices are collective good projects involving community water storage,

managed aquifer recharge or the management of groundwater nitrate attenuation, but for the most part they comprise good management practices (GMPs) which are dependent on individual landowner actions. The alleged promise of GMPs for solving freshwater problems has strongly underpinned councils' characteristic delays in introducing and implementing freshwater limits. The problematic nature of reliance on GMPs for delivering results in a limits-based system is explored next.

rather than curbing, the innovation and land use changes that New Zealand needs.

Both assumptions need to be carefully examined in a country like New Zealand, whose main environmental problems originate in large measure from intensive, grass-fed livestock farming, and whose soils and climate offer us many other land use options. In 2001 the dairy industry began an experiment which tested the first assumption. The industry established five experimental stream catchments, representative of intensive dairy farming across New Zealand, introduced a range of GMPs, and measured the overall effects on stream water quality.

> The environmental results achieved in the [Bog Burn in Southland, Waikakahi in Canterbury, Waiokura in Taranaki and Toenepi in Waikato] catchments are, from the perspective of a government wanting timely improvements in water quality, mostly not encouraging.

The doctrine of encouraging good management practice

Good management practices, and supporting measures for their dissemination such as catchment management groups and farm environmental plans, are clearly good things in themselves. The issues for debate are whether relying on them is really an adequate response by itself; and, where it is not, what kind of relationship should exist between them and the regulatory framework. There is optimism in some quarters that simply adding a regulatory 'nudge' to farmer uptake of GMPs, without creating impetus for reducing livestock numbers, would meet the government's objectives. This view embodies two assumptions, each of which is challenged in this section. The assumptions are:

- that if existing farmers were all to apply GMPs, environmental outcomes would then be satisfactory; and
- that a regulatory system based around GMPs, and therefore controlling how farming was done, could be designed and operated in a way that stimulated,

One of these catchments, Inchbonnie, is really only representative of the West Coast, where very high rainfall, very high flood frequency and proximity of indigenous forest appears to provide a relatively resilient environment for intensive dairying, although nitrogen flows from dairying to Lake Brunner may have to be managed in future (Wilcock et al., 2013a). Water quality in the Inchbonnie catchment is no longer being monitored. The other four GMP monitoring catchments, which are further examined here, are Bog Burn in Southland, Waikakahi in Canterbury, Waiokura in Taranaki and Toenepi in Waikato. The industry developed a series of GMPs and obtained good uptake of them among farmers in these four catchments. The main GMPs involved streamside fencing and planting, and improved management of dairy shed effluent, plus upgrading of irrigation technology (in Waikakahi) and of winter feed management (Bog Burn).

The environmental results achieved in these four catchments are, from the perspective of a government wanting timely improvements in water quality, mostly not encouraging. After 18 years of monitoring (including recent regional council results where available), the level of faecal contamination in the four catchments remains in the worst 25% of sites monitored in New Zealand – commonly unsuitable for swimming or gathering mahinga kai.[2] While concentrations of total suspended solids, and water clarity, have improved in all four streams, indicators of poor ecological health which were measured at the outset of the experiment remained largely unchanged when trend analyses were performed with data up to 2013 (Wright-Stow and Wilcock, 2017). These results probably reflect the influence of multiple stressors, including total nitrogen, the latter perhaps acting indirectly. Marginal improvements were reported on some measures at Toenepi, but the Land Air Water Aotearoa (LAWA) website records that in this stream, MCI (macroinvertebrate index, the preferred measure of ecosystem health) remains 'poor' at 68. Only at Waiokura is there an encouraging picture, mainly apparent since 2013, with MCI near Manaia now rated 'good' at 103.5. None of the catchments exhibit overall the compulsory national values of ecosystem and human health defined in the existing National Policy Statement for Freshwater Management, a document which is itself regarded as inadequate by the present government.

One response to this situation would simply be to introduce some regulatory compulsion on laggards to adopt GMPs, perhaps by requiring farms to have certified farm environmental plans, of the sort already used and promoted by industry groups. Wilcock et al. (2013b) say that for various reasons, including market forces influencing farm incomes and costs, and a slow rate of farmer adoption of some GMPs, monitoring programmes 'need to be much longer than ten years if they are to detect changes in water quality caused by farmer actions' (p.410). Wright-Stow and Wilcock (2017) offer some optimism

that the ecological health of the GMP catchments might gradually improve over several decades. But neither paper offers evidence that GMPs alone, even with regulatory compulsion driving their uptake, would enable New Zealand's more intensively farmed and/or fragile areas to meet catchment limits for ecosystem and human health based on the national policy statement. If we are serious about meeting limits for these values, and especially if, like the government, we are wanting timely delivery, a more precautionary approach seems to be called for.

This raises the question of whether livestock intensity in some areas, and livestock numbers overall, might need to be reduced, through policies favouring de-intensification and diversification of land use. The case for such policies is strongly reinforced if climate policy is integrated into the policy frame, although freshwater policymakers probably cannot rely on livestock farmers being required to pay the full social cost of their climate emissions for a very long time. So what happens now in freshwater regulation, and the form it takes, still matters. Arguably, we need a system capable of stimulating reduced livestock intensity and changes of land use in those catchments – probably many – where simply implementing GMPs for existing livestock farming systems will not be sufficient. A system of farm environmental plans focused on GMPs and using certifying consultants accountable to regional councils may be under consideration, but this is an unlikely vehicle for ensuring that intensive land users change or exit. Such a system amounts to input regulation tailored to incumbent land use systems (intensive sheep and beef, dairy or deer farming) and based on 'best practicable means', a commonly used strategy in resource management which 'implies that while better emission standards may be achievable, industry should not necessarily be required to implement them if this would not be practicable especially with respect to costs' (Calow, 2009, p.11). Such a system is attractive to sectoral interests because its effect is to protect incumbents against competing land uses which could perform better. Although widely used overseas, such an approach seems ultimately at odds with the system of 'environmental bottom lines' based on 'hard limits' that New Zealand has adopted, following the consensus of the Land and Water Forum.

Explanations for regional council behaviour

It is argued above that regional councils' responses to freshwater decline have long emphasised encouraging good management practice by voluntary means while enabling farmers to accrete entitlements to degrade fresh water, accretions that are contrary to the councils' own stated objectives; and that some councils are reluctant to countenance any significant reductions in existing livestock farms to achieve water quality objectives. What explanations can be inferred for this pattern of behaviour? Possible explanations may be examined under four headings: enablers; drivers; contextual factors; and challenges attributable to the logic of collective action. The enablers are susceptible to early central government action, while the other factors, although important, will take longer to change; they are addressed here only briefly.

> … some councils are reluctant to countenance any significant reductions in existing livestock farms to achieve water quality objectives.

First, the *enablers* notably include the fact that the highly discretionary section 104 of the Resource Management Act does not require council-issued consents to comply with, or even be consistent with, the objectives, policies and rules set out in plans. Rather, the requirement is merely to 'have regard to' these. Also, while since 2011 there has been the National Policy Statement for Freshwater Management, which has legal force under the RMA, it currently still allows councils until 2030 to produce their freshwater plans. Farms using certificates of compliance issued under pre-existing rules may not be affected by the 2011 policy until the 2040s. Furthermore, it has not proved easy for either central government or the courts to require councils to comply with their own plans. The evident unpopularity of the 'removal of democracy' at Environment Canterbury, and of legislative proposals to empower ministers to write text into regional plans, appears to date to have inhibited ministers from exercising powers which could be perceived as 'overriding local democracy' for the sake of meeting national objectives for water quality. Finally, the cumbersome nature of the plan change process, commonly requiring two rounds of hearings, drives delay and makes it difficult to curb the creeping process of accretions.

Second, the *drivers* of regional council behaviour include, notably, the farming and rural industry lobby groups, which are well-organised and resourced, and whose pressure on councils has been especially influential in regions where anxiety exists about perceived risks of socio-economic decline.

Third, there are *contextual factors* which may affect regional council behaviour, including rural-urban differences and tensions between regional and district councils which leave little room for middle ground. New Zealand's prevailing political culture has arguably become more fragmented and polarised, albeit not to the extent seen in some countries. Polarisation has sometimes been mellowed by collaborative efforts, such as the Manawatū River Leaders' Accord.[3]

Fourth, there are *challenges associated with the logic of collective action* (Olson, 1971; Lubell et al., 2006), which lead to power asymmetries manifested in electorate awareness of issues, in council elections and in regional decision-making. While public participation opportunities are provided for by law, including for submissions, hearings and court appeals,

individuals or small groups who engage in these activities face significant personal costs. When compared to the corresponding individual benefits of their actions, which are spread thinly and widely, the imbalance incentivises most individuals to become inactive free-riders. The minister for the environment's technical advisory group wrote in 2009:

> A series of public awareness surveys conducted by Environment Canterbury (ECan) every two years since its formation shows a fairly consistent pattern: only about two percent of Canterbury residents can name their local, elected ECan councillor, and only about ten percent can name the chairman of the council. It is likely that a similar pattern holds for other regional councils. The lack of a strong political mandate appears to hamper many regional councils in their dealings with other councils and with sector groups. This creates a risk of sector capture, and contributes to an evident difficulty in resolving contentious issues. (Minister for the Environment's Technical Advisory Group, 2009, p.54)

The situation described has been helpful for well-organised vested interests. According to McNeill (2008), farmers, despite being less than 1% of the total population, comprised 38% of regional councillors and formed a majority in five of the 12 regional councils.

In conclusion, regional councils have enabled widespread overshooting of freshwater limits to occur, and they are not well placed themselves to reverse this situation in a timely manner. Of course, councils do not operate in isolation, but form part of a multi-level governance structure which includes important roles for the Environment Court and (at least since 2010–11) for central government, which we consider next.

Issues with the multi-level governance structure

Central government has long struggled to fulfil its intended statutory roles of providing a framework of national policy and standards, and of presenting its views in RMA planning processes. Numerous national policy initiatives came to nothing during the first 20 years of the RMA. Only following the 2009 formation of the Land and Water Forum, a consensus-building body bringing together environmentalists, iwi, the primary sector and energy companies, did progress get under way, leading notably to the National Policy Statement for Freshwater Management in 2011, which was added to in 2014 and 2017. Even so, a significant proportion of the forum's recommendations had not been implemented during its nine-year lifetime. The weak leadership of successive central governments on freshwater policy reflects that they have long seen their first priority as promoting economic growth, mainly through primary sector exporting. This has also, arguably, given primary sector interests a longstanding dominant influence over environmental policies. This continues to make it difficult to apply the polluter pays principle in agriculture, despite support for developing economic instruments based on this approach from the Tax Working Group (2019), the Interim Climate Change Committee (2018) and the Waikato Regional Council (2017).

The prevailing political context has also discouraged government control of mechanisms for holding farmers accountable for their environmental practices, mechanisms which are effectively privatised. Overseer, the computer model developed by fertiliser interests (with a minor public shareholding) to enable farmers to better manage their nutrient leakage, has been adopted by many regional councils to hold farmers accountable for discharges into water bodies which have nitrogen limits. The model is useful for councils devising grandparenting schemes. But the way in which it has been developed, the inadequate scope of its calibration, and its lack of transparency appear to make it unfit for the purpose of holding farmers accountable at the property level; consideration should be given to bringing Overseer into public ownership (Parliamentary Commissioner for the Environment, 2018). Similarly, New Zealand's systems for writing and certifying farm environmental plans, which have largely been privately developed by primary sector industry groups, are now being considered for adaptation to a public regulatory purpose. This arguably needs very careful scrutiny also, if the system is to avoid industry capture and the disincentives to innovation and land use change that are associated with input regulation and 'best practicable means' policy approaches in Europe and North America.

While central government has been proactive in recent decades in addressing issues around the Treaty of Waitangi and has formally acknowledged iwi rights and interests in fresh water, this has generally not extended to negotiating settlements. The Labour Party's 2017 election policy of bringing fresh water into public ownership did not survive coalition negotiations, and the Ardern government's policy now echoes that of the Key government in insisting that no one owns water. The ongoing political refusal to address this issue is the main obstacle to addressing most of the Land and Water Forum's remaining unactioned recommendations,

The Labour Party's 2017 election policy of bringing fresh water into public ownership did not survive coalition negotiations, and the Ardern government's policy now echoes that of the Key government in insisting that no one owns water.

especially those on allocation, where the forum consensus was for the trading and pricing of defined water use rights to play a key role.

Some progress has been made on iwi interests at the level of governance, especially through the creation in 2010 of the Waikato River Authority as a co-governance entity sitting above the Waikato Regional Council. The potential for this to happen elsewhere spurred several other regional councils to establish improved mechanisms for engaging tangata whenua in council governance and policymaking. This shift has been important as te ao Māori embodies strong distinctive values on fresh water, and tangata whenua have found it difficult to win seats on regional councils through the prevailing first-past-the-post voting system.

The role of the Environment Court in the governance system has been controversial for two reasons. The long-running jurisprudence of 'overall balanced judgement' which gave rise to unpredictability in court judgments, enabled fudging of stated objectives and hampered accountability in the system, was overturned by the Supreme Court in the case of *Environmental Defence Society v NZ King Salmon* ([2014] NZSC 38) in favour of clear environmental bottom lines. A second source of controversy has been the fact that the right of *de novo* merits appeals to the court on regional plan proposals effectively creates two hearings in most cases, contributing to the very cumbersome nature of the planning process. A lack of agility in policymaking can be unhelpful to the environmental interest by delaying much-needed change in prevailing policies which, as described earlier, are facilitating the accretion of farmer entitlements to pollute. A possible solution could involve the independent hearings panel model used to review the Auckland Unitary Plan. This model was designed (and appointed by) central government to advance urban intensification relatively quickly and effectively after decades of political impasse (Salmon, 2015).

Five barriers to implementing the polluter pays principle

New Zealand operates a market economy and competes in a globalised environment, while the government has both economic and environmental objectives. It must therefore seek policy instruments which can decouple economic growth from environmental impacts, and, in this, the polluter pays principle will inevitably play a crucial role. The central challenge is the evident difficulty in implementing this principle within the politically powerful primary sector. In institutional terms, the main barriers may be summarised as follows:

- The accreted entitlement to farm highly erodible land has institutionalised ongoing erosion and sedimentation, except to the extent that public funding is available to pay polluters to desist.
- The failure to bring fresh water into public ownership by settling iwi rights and interests, and the political doctrine that 'nobody owns water', has effectively precluded charging for its use or contamination.
- The longstanding exemption of agricultural greenhouse gases from pricing mechanisms has favoured the intensification of ruminant livestock farming over less-polluting varieties of farming and forestry.
- The reliance of policymakers on grandparenting arrangements in both freshwater and climate policy, without a binding exit timetable, perpetuates the accreted entitlements of established polluters.
- To the extent that polluter pays depends on timely and effective regulation, the present multi-level governance design involving central and regional government and the Environment Court, in conjunction with privatised mechanisms for farmer accountability, has proven to be too dysfunctional, cumbersome and lacking in precaution to be fit for purpose.

An integrated view needs to be taken of the primary sector's environmental externalities, bringing the three key issues of biodiversity, fresh water and climate into a common framework. Once we do that, we can see that the unaccounted environmental costs are huge, and that by largely exempting agriculture from paying for these we have been hardwiring the economy into a pollution-intensive pattern of economic development. The real challenge for the government's reforms is not so much to achieve some short-term freshwater improvements in selected catchments, as to make progress on the longer-term agenda of creating institutions of integrity and effectiveness, which are capable of decoupling economic development from ongoing environmental degradation.

1 www.horizons.govt.nz/publications-feedback/one-plan-reviews-changes/plan-change-2. New information about attenuation of nitrogen flows between the root zone and the rivers is cited by the council in support of its proposed changes but has yet to be tested at a hearing.

2 In the case of Waiokura Stream, the Taranaki Regional Council argues that it is too small for swimming and is not representative of other intensively farmed catchments on the Mt Taranaki ring-plain because it is not directly flushed with flows off the mountain.

3 See www.manawaturiver.co.nz.

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Kalyan Chakravarthy, Frances Charters
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The Impact of Urbanisation on New Zealand Freshwater Quality

Abstract

Urban waterways represent less than 1% of the total river length in New Zealand. However, they are the most visible of all rivers, as 86% of New Zealanders live in urban areas. Urban waterways are impaired due to elevated levels of pathogens, turbidity, nutrients and heavy metals originating from anthropogenic activities. In addition to being conduits of storm water run-off from urban areas, some urban waterways also receive discharges from wastewater treatment plants and combined sewage overflows, thus greatly reducing their capacity to provide ecosystem services such as recreation, tourism, biodiversity and mahinga kai. This article summarises the state of New Zealand's urban freshwater quality, the major drivers of pollution, and mitigation measures needed to restore urban waterways.

Keywords storm water, impervious coverage, overflows, water sensitive urban design, source control

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Eighty-six percent of New Zealanders live in the 0.85% of the country classified as urban (Statistics New Zealand, 2018). Around 3,344 kilometres of waterways flow through urban areas, and this represents 0.86% of the total river length in New Zealand, but studies show that over 80% of this river length exceeds the relevant default guideline values for most of the measured water quality variables (Whitehead, 2018). For example, urban rivers have 30 times higher E. coli, 3.3 times higher turbidity, 19.5 times higher nitrate-nitrogen levels, and 4.7 times higher dissolved reactive phosphorous than rivers dominated by native land cover. Data collected in the past five years revealed that 94% of the total river length in the urban land-cover class is at high risk for swimming because the predicted average campylobacter infection risk is greater than 3%. Only 6% of river length in the urban land-cover class poses low or zero toxicity risk to aquatic biota with regard to nitrate-nitrogen and ammonia (Ministry for the Environment and Statistics New Zealand, 2019). In 12 out of 17 monitored urban sites, concentrations of dissolved copper exceeded toxicity guidelines, while 27 out of 50 monitored urban freshwater sites exceeded dissolved zinc guideline levels (Gadd, 2016).

This grim picture of the New Zealand urban freshwater environment is partially due to historical neglect and current lack of environmental stewardship. Urban freshwater bodies (be they streams, rivers or lakes) are often used as sinks for untreated urban run-off from a wide range of land uses, with the predominant urban pollutants being heavy metals (zinc and copper), nutrients (nitrogen and phosphorus), total suspended solids, polyaromatic hydrocarbons, and pathogens (e.g. E. coli). In addition to storm water run-off, a few urban waterways in Auckland also receive combined sewage overflows (CSOs), in catchments where storm water and sewage are not separated. CSOs contribute primarily towards the faecal pollution of waterways, thus making the receiving environment (rivers or coasts) unsafe for swimming. When direct discharges of outfalls from wastewater treatment plants to the freshwater environment occur, nutrients and pathogens, in addition to micropollutants such as pharmaceuticals, result in significant impacts to waterway health (Ebele, Abdallah and Harrad, 2017). Such pollution greatly reduces the capacity of urban waterways to sustain and provide ecosystem services such as recreation, tourism, biodiversity and mahinga kai.

There are two types of pollution influencing the water quality in receiving urban water bodies:

- point source: this type of pollution is caused by localised pollutant discharges. Municipal wastewater outfalls, industrial wastewater outfalls, septic tank discharges and waste spills fall under this category of pollution. They are readily identifiable as single or multiple point locations;
- diffuse source: this type of pollution is either a composite of different point sources or originates over large areas. Rainfall run-off from different land use types is considered diffuse source pollution as it collects litter, sediments, oil, grease, bacteria, fertilisers (excess nutrients), heavy metals and other toxic substances as it travels across different surfaces. Because of this diffuse nature, it is more difficult to control than point source pollution.

In urban areas, point source pollution is regulated by resource consents; in contrast, diffuse source pollution occurs mostly during storm events and its impacts depend on land use patterns and run-off controls. Diffuse pollution is characterised by its 'first-flush' effect, where pollutant concentration is highest in the initial run-off because of flushing of accumulated pollutants from the surface. The concentration decreases as pollutants are washed away; however, it can still remain well above in-stream guideline values for the remainder of the storm event. Hence, treatment for diffuse source pollution is more about source control (to minimise generation of polluted run-off in the first place) than 'end of the pipe' solutions.

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Impact of storm water

The principal difference between urban and non-urban areas in relation to freshwater and coastal impacts is the proportion of the catchment made up of impervious surfaces. These are the surfaces that do not allow infiltration into the soil, such as roofs, roads and sealed carparks. In catchments with 10–20% imperviousness this can result in increased peak storm water run-off, which is double the volume of run-off compared to areas with no impervious surfaces. Impervious cover of 35–50% can result in three times the run-off volume (Paul and Meyer, 2001). Without proper storm water control measures, this run-off carries numerous pollutants from the catchments in its path to the receiving waters. Even 10% impervious cover in the catchment can result in reduced water quality (Brabec, Schulte and Richards, 2002). Both urban population growth and urban sprawl are responsible for the conversion of native land cover into residential and commercial properties, roads, carparks and other impervious surfaces. During heavy storm events, the amount of water draining from the average roof can exceed the amount of wastewater flows from more than 40 households (Watercare, 2019). The number of storm water discharge outlets in major cities of New Zealand is variable, with Auckland having by far the most at nearly 20,000 (Water New Zealand, 2018).

The most visible degradation in receiving waters is caused by gross pollutants (litter, debris and sediment greater than 5mm in size). Studies have shown that nominal annual gross pollutant loads can be estimated to be 90kg/ha/yr of wet weight, with an expected volume of 400L/ha/yr (Fitzgerald and Bird, 2010). Although gross pollutant traps can be used to remove the larger size pollutants before the storm water enters the receiving waters, they are ineffective at removing chemicals, sediments, bacteria and heavy metals, which all contribute to urban waterway degradation.

Suspended sediment is contributed by storm water run-off via build-up and wash-off from impervious surfaces; sources include breakdown and degradation of materials, soil erosion and vehicular sources (Zanders, 2005). Suspended sediment can smother biota, causing respiratory damage and reduced light penetration, decreasing food supply for benthic organisms. It may also settle once in the waterway as deposited sediment, which causes clogging of the waterway bed and smothering of biota, and can affect water supply intakes (Clapcott et al., 2011; Ryan, 1991).

Sources of copper include brake pads, roofs, claddings, facades and air conditioning pipes (O'Sullivan, Wicke and Cochrane, 2012). Rubber tyres and

galvanised roofs contribute zinc to the waterways. Accumulation of lead in waterways may also have occurred due to historical usage of leaded fuels and lead in old paints (Egodawatta, Ziyath and Goonetilleke, 2013).

Heavy metals cause ecotoxicity in the aquatic environment (Harding, 2005). Metals can switch from particulate (attached to sediment) to dissolved phase depending on the chemical conditions in the receiving waters. Metals in dissolved fraction are more readily available for uptake by freshwater biota (bioavailable) and hence can bioaccumulate in the freshwater biota and be carried up the food chain. Algae, crustaceans and salmonids are particularly sensitive to elevated levels of heavy metals in water. Chronic effects of toxic levels of these metals include reduced growth, lower reproduction rates and higher mortality in aquatic biota. Human consumption of shellfish containing high levels of accumulated metals is a public health risk.

Impact of overflows

Wastewater networks in cities are designed to convey wastewater (residential, commercial and industrial sewage) to treatment plants. However, these systems can have both controlled and uncontrolled overflows that can affect urban waterway health. Within the wastewater pipe network, uncontrolled inflow and infiltration from storm water run-off through gully traps, illegal connections, broken pipes or unsealed manholes can cause total inflows to the wastewater network to exceed its storage and pumping capacity.

In cities such as Auckland with combined sewer systems, CSOs are used to divert excess flows received during storm events into nearby receiving waters. This is done to reduce pressure in the system and prevent possible flooding due to system failure. However, these CSOs contain untreated wastewater discharging into receiving waters and pose a public health risk. Targeted monitoring during wet weather events showed that CSOs in Auckland carried more than 2 million E. coli bacteria per 100mL in the first flush (Coup, Clarke and Sharman, 2012). In addition, CSOs carry increased levels of organic matter from untreated wastewater. Decay of such organic matter by bacteria, respiration, flux of benthic oxygen into the sediment and ammonia oxidation contributes to oxygen depletion. Such low or zero oxygen conditions can be fatal to aquatic organisms, particularly those that cannot relocate to a more oxygenated area.

The sewage discharges also carry pharmaceuticals, and other drugs such as aspirin and caffeine (Stewart et al., 2014). These chemicals bioaccumulate through the food chain from shellfish and consequently affect human health upon consumption.

Even during dry weather, overflows can occur due to blockages or mechanical faults (such as pump failures or power outages). Blockages can happen due to 'fatbergs' (congealed lumps of cooking fat and other material). In 2018 there were approximately 1,642 dry weather wastewater overflows reported due to blockages (Water New Zealand, 2019).

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Impact of wastewater treatment plants

Centralised wastewater treatment plants are found in many towns and cities of New Zealand. The majority of them were constructed in the past 60 years and they serve about 85% of the New Zealand population (Water New Zealand, 2019). More than 500 billion litres of sewage flows into these plants annually (Ministry for the Environment, 1997). Out of the 321 publicly owned wastewater treatment plants, about 152 of them discharge to fresh water (GHD-Boffa Miskel, 2018).

Although wastewater treatment plants effectively reduce contaminant load and biochemical oxygen demand, the effluent does not exactly match the receiving waters in terms of water quality. The effluent water quality varies across regions, primarily due to the level of treatment. Plants treat sewage at three different levels: primary, secondary and tertiary. Contaminant removal efficiency at each stage is 10%, 50% and more than 90% respectively (Strokal et al., 2019).

The potential ecosystem effects of primary or secondary treated effluents include increased nutrient loading and eutrophication (Gücker, Brauns and Pusch, 2006). The effluents also reduce natural biological and chemical variability, and increase biotic homogenisation in the river ecosystems (Drury, Rosi-Marshall and Kelly, 2013).

Out of the 152 wastewater treatment plants that discharge to fresh water in New Zealand, only 42 discharge effluent treated to the tertiary stage. More than 50% of outfall discharges contain high E. coli levels which do not meet the National Policy Statement for Freshwater Management attribute state C target in the receiving waters, and 95% do not meet the attribute state B target (Ministry for the Environment, 2017; GHD-Boffa Miskel, 2018).

Mitigation measures

Mitigation measures to reduce storm water and wastewater contamination of urban waterways can be classified into broad categories of targeted infrastructure and source control management. Compliance requirements imposed by national or local guidelines or legislation, in addition to local activism, often trigger local authorities to act in implementing solutions.

In New Zealand, the principal measure to mitigate the impact of storm water and wastewater on the freshwater environment has been upgrading infrastructure. For example, in Auckland the 13km-long Central Interceptor aims to reduce

overflows by 80%. With a capacity of 200,000m^3, it will collect wastewater and storm water from more than 100 overflow points and transport the water to the wastewater treatment plant at Māngere, with the total cost estimated to be $1.2 billion (Bhatia, 2019). The total cost of upgrades to wastewater treatment plants so that the outfall discharges meet the national policy statement's attribute state B is estimated to be between $1.4 and $2.1 billion (GHD-Boffa Miskel, 2018).

Water sensitive urban design, an approach to planning and designing urban areas, is increasingly being considered for mitigation of storm water impact on New Zealand's urban freshwater environment. The implementation of water sensitive urban design can effectively address both water quantity and water quality issues. Water sensitive urban design promotes the use of natural resources and integration of natural water systems into urban landscapes to assist in trapping of sediments and pollutants for improved water quality, increase residence time in ponds and wetlands to allow more sediments to settle, enhance infiltration (as it would occur naturally if the impermeable surfaces were not there) and increase groundwater recharge for healthier aquatic ecosystems (Moores et al., 2019).

Popular treatment systems included in water sensitive urban design in New Zealand include wetlands, vegetated swales, bioretention systems, rain gardens and pervious pavements. New systems are also being developed locally utilising recycled or waste materials for contaminant removal at source. One example is Storminator™, which has been shown to remove more than 80% of metals directly from roofs by treating the storm water run-off as it drains through the building downpipes. It is designed to have a minimal footprint by retrofitting and sitting in line with existing downpipes (University of Canterbury, 2018).

Water sensitive urban design also allows for integration of mātauranga Māori and principles of tikanga Māori (Māori knowledge and practices) to provide a holistic approach to water protection for future generations. This integration aligns with natural hydrological water cycle processes and provides enhanced sociocultural outcomes in addition to environmental stewardship (Afoa and Brockbank, 2019). The Ministry for the Environment's ten urban water principles also reflect this position (Ministry for the Environment, 2018). The integrated holistic approach to urban water management following te ao Māori recommends maintaining sufficient water flow to support ecosystems, increasing water use efficiency, decreasing wastage of water resources, reducing or eliminating wastewater and storm water flow, and encompassing the views of tangata whenua for development.

Management-based initiatives to target reduction in source pollution are also being more frequently implemented. For example, some local councils have adopted and promoted the use of copper-free brake pads in their vehicle fleets to reduce copper contamination of urban waterways. Street sweeping to remove total suspended solids and metals before they enter the storm water network is also a common management practice of several councils around New Zealand. Other management initiatives have focused on removing legacy contamination from heavily polluted waterways through dredging or vacuuming as a way to reduce resuspension of contaminants.

Proactive management initiatives have also been undertaken to identify hotspots of pollutant sources through modelling (Chakravarthy et al., 2019). Modelling approaches allow for more targeted infrastructure or management solutions to be implemented.

Conclusion

New Zealand's urban waterways have historically been viewed as drainage networks to quickly remove storm water and waste from urban centres. Until recently, these waterways received less attention from media, the scientific community and government than waterways in rural areas. As a result, most urban waterways currently have poor water quality, degraded habitat and impaired ecological health due to elevated levels of sediments, bacteria, nutrients, heavy metals and other pollutants originating in the urban environment. In addition to identifying the primary sources of waterway pollution in urban areas, targeted national and local policies are required to trigger appropriate remediation activities. Restoring degraded urban waterways to full health will require a combination of infrastructure upgrades and technical and policy-based advancements in storm water management.

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Don Rood

How Water is Reshaping the Political Landscape

Abstract

New Zealanders place great value on the quality of their freshwater rivers, streams and lakes for recreation, conservation and food gathering. But over the last 25 years they have become increasingly concerned at the deterioration in water quality, the loss of swimming holes and fishing spots, and the impact of pollution on native and valued introduced species and their habitat. The issue has deeply divided the community and become more and more acrimonious. Recreational and conservation groups blame industrial agriculture for much of the decline, and accuse central and local government of turning a blind eye to the problem and failing to protect the environment. Scientists have added their voices to the debate, but big agriculture and its lobby groups have responded aggressively, denying the problem exists, attacking their accusers and warning government against tackling the problem with tighter controls. Public frustration at the political paralysis and inaction has seen water quality become New Zealanders' biggest single concern. The issue is now firmly established on the political agenda and one any political party wanting to govern the country ignores at its peril.

Keywords politics, dirty dairy, election issue, contamination, drinking water, tourism, the Environment Election

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The enormous power of water to reshape the land is etched all over New Zealand. The relentless flow of rivers has carved gorges through solid rock, eroded mountains to form vast, fertile alluvial plains, and filled lakes with billions of cubic metres of some of the clearest and cleanest water in the world. Now, water is also reshaping the political landscape.

In the past, the seemingly endless supply of fresh water was taken for granted. Lowland streams, rivers and lakes were exploited and abused for economic gain or simply because it was cheaper to dump urban waste into waterways than to install expensive treatment systems. At times, the only concerns about water publicly voiced by political and agricultural business leaders was that rain fell in the wrong places or that it was a waste to let water flow out to sea. The solution they pursued was to spend greater sums of money on capturing and storing water and building irrigation schemes to divert and harness even more of our freshwater reserves.

But in the last 20 years, that mindset has been challenged. New Zealanders have been increasingly voicing their concern about what is happening to their rivers, lakes and streams. They have marched on Parliament, signed petitions and protested that waterways have been getting dirtier: drained and contaminated by intensive agriculture and thoughtless urban development. And they have voiced their anger that New Zealand's lax approach to anything to do with water has not only polluted their local swimming hole, but also allowed foreign companies to bottle and ship large volumes overseas without paying a cent in royalties for the privilege.

The debate has introduced a new word to the political lexicon – swimmable – and a new phrase – dirty dairying. They were descriptions the ruling National Party from 2008 to 2017 did not pay enough attention to and that, according to National insiders, cost it the 2017 election. David Farrar was a trusted advisor to former National prime ministers and the man who Prime Minister John Key praised in his victory speech on election night 2014 as 'the best pollster in New Zealand'. Farrar recently told *Fish & Game* magazine that he is in no doubt National paid a heavy price for its failure in 2017 to identify water as a significant issue: 'When in power, National misread what was happening and made mistakes. There were several factors involved: water purity, clean streams, bottling, and irrigation. And they all combined to be a nasty issue for the Key and English government,' Farrar says (Rood, 2019).

> … in the last 20 years … New Zealanders have been increasingly voicing their concern about what is happening to their rivers, lakes and streams.

Farrar attributes the fact that water quality became a crucial election issue in 2017 to the effective campaigning by environmental groups such as Fish and Game New Zealand, Forest & Bird and Greenpeace: 'Clean water is very powerful because it directly affects a person's life and people have an immediate reaction to the issue,' Farrar says. 'No one wants to be arguing against drinkable or swimmable water. National has learned its lesson, realising it mishandled the clean water issue while in power.' Those views are backed up by long-time National Party observer and political commentator Matthew Hooton. He told *Fish & Game* that National turning a blind eye to the importance of water cost it dearly. The 2017 election result was close – too close to call on election night – but in Hooton's view it was water that won it for Labour:

> National knows the clean water issue cost it the last election. When you talk to them, they will admit they got it wrong and they lost votes. Water quality is now a mainstream issue. Everyone cares about water quality. National didn't understand that, nor the depth and breadth of public feeling, and it cost them.

Hooton now considers the environment and water quality as defining issues for this country's political parties, not fleeting or fashionable topics:

> It is like good monetary policy; to win, a political party better have an environment policy and it better be a good one. It is unacceptable the state the rivers and lakes have got to. It is a serious political issue which has to be resolved. (ibid.)

Although National dropped the ball in 2017 by failing to heed the public mood on water, and those close to the party now admit so, the signs of growing voter unease had been there for a long time. As far back as 2001, the statutory organisation charged by Parliament to manage game bird hunting and trout fishing and habitat, Fish and Game New Zealand, commissioned NIWA, the National Institute of Water and Atmospheric Research, to look at farming's impact on the environment. The initiative was prompted by growing concern from the organisation's tens of thousands of fishing licence holders about the deteriorating state of many rivers and streams and the impact the resulting poor water quality was having on native and sports fish numbers.

The NIWA review confirmed Fish and Game's worst fears. It concluded: 'Lowland rivers in agriculturally developed areas are in poor condition due to high nutrients, turbidity and faecal contamination.' And it sheeted home the blame for the situation to agriculture: 'this report firmly established the link between agricultural land use and poor water quality, stream habitat and impacted biotic communities' (Parkyn et al., 2002).

Fish and Game responded with a public awareness campaign which not only thrust the issue into the public and political spotlight but also spawned the phrase 'dirty dairying'. The campaign seemed to quickly resonate with the wider public. Lincoln University's *Public Perceptions of New Zealand's Environment 2002* survey revealed a big leap among New Zealanders

identifying farming as one of the main causes of damage to fresh waterways. In 2000 the same survey had shown farming in fourth place, with 24.4% of those polled blaming it for damage to fresh water, behind sewage on 46.6%, and hazardous chemicals and industrial activity. By 2002 farming had leapt to bearing 38% of the blame, in second place behind sewage, which was little changed on 46.9% (Hughey, Kerr and Cullen, 2016).

Stung by the negative publicity generated by Fish and Game's campaign and increasing public criticism of agriculture's pollution of waterways, particularly by intensive dairying, the dairy industry giant Fonterra reacted with an initiative it hoped would ease public concerns. Known as the Clean Streams Accord, the initiative set ten-year targets for dairy farmers to fence streams, protect wetlands and better manage effluent and nutrient discharges. The streams to be protected were defined as permanently flowing and more than ankle deep and a metre wide. A more colloquial definition was 'wider than a stride and deeper than a Red Band gumboot'.

The accord was signed in May 2003 by Fonterra, the ministries for agriculture and the environment, and Local Government New Zealand on behalf of regional councils. In 2013 it was succeeded by the *Sustainable Dairying: water accord* (DairyNZ, 2015). However, as Phil Holland pointed out in an article he wrote for the 2014 *Lincoln Planning Review*, the dairy industry made a big mistake by snubbing the environmental groups which had raised the concerns in the first place. Holland argued that by not inviting Fish and Game and other advocates for the environment like Forest & Bird to be part of the agreement, these organisations were left free to step up their clean water campaign and criticise the new accord (Holland, 2014).

Two of the environmental groups' main criticisms were that the accord was only voluntary and that it did not protect the thousands of smaller streams narrower than a metre which naturally flow into bigger waterways. The significance of omitting smaller streams has been pointed out by AgResearch scientist Richard McDowell in a 2017 article in the *Journal of Environmental Quality* (McDowell, Cox and Snelder, 2017). These smaller, exempt streams actually account for 77% of a catchment's contamination load, according to McDowell.

Even though the accord was voluntary, farmers and their lobby groups such as Federated Farmers and DairyNZ were unhappy that it asked them to fence streams and better control dairy effluent. This appeared to be fuelled by their increasing concern about how local and central government were reacting to the public's growing focus on environmental issues, such as climate change and freshwater pollution, and the potential impact that attention would have on the viability of traditional farming. Acrimonious climate change policy debate had already prompted the National and ACT parties to align themselves with Federated Farmers to fight the Helen Clark Labour government's proposals to tackle global warming by targeting emitters of greenhouse gases. These proposals included a levy on farm stock methane emissions to fund research into reducing farm emissions, an idea which farmers and Labour's political opponents quickly dubbed a 'fart tax'.

While the looming global financial crisis diverted voters' attention in the lead-up to the 2008 election, little more than a year after winning the new National-led government thrust water back into the headlines.

The then president of Federated Farmers was Charlie Pedersen, an outspoken Manawatū farmer who was vocal in his scepticism about the need to tackle climate change at all, let alone to protect fresh water affected by greenhouse gas-causing nitrogen emissions. And he was scathing about the public's growing demands that more needed to be done to protect the environment. In a 2006 speech to Federated Farmers' annual conference, Pedersen targeted the emerging environmental concern, warning delegates that environmentalism was being elevated to 'a religious status' and that environmentalists were waging 'war against the human race'. He went on to describe environmentalism as the 'politics of envy' and said environmentalists were trying to 'reduce the brightest and hardest working' to 'the level of the ordinary, the uninspired' (Pedersen, 2006).

Pedersen was not alone among farmers in seeking to downplay the need for politicians to listen to environmentalists. In the same year, DairyNZ chairman Frank Brenmuhl likened environmental constraints on farming to 'state theft', drawing comparisons to the Mugabe regime's farm confiscation programme in Zimbabwe (Brenmuhl, 2006). It was against this increasingly bitter backdrop that water quality, climate change and the environment started to seep into the political mainstream.

The Labour-led government, stung by the backlash over the seabed and foreshore controversy and worried by the potential for Māori claims for water should it try to crack down hard on freshwater allocation and management, made slow progress on issues like water quality. The business backlash to its emissions trading scheme made the going even tougher for its flagship climate change policy and the implications for the economic control of water.

While the looming global financial crisis diverted voters' attention in the lead-up to the 2008 election, little more than a year after winning the new National-led government thrust water back into the headlines. In March 2010, the government suddenly sacked all democratically elected

councillors from Canterbury's regional council, ECan, and replaced them with a new chair and commissioners (Gorman, 2010). The reason given was water. Environment Minister Nick Smith and the local government minister, ACT's Rodney Hide, cited what they claimed was ECan's failure to address 'urgent problems with water management in Canterbury' for the decision (Smith and Hide, 2010). As late as 2015, Smith was still resisting a return to democracy for ECan, saying it carried 'too many risks' (Pearson, 2015).

At the time of his decision to sack the ECan councillors, Smith said efficient water management was crucial to New Zealand's competitive advantage and clean, green brand. That reference to clean, green New Zealand would soon come back to haunt National, this time on a world stage. In 2011 the prime minister, John Key, was interviewed on BBC World's programme *Hard Talk* by Stephen Sackur. Sackur challenged Key over New Zealand's '100% Pure' tourism marketing campaign, saying New Zealand was clearly not 100% green, that it was struggling with water pollution and that government had been complacent about the issue for years. Key dismissed the concerns of scientists Sackur cited to back up his claim, saying they were like lawyers and he could 'give you another one that will give a counterview'. '[I]f you don't believe it is clean and green you need to show me a country which is cleaner and greener,' Key retorted (Murray, 2011).

As it happened, academics from Princeton, Harvard, Singapore and Adelaide universities had been compiling just such a list. In a report published in 2010, New Zealand was placed 18th among the 20th worst countries by proportional composite environmental rank (Bradshaw, Giam and Sodhi, 2010).

It wasn't only conservative politicians who were getting the message that the environmental harm being caused by intensive farming was a growing threat. In a 2013 speech to a Trans-Tasman Business Circle lunch, Fonterra chief executive Theo Spierings warned farmers that they were a decade behind their European counterparts in environmental sustainability. He said this was disappointing and it was time farmers got their act together because they could not continue to grow the way they had in the past or they would hit the wall in terms of environment and sustainability (Hickey, 2013).

There was a sound basis to Spierings' concerns. Environmental protection had failed to keep up with the explosion in dairy cow numbers as eager investors read the market signals and tried to capitalise on soaring dairy prices. The rapid expansion in dairy herds saw new farms carved out of less profitable sheep and beef farms in less traditional dairying areas like Canterbury and Southland. In the 21 years from 1994 to 2015, the number of dairy cows soared 69% to 6.5 million (Statistics New Zealand, 2018). More than half of these animals were concentrated in just three regions: Waikato was home to the biggest dairy herd of 1.75 million animals, followed by Canterbury with 1.25 million and Southland with 0.75 million. The biggest increases over this time were in Southland, which recorded a 539% growth in dairy herd numbers, followed by Nelson's 499% growth and Canterbury's of 490%.

In ... 2013 ... Fonterra chief executive Theo Spierings warned farmers that they were a decade behind their European counterparts in environmental sustainability.

The impact these millions of extra animals was having on the environment, and fresh waterways in particular, was becoming obvious. Over this period, the parliamentary commissioner for the environment released several reports on the problem, pointing to the explosion in dairy cow numbers as the root cause of dirty rivers, warning of the continuing damage being caused and calling on the government to do more to tackle the issue.

National had tried to bring competing interests together by establishing the Land and Water Forum in 2009. The forum was set up using a Scandinavian model designed to provide consensus, but that proved difficult to achieve. After several reports and hundreds of recommendations, most environmental groups quit, complaining that remaining was pointless because the government was not acting on the forum's advice and recommendations (Press, 2015).

By 2014 the mounting pressure for change was starting to have an effect and explicit water quality policies appeared in political party manifestos. National surprised many with its 2014 election pledge to spend $100 million to protect waterways. The initiative would see what it described as 'selected areas of farmland next to important waterways' bought and retired over ten years. In its third term, the Key government tried to ease the growing public discontent and demonstrate that it was taking the issue seriously, releasing a consultation document, *Next Steps For Fresh Water,* in February 2016 (Ministry for the Environment, 2016). It correctly identified that our rivers, lakes and streams were being polluted by agriculture, industry and urban activity, dirtied by erosion caused by farming, forestry and infrastructure and drained and dammed by irrigation and electricity generation. But its proposed remedies were dismissed by critics as weak and inadequate. Fish and Game chief executive Bryce Johnson described it as an attack on the environment, a win for agriculture and out of step with public sentiment.

The threat the country's deteriorating water quality posed to public health was also becoming apparent. In Canterbury, the region's medical officer of health, Alistair Humphrey, issued warnings that the contamination of drinking water by nitrates from intensive farming posed a serious health risk (Humphrey, 2011). The most vulnerable were babies under the age of three months, who, he warned, were at risk of 'blue baby' syndrome caused by the high nitrate levels in the water used to mix

their milk formula robbing them of oxygen.

Toxic algae blooms in rivers and lakes were also gaining increasing publicity as the algae killed dogs and forced authorities to close popular swimming spots. But it was the deadly contamination of drinking water in the affluent Hawke's Bay town of Havelock North which may have proved the tipping point for the public. In August 2016, more than a third – 5,500 – of the town's 14,000 residents fell ill with campylobacteriosis after their drinking water supply was contaminated by farm animals. E. coli had travelled from pastures into an underground water bore. Three people died, with another 45 admitted to hospital. The official report into the contamination said the incident raised serious questions about the safety and security of New Zealand's drinking water (Government Inquiry into Havelock North Drinking Water, 2017a, 2017b).

Local government's role in protecting the environment and water quality also came under fire, with public law specialist and former prime minister Sir Geoffrey Palmer saying that regional and district councils' performance was seriously deficient. In *Local Government Magazine*, Palmer launched a blistering attack on the lower North Island's Horizons Regional Council after it lost a case in the Environment Court over its failure to properly protect water. Palmer said the 'illegality of the council's decision-making is quite stunning' and had bordered on misfeasance. He warned that the interests of future generations were now at stake (Palmer, 2017).

It was precisely the new generation of environmentalists making their voices heard when a new environmental pressure group, Choose Clean Water, was launched in late 2015 (www.choosecleanwater.org.nz). Choose Clean Water targeted younger people, grabbing media and public attention with a nationwide tour to raise awareness, marches on Parliament and petitions calling for action to fix the problem. The Tourism Export Council backed the new group, highlighting the fact that tourism had overtaken dairying as New Zealand's biggest single income earner.

By the start of election year 2017, public patience had run out with central government's handling of water quality. Frustration compounded when the government released its latest plan to tackle the issue (Ministry for the Environment, 2017). Its proposal to designate waterways as 'wadeable' rather than 'swimmable' and to make that the new target drew widespread scorn. Tourism Export Council chief executive Lesley Immink bluntly told Environment Minister Nick Smith: 'A national water policy statement that only aspires to *wadeable* is a marketing disaster for New Zealand.' Water scientists admitted they found the plan complicated, and Nick Smith courted derision when he suggested culling birds was a possible solution to improving water quality (Burry, 2016).

Prime Minister Jacinda Ardern explained the concept to world leaders at the World Economic Forum in … Davos at the beginning of 2019, saying it would take a broader approach to defining a nation's health.

The toxic brew of public anger, scientific bewilderment, government duck-shoving, dirty dairying and declining water quality was now attracting the attention of international media. Critical articles appeared in well-respected publications like the *New York Times*, the *Guardian*, the *Economist* and the *South China Morning Post*, as well as documentaries on international television networks like Al Jazeera. The *Economist*'s blunt headline cut deep: 'Dairy farming is polluting New Zealand's water' (Economist, 2016). It was against this backdrop that the 2017 election was fought and water emerged as a central battleground.

The *Stuff* website dubbed it 'The Environment Election', journalist Ged Cann noting that the 'environment is having its moment in the 2017 election. It seems more voters are concerned about it than ever before' (Cann, 2017). Jamie Morton in the *New Zealand Herald* noted that water quality was dominating the environment debate as a result of what it described as Kiwis' anger over our freshwater estate reaching boiling point (Morton, 2017). Labour released detailed environment and water quality policies, and while they generated a fierce backlash among farmers and conservative politicians, the policies thrust the issues further into the political spotlight and appeared to resonate with voters. Water quality also featured in the manifesto of the Opportunities Party, which snared 2.4% of the final vote – a good showing for a minor party fighting an election for the first time.

Labour has made a start at implementing the strong environmental and water quality policies it campaigned on, with Environment Minister David Parker promising noticeable and measurable improvements in freshwater quality within five years. It has already outlined its freshwater strategy in a document titled *Essential Freshwater: healthy water, fairly allocated* (Ministry for the Environment and Ministry for Primary Industries, 2018) and will soon release a new National Policy Statement for Freshwater Management and national environmental standard for fresh water.

The freshwater strategy and its intergenerational goals dovetail with the government's announcement of this year's financial statement as the world's first well-being budget. Prime Minister Jacinda Ardern explained the concept to world leaders at the World Economic Forum in the Swiss alpine resort of Davos at the beginning of 2019, saying it would take a broader approach to defining a nation's

health. Water quality and the environment, she stressed, are central to that thinking.

National also appears to be embracing the same approach. In his state of the nation speech in January, National leader Simon Bridges admitted that he and his party now realise how concerned New Zealanders are about water quality and the environment. 'Economic growth and improving the environment can and must go hand in hand,' he said. 'New Zealanders have always trusted National with managing the economy. They know we'll be careful with your money. But I want you to know you can trust us to care for the environment as well' (Bridges, 2019). Underscoring just how important these issues now are to National, the first of the party's policy discussion documents to be released this year was on the environment. National is also considering a new environmental party as a future coalition partner, with suggestions of a Blue-Green Party being formed (Bennett, 2019).

Have the politicians finally read the mood of the electorate accurately? The depth of voter concern about water quality is confirmed in a number of public surveys. Just before the 2017 election, Water New Zealand released the results of a survey showing that nearly three-quarters – 73% – of the public are concerned about poor water quality in our rivers and lakes (Water New Zealand, 2017). A poll conducted by Colmar Brunton for Fish and Game in December 2017 found 75% of those surveyed were extremely or very concerned about pollution of rivers and lakes. They rated the issue as one of their top two concerns, just behind the cost of living on 77%.

In April 2018 Colmar Brunton conducted another poll, this time for the Ministry for the Environment to gauge New Zealanders' concerns about climate change and water quality. The poll found that 82% of those surveyed believed it was very or extremely important to improve water quality in lakes and rivers (Ministry for the Environment, 2018). In December 2018 Colmar Brunton repeated its poll for Fish and Game (Fish and Game New Zealand, n.d.). This time, pollution of rivers and lakes had risen to be New Zealanders' number one concern, with 82% saying they are extremely or very concerned about the issue. The cost of living was in second place, with 80% extremely or very concerned. The health system was third on 78%, followed by child poverty, 72%, education and climate change both on 70% and housing 67%. These results demonstrate that water and climate change are now established as major issues for voters.

The 2020 election will see a new cohort of voters entering the ballot booths: voters who weren't born when the climate sceptics had the upper hand … and who have grown up in an economy where tourism, not dairy, is the lead export earner; in a world where the news routinely features stories of rapidly shrinking glaciers, record-breaking summers and increasingly ferocious weather events.

The next election in 2020 could well see a new direction for New Zealand policymakers and political parties. Mainstream parties will have to reassess whether the traditional policies they have relied on for decades to appeal to voters are still relevant or need rethinking and reprioritising. An emerging generation of young voters will likely be more swayed by environmental and climate change policies than hip-pocket staples like tax, state aid and superannuation. The two major parties, Labour and National, have already started that process. Labour stole a march on National in 2017 with its election water policy. Although the initial reaction, from the agriculture sector in particular, was negative, the commitment to restore lakes and rivers to a swimmable state resonated with voters to the extent that, as we have observed, it may well have cost National the election.

Although National is now trying to play catch-up, the ground will continue to change. The 2020 election will see a new cohort of voters entering the ballot booths: voters who weren't born when the climate sceptics had the upper hand in international policy debates and who have grown up in an economy where tourism, not dairy, is the lead export earner; in a world where the news routinely features stories of rapidly shrinking glaciers, record-breaking summers and increasingly ferocious weather events. Through their formative years they have listened to the rising concern about the continuing deterioration of our rivers, lakes and streams and seen the failure of successive governments to properly address water quality and climate change, knowing it will be they who live with the consequences, not their parents. Their arrival on the electoral scene is sure to turbocharge the growing momentum for a fundamental change in political imperatives. The potential scars on the political landscape for those who choose not to listen may be as pronounced as those of water's indelible mark on the land.

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Bryan Jenkins

Changing Water Management Practice in Canterbury to Address Sustainability Limits

Abstract

Irrigation expansion in Canterbury has led to sustainability limits being reached for water availability and cumulative effects of land use intensification. Increasing water availability through storage was proposed, but there was strong community opposition to impacts of storage and further intensification. Effects-based institutional arrangements proved inadequate to address these issues.

The regional council introduced a strategic approach based on nested adaptive systems and collaborative governance. A regional water strategy was developed through a multi-stakeholder steering group under the Canterbury Mayoral Forum and with extensive community engagement. Zone committees were established to develop zone implementation programmes. Farmer collectives are being established for operational delivery of water management targets. Farmers develop farm management plans to meet property-level outcomes, which are independently audited.

Strategy investigations demonstrated that focusing on new development would not achieve sustainable development; rather, existing users also had to improve. Water use efficiency improvements were more cost-effective than new storage. Furthermore, different forms of storage, such as managed aquifer recharge, were identified to avoid adverse effects on main stems of alpine rivers. Proactive measures were needed to address water quality degradation, biodiversity loss, Māori involvement and ecological restoration.

A systems perspective and a governance change from regulatory to collaborative have improved water management. However, they also identified issues concerning affordability of proactive measures, equity in allocation, and need for a public infrastructure agency. Uneven implementation of measures has led to some groups withdrawing from the collaborative process.

Keywords nested adaptive systems, collaborative governance, sustainability strategies, water resource management, community outcomes

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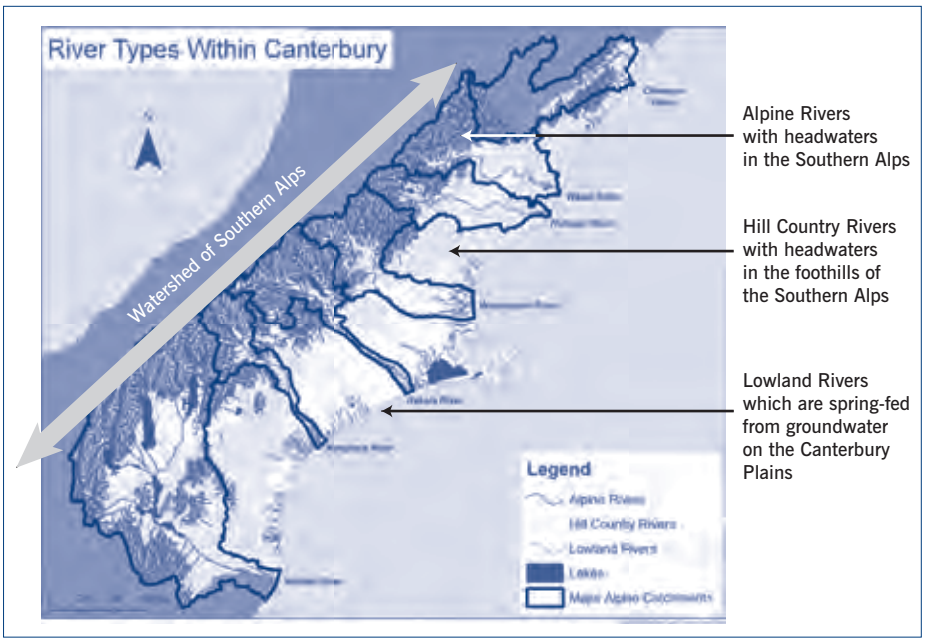
Figure 1: River types in Canterbury



Source: Environment Canterbury

Background to reaching sustainability limits

Water is a vital component of both the economy and the ecology of the Canterbury region. Although only 12% of New Zealand's area, Canterbury allocates 58% of the country's water, has 64% of its irrigated land, generates 24% of the country's power through hydroelectricity, has 65% of the nation's hydro storage, and provides a high-quality drinking water supply to its major city, Christchurch, without treatment. Moreover, water sustains braided rivers of international significance, high country and coastal lakes, groundwater basins of the Canterbury Plains, and groundwater-fed lowland streams and wetlands (Jenkins, 2007a).

Canterbury is in the rain shadow of the Southern Alps on the relatively dry east coast of New Zealand's South Island. It is the region with the greatest evapotranspiration deficit (322 mm/a) and is dependent on irrigation for increasing agricultural productivity. Aquatic ecology is sensitive to flow variability, low flows and water quality, making it vulnerable to water extraction for irrigation and water quality impairment from land use intensification (Jenkins, 2018).

Canterbury has seen a 60-fold increase in dairy production, from 6 million kilograms of milk solids in 1984–85 to 385 million kilograms in 2015–16 (LIC and DairyNZ, 2016). This is from converting dryland farms to irrigated dairy farms, adding significantly to the irrigated area in the region. Census data estimated irrigated area in Canterbury at 287,168ha in 2002, while detailed mapping indicated 507,468ha in 2015 (Brown, 2016).

Expansion of irrigation resulted in cumulative effects on river flows from abstraction (primarily associated with lower flows and reduced variability), groundwater drawdown and reduced flow in groundwater-fed streams, and water quality effects from land use intensification (primarily nutrients, bacterial contamination and sediments). Flow reductions and longer duration of low flows led to decreased freshwater habitat and reduced connectivity to other habitats. Reduced flow variability lowered streams' ability to flush fine particles and algae, thereby diminishing the quality of freshwater habitat. Reduced flood flows decreased riverbed mobility required to maintain the braided character of Canterbury's alpine rivers (Biggs, Ibbitt and Jowett, 2008).

Surface water availability is at sustainability limits as out-of-stream withdrawals are restricted at low flows (Environment Canterbury, 2016a). Groundwater availability is at sustainability limits as effective allocation exceeds the allocation limit for nearly all groundwater zones (Jenkins, 2018). In addition, nitrate and bacterial contamination of groundwater from land use intensification is increasing and exceeds drinking water standards in some locations (Hansen and Abraham, 2009). This has resulted in nutrient enrichment, algal blooms, faecal contamination, siltation and nitrate toxicity approaching, and in many cases exceeding, water quality standards in groundwater-fed lowland streams and the lower reaches of foothill and alpine rivers (Stevenson, Wilks and Hayward, 2010; Robinson and Bolton-Ritchie, 2014).

Water availability concerns associated with the droughts in the late 1990s led to an initial strategic response to increase storage on Canterbury's alpine rivers. A regional supply/demand analysis (Morgan et al., 2002) indicated that allocable flow from surface and groundwater was unable to meet existing demand (as at 2001), let alone future demand, with current means of abstraction (i.e. direct withdrawal). However, based on annual average flow, there was potential for 594m^3/s to be allocated from surface water if storage infrastructure was provided. When added to the then (2001) groundwater allocation of 16m^3/s, this could provide 610m^3/s. This was greater than the 2001 annual average demand (81m^3/s) and forecast future (2021) annual average demand (229m^3/s).

The second stage of strategic investigations was undertaken to identify major storages (Aqualinc Research, 2008). The focus was on storages on alpine rivers of Canterbury, which carry 88% of the annual average flow (Figure 1), as the hill country and lowland rivers have lower flows and were already under greater pressure from extraction. The third stage of strategic investigation was a multi-stakeholder evaluation of possible storage options; however, the multi-stakeholder group also recommended that before storage decisions were made, rigorous scientific and public consideration was needed of: (1) impacts of land use intensification and its effects on water quality; (2) mitigation and management systems of water quality; and (3) methods for maintaining or improving flow variability and low flows in major rivers (Whitehouse, Pearce and McFadden, 2008).

While storage on the main stems of alpine rivers may provide a means of addressing water availability, there are

significant sustainability issues with this approach. They include: (1) impacts on the naturalness of high country areas in relation to landscape, ecosystem habitat and amenity values; (2) reduction in flood flows, which decreases the number of braids in braided rivers; (3) sediment entrapment, which reduces the bedload downstream of dams and the sediment supply to the coast, leading to increased coastal erosion; (4) reduction in flushing flows, resulting in greater frequency and persistence of algal blooms; (5) temperature stratification in reservoirs, which inhibits oxygen diffusion to the hypolimnion, resulting in deoxygenation of bottom waters; (6) nutrient retention in reservoirs from land use intensification, leading to occurrence of aquatic weeds; and (7) reduced in-stream recreational opportunities for white-water sports and fishing (Jenkins, 2007b).

Water quality impairment from land use intensification was a major concern. Monitoring indicated that 11% of sampled wells in the central Canterbury Plains exceeded the maximum acceptable value for drinking water of 11.3mg/L (Hanson and Abraham, 2009). Regional modelling of nitrate leaching to groundwater predicted increases above drinking water quality in many locations if all potentially irrigable land was irrigated using existing land use practices (Bidwell et al., 2009). Further intensification with current land use practices would also exacerbate water quality contamination of surface water.

There was recognition by 2008 that a paradigm shift in water management in Canterbury was needed. The focus on storage as a means of addressing water availability issues did not have widespread community support. Effects-based legislation and legal processes focused on individual projects were inadequate to deal with cumulative effects of multiple projects and exacerbated community conflict. There was need for an approach which (1) addressed sustainability limits of water availability, (2) managed cumulative effects of water extraction and land use intensification, and (3) facilitated consideration of multiple issues at multiple scales.

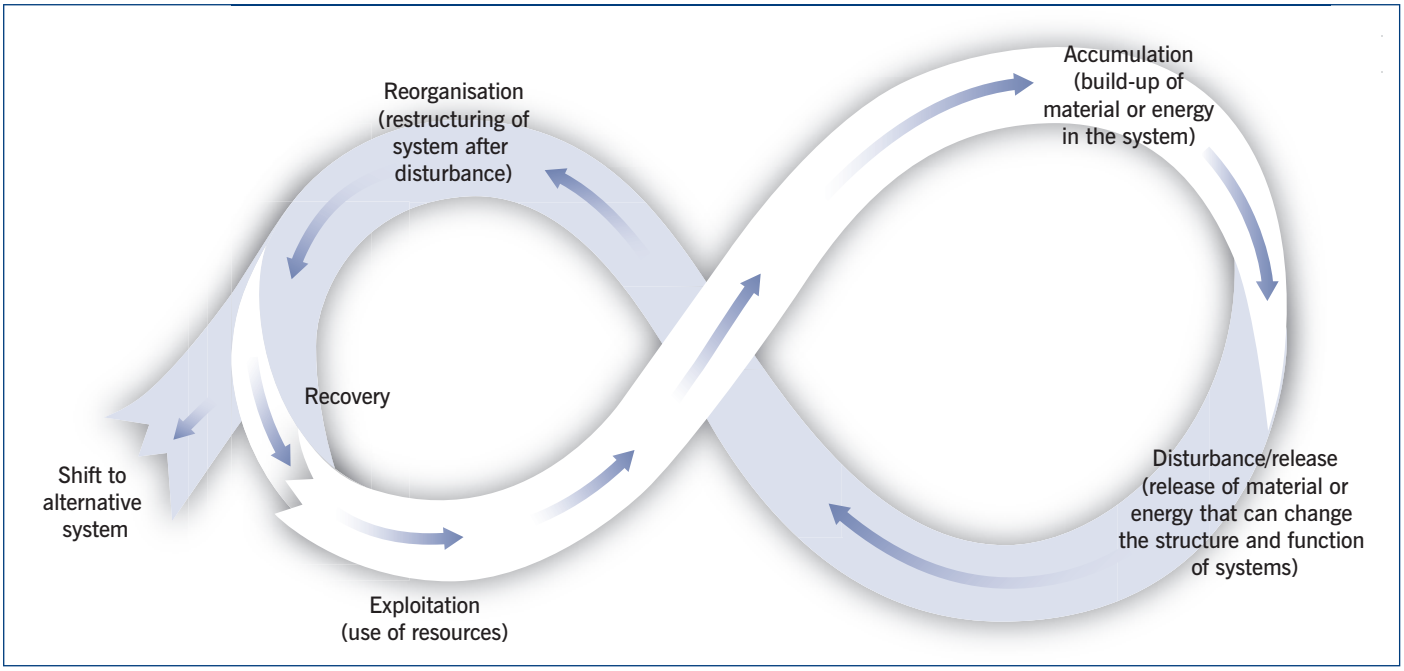
A major factor in seeking a new paradigm was the failure of the Resource Management Act 1991 (RMA) to address resource use and cumulative impacts at sustainability limits. The RMA is effects-based legislation and focuses on the environmental effects of activities rather than the activities themselves. The act established an Environment Court with powers to review the technical merit of decisions. This makes resource management a highly legalistic process and led to an adversarial style of decision-making. A major process under the act is environmental impact assessment of new development proposals. This provides a capacity to address project-specific effects, but the act was not designed to manage cumulative effects of multiple activities.

The purpose of the act is 'sustainable management' – allowing use of resources subject to environmental bottom lines. However, there is no elaboration in the act on how decision-makers can apply this purpose. Interpretations by courts have defined an 'overall broad judgement' of balancing resource use and environmental effects (Skelton and Memon, 2002). This concept of overall broad judgement has led the Environment Court and hearing commissioners to approve further intensification in Canterbury despite limitations on water availability or degraded water quality (Environment Court, 2005; Milne et al., 2010).

Theoretical framework underpinning the new paradigm

The regional council introduced a strategic approach based on nested adaptive systems and collaborative governance. A regional water strategy was developed through a multi-stakeholder steering group under the Canterbury Mayoral Forum and with extensive community engagement. The alternative paradigm developed was based on the concept of nested adaptive systems developed by Gunderson and Holling (2002) to define failure pathways, and sustainability strategies derived from Chapin and his colleagues (Chapin, Kofinas and Folke, 2009). The

Figure 2: The adaptive cycle



Source: adapted from Gunderson and Holling, 2002

collaborative governance approach for developing the regional strategy was based on Elinor Ostrom's institutional design for governing the commons (Ostrom, 1990).

Gunderson and Holling define an 'adaptive cycle' to describe how an ecological or human system can be sustained in obtaining resources for its ongoing survival, and in accommodating disturbance to the system and restructuring. This provides the basis for defining sustainability with respect to the maintenance of the relationships in adaptive cycles across different time and spatial scales. There are four phases in the adaptive cycle: (1) exploitation – use or harvesting of resources; (2) accumulation – storage of material or energy in the system; (3) release – disturbance of the system; and (4) reorganisation – restructuring of the system after disturbance.

The four phases of the adaptive cycle can be depicted as a Lissajous figure (Figure 2). The cycle is sustainable if the resources needed to maintain the system continue to be available and if the system can recover after disturbance. There is a critical point in the reorganisation phase as to whether the system continues (recovery) or whether the system fails and shifts to an alternative system.

The adaptive cycles associated with different levels can be linked – what is referred to as 'nested adaptive systems'. For sustainable water management in Canterbury, at least four spatial scales need to be considered: (1) regional level, to address water availability and land use intensification; (2) catchment level, to address sustainable levels of water use, cumulative impacts of intensification, and reliability of supply for irrigation; (3) sub-catchment level, to address environmental flow requirements in river reaches, and ecosystem management of streams and their riparian margins; and (4) property level, to address land use practices that influence water quantity and water quality (Jenkins, 2007a).

The governance approach designed for Canterbury was based on Ostrom's collaborative governance arrangements for managing common pool resources, such as water extracted for irrigation. She found that long-term survival of common pool resources was associated with self-governing communities with the following characteristics: (1) clearly defined boundaries; (2) congruence between appropriation and provision rules with local conditions; (3) collective choice arrangements; (4) active monitoring of resource condition and member behaviour; (5) graduated sanctions for violating operational rules; (6) conflict resolution mechanisms; (7) rights of resource users to devise their own institutions; and (8) nested enterprises for larger systems (Ostrom, 1990).

> The focus of water management shifted from water availability and storage to identification of community values and the wide range of uses and benefits associated with water.

The Canterbury approach

The fourth stage of the strategic investigations was developing the Canterbury Water Management Strategy (Canterbury Water, 2009). A key element of the strategy was the collective choice arrangements, including: (1) stakeholder and community engagement in developing strategic options and fundamental principles of the strategy; (2) definition of strategic options by a multi-stakeholder group; (3) region-wide consultation with communities on option preferences; (4) strategic investigations of likely outcomes to inform the engagement process; (5) sustainability appraisal of options in relation to economic, social, cultural and environmental criteria; and (6) agreement on a strategic approach to water management, environmental restoration, infrastructure requirements and governance arrangements (Jenkins and Henley, 2014).

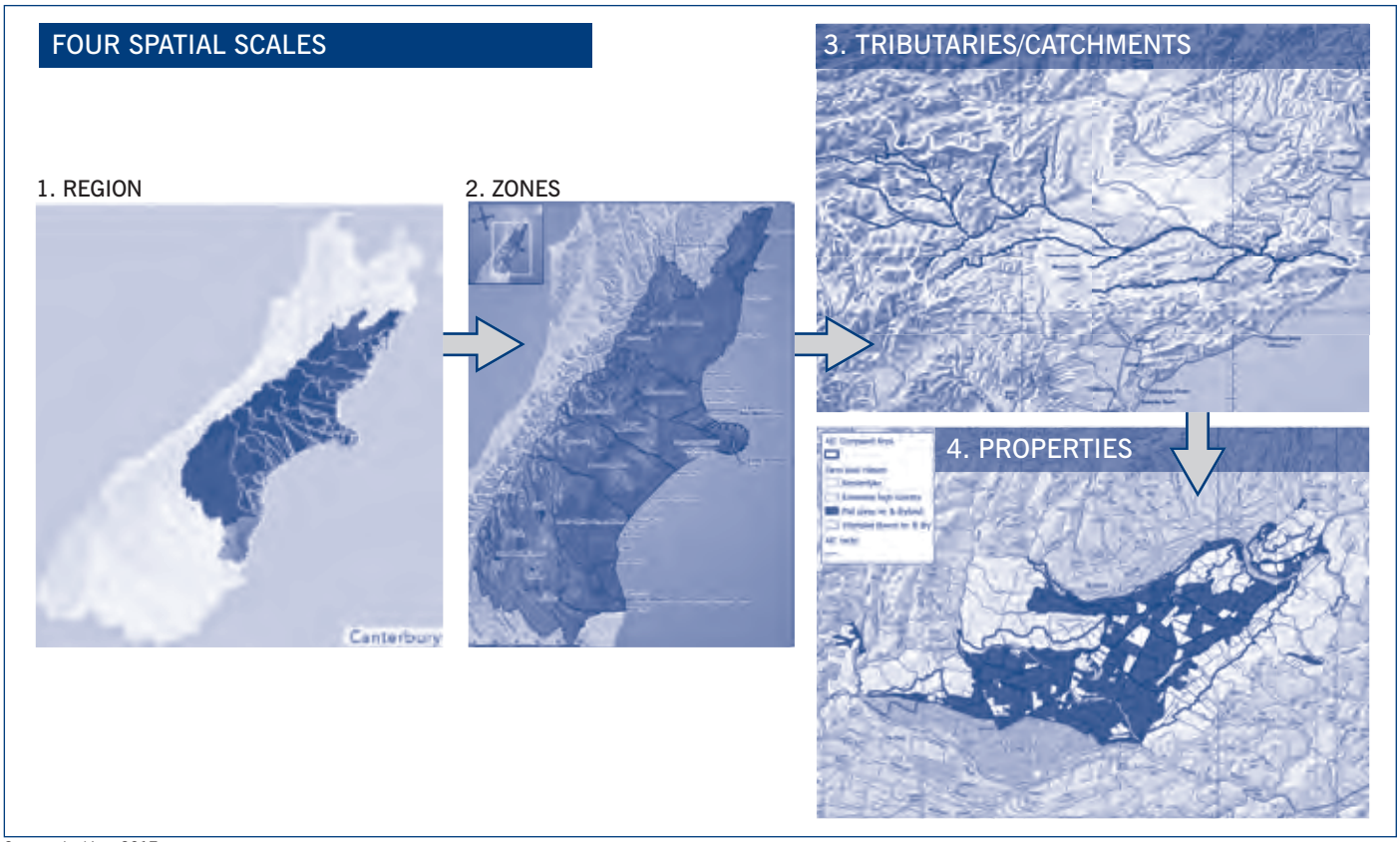
Development of the strategy was under the auspices of the Canterbury Mayoral Forum (comprising the mayors of city and district councils in the Canterbury region, the chair of the regional council, and their chief executives) to achieve political collaboration. Oversight of the process was by a multi-stakeholder steering group (a 16-person group with backgrounds in irrigation, industry, conservation, fishing, recreation, the Māori community, and local, regional and central government).

Community engagement included the following processes: (1) open meetings across the region on uses and benefits of water, leading to the definition of a 'vision and fundamental principles' for a strategy and ten community outcomes for water; (2) facilitated workshops for developing strategic options by the multi-stakeholder steering group and public consultation on those options; (3) facilitated workshops for the sustainability appraisal of strategic options to define components of a draft strategy; and (4) public hearings and stakeholder review of the draft strategy, leading to the preparation of the final strategic framework document (Canterbury Water, 2009).

Some key conclusions from the strategy comparison were that: (1) the status quo of reliance on the Resource Management Act was not sustainable; (2) a strategy based on main stem storage on alpine rivers could meet economic but not environmental criteria; (3) a strategy based on environmental enhancement could meet environmental but not economic criteria; and (4) to achieve sustainability it was not sufficient to assess new developments; there was also a need to improve water use efficiency and land use practices (in relation to their effects on water quality) of existing users.

The Canterbury Water Management Strategy led to a transformation in water management in Canterbury from a polarisation of community views concerning water storage and land use

Figure 3: Four spatial scales for implementing the Canterbury Water Management Strategy



Source: Jenkins, 2017

intensification, to widespread support for integrated water management that addressed ten community priority issues for water: ecosystem health, natural character, kaitiakitanga (Māori stewardship), drinking water, recreation, water use efficiency, irrigated land area, energy, economy and environmental limits.

The focus of water management shifted from water availability and storage to identification of community values and the wide range of uses and benefits associated with water. The acceptance of the strategy appeared to be related to the ability to be involved and to influence strategy development and the outcome of the process.

Collaborative processes increased the level of constructive dialogue between different stakeholder interests compared with the legalistic, adversarial style of statutory processes. New concepts for water availability were brought into the process, such as diversions to tributary storage and managed aquifer recharge, rather than main stem storage and water use efficiency (Jenkins, 2018). They also led to addressing land use practices to reduce water quality impairment (MGM Governance Group, 2015) and to proactive approaches to biodiversity enhancement (Environment Canterbury, 2016b).

The implementation of the Canterbury Water Management Strategy strategic framework document (Canterbury Water, 2009) contained three key elements: (1) proposed immediate actions – for example, establishment of nutrient limits; (2) investigations to deal with important areas of uncertainty – for example, setting of catchment load limits; and (3) definition of the way that deferred choices would be made – that is, continuation of the collaborative approach at the local level through 10 zone water management committees, and at the regional level through a regional water management committee, with the development of zone and regional implementation programmes.

Zone committees brought together the authorities for water (regional council) and land use (city and district councils), rūnanga (Māori tribal groupings), and six to seven appointed members of the community. The purpose of zone committees was to facilitate community engagement in developing zone implementation programmes (ZIPs) to give effect to strategy targets at the zone level. The ten zones are shown in Figure 3. The regional committee has regional council, city/district council, Māori and community representation and a representative from each zone committee. It is a nested rather than hierarchical arrangement: zone committees deal with catchment issues and the regional committee with regional issues.

There has been progressive establishment of zone committees throughout the region. ZIPs were prepared within 12–18 months of committees being established (e.g. Canterbury Water, 2011). More recently, several zone committees have prepared addenda to their ZIPs focused on 'solution packages' for more difficult issues (primarily water quality issues for lakes) that had not been addressed in detail in the original ZIPs. The regional committee has produced a regional implementation programme (Canterbury Water, 2012).

Like the Canterbury Water Management Strategy, the recommended programmes of the committees in the ZIPs were non-statutory. Statutory backing of the Canterbury Water Management Strategy

was provided by a new regional policy statement (Environment Canterbury, 2013). Statutory backing for the implementation programmes was provided by the *Canterbury Land and Water Regional Plan* (Environment Canterbury, 2015), which is a nested document with a regional component for region-wide rules and ten zone components for rules within each zone.

Canterbury Water Management Strategy outcomes

In relation to water availability, there has been a shift in emphasis from storage on alpine rivers to water use efficiency in order to reduce water requirements for further irrigation. This has mainly been achieved through conversion of border dyke (flood) irrigation to spray irrigation (Brown, 2016), and of water distribution systems in irrigation schemes from open channels to piped distribution (e.g. the Ashburton Lyndhurst irrigation scheme).

New approaches to storage that avoided the effects of dams on main stems of alpine rivers were identified in order to improve water availability and enhance reliability of supply. Off-river storage of high river flows (e.g. at Arundel) and diversions to storage on tributaries (e.g. from the Hurunui River) were alternative approaches to accessing alpine river water. Another option is groundwater recharge, that is, managed aquifer recharge for storage and recovery, which is being trialled in the Hinds catchment. Improved reliability was achieved by on-farm storage and storage within irrigation schemes (e.g. the Carew storage in the Mayfield Hinds irrigation scheme).

With respect to effects of land use intensification on water quality, there has been the introduction of changes in land management practices to reduce nutrients in surface run-off and seepage to groundwater. Water quality criteria for receiving waters have been defined and catchment nutrient load limits to achieve these criteria have been estimated (e.g. Norton, 2013).

Collaborative processes have led to agreements to raise minimum flows and reduce allocations at low flows – e.g. for the Pareora River (Environment Canterbury, 2010). These agreed changes do not always achieve the full extent of desirable environmental flows because changes come at a cost to existing users. Collaborative outcomes have recognised the need for allocations at higher flows that involve on-farm storage for their effective use. There has also been the recognition that existing users need time to adjust.

> Improved water use efficiency of existing users increases water availability without requiring further abstraction, and reduces surface run-off and groundwater leakage contaminated by land use intensification.

For the target area of biodiversity, implementation programmes have identified priority areas for rehabilitation. Projects are being funded through the Immediate Steps Biodiversity and Enhancement Programme (Environment Canterbury, 2016) based on community recommendations and their contribution to the goals of the Canterbury Biodiversity Strategy (Environment Canterbury, 2008). Over 800 projects have been funded (as at June 2018). An example is the management of black-fronted tern breeding habitat in the upper Clarence River: through a combination of safe breeding islands and predator control, a five-fold increase in breeding success has been achieved compared to non-managed areas (Environment Canterbury, 2019).

Progress is also being made in kaitiakitanga. There is Māori representation at the governance level on zone committees and the regional committee. A relationship agreement – Tuia – has been signed between the regional council and rūnanga for ongoing collaboration in water management (Ngā Papatipu Rūnanga and Environment Canterbury, 2012). The Mahaanui Iwi Management Plan has been prepared, which includes ngā paetae (objectives), ngā take (issues of significance) and policies to guide freshwater management in a manner consistent with Ngāi Tahu cultural values and significance. Work on a restoration programme – Whakaora Te Waihora – for Te Waihora/Lake Ellesmere, a lake of cultural significance to Ngāi Tahu, is progressing (Ngāi Tahu and Environment Canterbury, 2016)

Operational management has introduced a new alternative to the RMA approach of the regulator setting consent conditions that are inspected for compliance by the regulator, adopting instead an approach reflecting Ostrom's principles. The primary governance element is the establishment of farmer collectives based on irrigation districts, tributary catchments (or stream allocation zones) or farm enterprises, with a secondary governance element as the farm property (Figure 3). It is a nested system based on the achievement of water quality targets in rivers and lakes which lead to catchment contaminant load limits defined as a collective responsibility; and with each farmer developing a farm environment plan to specify on-farm actions to meet farm management objectives and targets within the environmental management system for the collective. Each farmer is responsible for monitoring the actions undertaken and achievement of the targets, which are audited by a certified farm plan auditor.

Further changes needed

While there have been significant positive shifts towards sustainable water management, a sustainability analysis identified shortcomings in the level of intervention in the implementation programmes and issues needing to be adequately addressed (Jenkins, 2018).

The solution packages for water quality management devised by zone committees will improve water quality compared to current management. However, they will not achieve desired community water quality outcomes. This is recognised by zone committees, with their proposals being seen as a significant first step and awareness that there is a need for further improvement over time.

Improved water use efficiency was a critical element of the Canterbury Water Management Strategy. Improved water use efficiency of existing users increases water availability without requiring further abstraction, and reduces surface run-off and groundwater leakage contaminated by land use intensification. It was recognised that defining efficiency is not straightforward, so development of benchmarks and reporting on them was a target of the strategy implementation scheduled for 2015. This has not been achieved.

New Zealand's response to climate change has been minimal, with emissions continuing to increase. The agricultural sector is the largest contributing sector, responsible for 47% of total emissions and projected to provide 77% of the growth in emissions (Sustainability Council of New Zealand, 2015). However, there are actions that could be taken through mitigation measures and offsets. Furthermore, better use could be made of economic instruments and environmental impact assessment procedures to manage emissions. While the consequences of climate change have been identified, there is not an adaptation or emission reduction strategy in place.

A key element of the acceptance of the Canterbury Water Management Strategy was the commitment to targets that reflected the range of uses and benefits that the community sought from water management in Canterbury. However, there has been differential progress in the implementation of these targets. In particular, the 2015 targets for recreational and amenity opportunities, ecosystem health and biodiversity, and economic externalities have not been met, leading to the withdrawal of some stakeholders from the collaborative process.

Affordability of management measures has been a constraint on the ability to implement elements of the strategy. Affordability has been an issue in finding viable storage schemes to improve water availability, for improvements in land management practices to reduce water quality contamination, and for communities in water treatment for addressing the risks of waterborne diseases. Related to this is the need for funding mechanisms for water infrastructure. While the private sector can address commercial water resources development, it is not well placed to address lake or river restoration, climate change strategies, managed aquifer recharge, biodiversity projects and catchment-wide public good infrastructure. There is no central government agency for water management, and regional councils have been established with a regulatory function.

The paradigm in current legislation as determined by the Resource Management Act is based on managing effects of development within environmental limits. However, with pollutant load uncertainties, inaccuracies in load estimation, natural variability, multiple variables affecting outcomes, contributions from legacy issues as well as current activities, lag times in effects, unresolved cause–effect relationships and difficulties in enforcing limits that lack certainty, managing to limits for project effects to achieve sustainable outcomes is not enough. Furthermore, for cumulative effects there are multiple geographical scales, many potential points of intervention and multiple actors. A statutory framework involving a systems-based approach, like nested adaptive cycles, is needed to achieve sustainable outcomes.

While the RMA provides a framework for regulation of activities and mitigation of adverse effects, it does not provide a framework for proactive measures to achieve sustainable outcomes. The act is not well suited to managing water scarcity and cumulative effects of diffuse sources from land use intensification. This could be achieved by putting in place water framework legislation, like the European Union approach of the Water Framework Directive (European Commission, 2000), and a requirement for regional sustainability strategies like the Canterbury Water Management Strategy. The concepts of sustainable development have evolved since the framing of the RMA in 1991. The role of government has also changed. It is appropriate to change the legislative and institutional framework to reflect these evolving concepts of sustainability, and the changing role of government from environmental regulator to facilitator of sustainable development.

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Three Perspectives on Canterbury Freshwater Management

Freshwater management has attracted more public and media attention in Canterbury than in any other New Zealand region. Public interest peaked with the controversial 2010 dismissal of the elected regional council under special legislation (Environment Canterbury (Temporary Commissioners and Improved Water Management) Act 2010). For a range of views on these complex issues, we asked three people intimately involved in the process – elected councillor Lan Pham, appointed commissioner Tom Lambie and Ngāi Tahu cultural rights expert Karaitiana Taiuru – to contribute a short essay assessing the Canterbury Water Management Strategy.

Lan Pham

The ECan Water Management Strategy Experiment

the good, the bad and the tipping – what has the last decade of collaborative planning delivered to Waitaha/Canterbury communities?

The Canterbury Water Management Strategy is a collaborative framework created to guide the management of Canterbury's water resources. The framework attempts to capture community values across a wide spectrum in the form of ten 'target areas', including environmental limits, kaitiakitanga, irrigated land area, and seven others. Governance of the strategy rests with the Canterbury Mayoral Forum (made up of the ten Canterbury mayors and chairs), and Environment Canterbury (ECan) as the regional council. It also involves ten 'zone committees'. These are joint committees of ECan and Canterbury's various city and district councils and comprise a combination of council, rūnanga and community representatives.

The Canterbury Water Management Strategy aims to bring about change to water management in Canterbury. Because I recognise that change isn't easy, I'll start by listing some positives before discussing some of the pitfalls of the last near-decade of the strategy.

- Most significantly, the 'environmental limits' and 'ecosystem health and biodiversity' target areas are given statutory effect through the creation of the Canterbury Land and Water

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projects in each zone every year. Although there has been criticism that this has resulted in 'pepper pot' projects with little strategic guidance, I know of many small restoration and fencing projects which have got off the ground because of the zone committee's support.

- More recently, the Canterbury Water Management Strategy process spawned industry-agreed 'good management practice' which is now required to be demonstrated through farm environment plans for the highest-risk farming activities (namely, those farmers with over 50ha of irrigation or over 10ha of winter grazing).

These are positive things. However, in 2019 our world is changing. Rapidly. The latest IPCC report signalled that we have 12 years to avoid climate catastrophe and the associated effects on the water cycle. Global biodiversity loss is now at crisis levels and the United Nations has acknowledged that humanity itself is threatened. We know the pressures on our precious freshwater ecosystems are only going to increase. So how and why does the Canterbury Water Management Strategy fall short in addressing the major challenges we face?

In my view, the primary problem with the strategy is that it perpetuates the commonly spouted myth that we can 'balance' the environment with the economy. The ten target areas are intended to be achieved concurrently, but in reality some target areas have been advanced (either intentionally or unintentionally, as some are much more complex than others) while others are either lagging, completely unresourced, or put in the 'too hard' basket (Environment Canterbury, 2017).

For example, the first-order priorities of the Canterbury Water Management Strategy are the environment, customary use and drinking water (community and stock). Given this, it is perhaps surprising that our environmental, kaitiakitanga and drinking water targets lag greatly in showing tangible improvements (ibid.). Taking the 'environment' target as an example: ECan's latest (2019) annual groundwater survey from 2008–2018 data revealed that nitrate exceeds ecological thresholds in 75% of the monitored groundwater that feeds surface water and that, overall, nitrate concentrations are increasing.

The change occurring under the Canterbury Water Management Strategy may be worthy in terms of 'holding the line' on environmental decline, but this is an optimistic view. The change is not happening fast enough to fill the chasm between some positive on-farm changes and industry improvements and actual ecologically meaningful environmental improvement.

The change occurring under the Canterbury Water Management Strategy may be worthy in terms of 'holding the line' on environmental decline, but this is an optimistic view.

Perhaps the biggest flaw in the implementation of the strategy is the priority given to 'farm operating surplus' during the sub-regional plan development phase with the zone committees, and the lack of consideration of economic externalities (such as the cost of environmental restoration or lost recreational or cultural values). My own experience on the Ōrari Temuka Ōpihi Pareora Zone Committee confirmed that, when push comes to shove, 'farm operating surplus' trumps all other values.

I think the most glaring case is found in the Selwyn Waihora zone, however. A recent externalities assessment for Te Waihora/Lake Ellesmere estimated the change in operating surplus of farms in the catchment if the lake was to meet the trophic level index under the National Policy Statement for Freshwater Management (Harris and Davies, 2017). The assessment concluded that, to meet this improved trophic level, all intensive land use in the catchment would need to cease, resulting in an operating surplus loss to the local farmers and industry of around $300 million. Alternatively, excess nutrients could be stopped from entering the lake through undertaking large-scale wetland restoration at a cost of around $380 million.

The most widely held interpretation of this report was that the results indicated that it was impossible for the lake to meet the trophic levels under the national policy statement due to the economic impact on farmers and industry in the catchment. My interpretation is that the public are effectively subsidising intensive agriculture in that catchment to the tune of $300–$380 million per year by allowing an unsustainable land use to continue and that these costs represent the ecological realities which will ultimately be brought to bear on future generations.

Ignoring externalities is also leading towards other perverse outcomes. For example, in the Christchurch–West Melton zone, future nitrate contamination of Christchurch city's drinking water supply is modelled to reach 3.8mg/l over the next 50-plus years, yet our proposed rules for farms in the main contamination source areas ('hot spots') will (if adopted) require only 15% reductions in nitrogen loss for dairy farms every decade and a 5% reduction for all other land uses. Christchurch is currently New Zealand's largest metropolitan area with the luxury of a relatively pure untreated drinking water supply, yet we are accepting and justifying this future nitrate contamination on the basis that the proposed rules are pushing the relevant farms as hard as is 'economically possible'. There are fewer than ten farms in the worst contamination hot spots, yet in the planning process to date their operating surplus has effectively been given precedence over the protection of the drinking water of more than 380,000 people. At what point do we decide to broaden our economic considerations to include the whole community and transfer

the 'risk' burden – which currently rests with the environment and society – onto the commercial activity that is utilising and/or abusing a public resource for private profit?

The lack of environmental and cultural improvement under the Canterbury Water Management Strategy has also resulted in consistent NGO and rūnanga discontent and disengagement. For example, in the latest proposed plan change for the Waimakariri zone the area will see minimum flow increases for only eight of the 17 streams and rivers in the zone by 2032. Both Te Rūnanga ō Arowhenua and Te Ngāi Tūāhuriri formally stated (among other concerns) their lack of support for the minimum flows set in the recommendations made by their respective zone committees in 2018. How can we, and why would we, expect to see meaningful improvement in mahinga kai (traditional food sources) or biodiversity values when we are not even bringing ecologically significant water flows back to our mostly over-allocated catchments? These recommendations are now going through a Resource Management Act process which includes public submissions and hearings by a panel of RMA commissioners in 2019.

Ultimately, my perspective is that the 'collaborative model' based on a conversation where all ten targets are advanced is fundamentally flawed. How do we account for the immense biodiversity and ecosystem loss which has already taken place? The almost complete and sustained loss of traditional mahinga kai values for the papatipu rūnanga of Ngāi Tahu? The 90% of wetland ecosystems already drained? The Canterbury Water Management Strategy as currently implemented is a continuation of the thinking that business as usual will somehow deliver us different environmental outcomes. No matter what our 'opinion', we will eventually find that the environment cannot and will not 'compromise' on its ecological limits. In my view, the ecological/environmental targets need to be prioritised above all others, with all other targets only pursued in a manner that is consistent with the overarching ecological realities.

The collaborative water management strategy process has shown that even if shared values and sentiment exist, they do not in themselves equate to environmental improvement. We need a rethink of society's long-held view that we can 'balance' the environment with the economy and move instead toward a recognition that economic sustainability implicitly requires environmental sustainability at its core. In the context of the Canterbury Water Management Strategy, this means placing greater resourcing and focus on the priority areas of environment, customary use and drinking water and taking seriously, and urgently responding to, the climate and ecological alarm bells that our scientific community and the public are sounding.

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Tom Lambie

The Success of the Canterbury Water Management Strategy

To understand what the collaborative Canterbury Water Management Strategy has achieved we need to look back to the 'water wars' of the 2000s.

During the 2000s, farmers and environmentalists were locked in a fight over water following the disastrous droughts of the late 1990s. Access to water was the goal, but Environment Canterbury's councillors of the time were divided. People were frustrated and could see that the old adversarial ways weren't working; as a result, the Canterbury Water Management Strategy was agreed and put in place in 2009 to find a better way to manage fresh water.

In my view, the Canterbury Water Management Strategy has delivered a huge amount and will continue to do so in the coming decades. A lot of what it has

Tom Lambie is an Environment Canterbury councillor.

delivered, however, is intangible: it's the way people interact, receive information, deal with complexity, and make decisions based on the best evidence and shared values rather than a predetermined position.

There is good evidence that we have stopped the long-term decline in water quality and are starting to see environmental and ecological improvements because of the strategy. It has taken more than 150 years to get to this point, however, and our scientists acknowledge that it may take decades to begin to see improvements in the most affected areas. While our monitoring of water quality trends shows ten-year improvements in most aspects, including nitrogen and phosphorus measures (NNN, DIN, total N, total P, DRP), we still have work to do to reduce water turbidity and bacterial contamination. The MCI measures of ecological health – which are very sensitive – will also take time to show improvements.

The Canterbury Water Management Strategy is collaborative, which some people have criticised or seen as weak or inconclusive. But collaboration brings certainty, far more so than relying on a court to decide on an environmental issue. Collaboration is about consensus – working with all stakeholders to look at options and agree on preferred solutions. It is not easy and at times the community discussions were very heated, but always managed to find a way forward. The Canterbury Water Management Strategy has brought people together who, previously, would never have talked, let alone understood each other's views. This includes farmers and local iwi, fishers and environmentalists, community leaders and people just wanting to make a difference.

The strategy empowered Environment Canterbury to introduce – in 2012 – the toughest nitrate pollution rules in the country as part of the Canterbury Land and Water Regional Plan. We should remember that the previous regional plan had been ten years in the drafting and was still not operative when commissioners were appointed in 2010. The first thing the Land and Water Regional Plan did was to put a limit on nitrate pollution; that had never been done before in Canterbury. Farmers had to keep their nitrate leaching at or below their average level from the previous four years. The plan also introduced region-wide stock exclusion rules for waterways, a key tool needed to protect streams and rivers. The key issues in Canterbury were and still are sediment, bacterial contamination, and nutrients such as nitrogen and phosphorus.

Several years on, many farmers now need a land-use consent to farm; this includes a farm environment plan subject to an independent audit. We see this holistic and educational approach to environmental management as more like the fence at the top of the cliff, than the (compliance) ambulance at the bottom. While we still have a focus on compliance and come down hard on environmental polluters, the greatest environmental benefits will come from farmers taking responsibility from the start.

The collaborative process really comes to the fore at the catchment level, where the job is to reduce nitrate pollution rather than just hold the line. Environment Canterbury identified the most at-risk catchments and worked with water management committees and communities on the key local issues and potential solutions, well before the planning work started. This process brought together everyone who had an interest in water, including the local iwi who have a very strong voice in freshwater management in Canterbury. This locally led process has allowed us to bring in very tough planning rules to significantly reduce nitrate leaching in some of the most difficult catchments in Canterbury, including Selwyn Waihora, Hinds, lower Waitaki and the Mackenzie, with more to come.

The water management committees have been criticised by some for being too farmer heavy. The reality is they reflect their communities and members are chosen because of their understanding of local issues as well as for being open to the views of others. The committees also include papatipu rūnanga representatives, who have a strong interest in kaitiakitanga in addition to the other nine target areas of the Canterbury Water Management Strategy.

The collaborative, community-focused approach of the water management strategy turns the traditional planning process on its head – issues and potential solutions are identified before plans are written. This results in very robust and wide-ranging discussions, led by the water management committees, and involving communities of interest. The work often includes extensive work on possible scenarios, before a set of detailed recommendations go from the water management committees to Environment Canterbury.

While the planners and scientists are involved from the start of the community process, the draft plan is completed only after the committee's recommendations are received. The draft plan must then go through a full and rigorous Resource Management Act process, including submissions and a public hearing, run, in Canterbury's case, by a panel of independent commissioners. The hearings focus on evidence and what matters under the RMA. While this process takes time, the outcome is a planning regime which better reflects the wishes of the broader community.

Another important change in Canterbury is that consents are being aligned with the ten-year planning time frames. What this means is that when a consent expires and a new consent is required, it will be written under any new rules or limits rather than extending for decades.

In summary, collaboration has helped communities across Canterbury accept that there are serious problems with water quality and ecological health, and that they are part of both the problem and the potential solutions, as well as building a greater understanding of what's needed and the time it will take to achieve meaningful change.

Collaboration has helped connect the planning process with science, with the community and Ngāi Tahu, with stakeholders and advocacy groups, as well as introducing differing voices and viewpoints. We can now use the relationships and trust built through collaboration to deliver the environmental, social, economic, cultural and recreational benefits envisaged in the Canterbury Water Management Strategy.

Karaitiana Taiuru

Ngāi Tahu Perspectives on Fresh Water

Introduction

This article attempts to explain the South Island's largest iwi, Ngāi Tahu, and its complex decision-making process and belief systems around fresh water within its tribal boundaries. Unlike other iwi in New Zealand, who have maintained a traditional tribal structure, Ngāi Tahu have adopted a Western corporate structure that does not always reflect the opinions of its tribal members.

Water is a taonga to Ngāi Tahu, as it is to other iwi. But with generational loss of authority, best practices and partnerships to protect fresh water, Ngāi Tahu have seen the constant degrading of this taonga. There are authorities justifying water quality with new goals while ignoring the fact that our customary food gathering practices ensured that the water was always fresh. These practices that have been followed for centuries by whānau are no longer possible due to pollution.

For Ngāi Tahu, much of its traditional knowledge has been lost. Ngāi Tahu upoko and Canterbury University scholar Professor Te Maire Tau has described that lack of cultural knowledge within the iwi. His statement reinforces the observation of Hirini Mead that, in 1979, it was obvious that few people really understood tikanga (Mead, 2016), and this included our own people. Writes Tau:

> By 1996, Ngāi Tahu could no longer boast a native speaker. In 1992 Pani Manawatu, the Upoko of the Ngāi Tu Ahuriri Runanga and last native speaker of the language, died. His death had been preceded by that of his cousin, Rima Te Aotukia Bell (née Pitama), an elder aunt of the writer who was learned in tribal traditions. In 1996 Jane Manahi, a spiritual elder and leader from Tuahiwi, also passed beyond the shaded veil. These deaths and the 1996 Te Runanga o Ngāi Tahu Act saw the end of Ngāi Tahu old and the evolution of a Ngāi Tahu new. Just as the Gauls and Germanic groups de-colonized themselves and rebuilt their world, so too have Ngāi Tahu. (Tau, 2001, p.148)

There have also been 230 years of immigration and missionary influence introducing new religions that taught that Māori religious beliefs were bad. As a result, many Māori adapted to these new religions, leaving behind their traditional knowledge systems and beliefs. There were also several years of government-led cultural assimilation initiatives against Māori, including the forced removal of water rights. Te Maire Tau refers to being a witness in the 1970s and 1980s to the government actively destroying Ngāi Tahu communities with their 'white death machine', attacking Ngāi Tahu on two fronts: by destroying traditions of mahinga kai and by dismantling fishing camps on the rivers (Tau, 2013, p.15). I argue that current freshwater policies and attitudes that some freshwater pollution is acceptable are just another, but more discreet, 'white death machine' that is enabled due to lack of resources to fight back.

A common argument against tikanga and customary rights is that they are no longer relevant. The same is often said of the Bible and religion. Others believe that the Treaty of Waitangi is also obsolete in this age (Archie, 1995). Tikanga and the Treaty of Waitangi are both relevant and are unique building blocks for modern day New Zealand society. For many Māori, traditional tikanga is still applicable and highly relevant; it is handed down through stories in the whānau or, for some, it is just instinct that cannot be described.

Water is as important to Ngāi Tahu and other iwi as land is. We use water to harvest food and for rituals. If the water is polluted, the land is also polluted. Thus, our spiritual, birth and Treaty rights are being denied.

Water is a taonga

As Te Rūnanga o Ngāi Tahu observes:

> Water is central to all Māori life. It is a taonga left by ancestors to provide and sustain life. It is for the present generation, as tangata tiaki [guardians], to ensure that the taonga is available for future generations in as good as, if not better quality. (Te Rūnanga o Ngāi Tahu, 2015)

The definitions of a taonga used by the Waitangi Tribunal mean that any taonga is protected under the guarantees in article 2 of the Māori text of the Treaty of Waitangi, which states:

> The Queen of England agrees to protect the chiefs, the subtribes and all the people of New Zealand in the unqualified exercise of their chieftainship over their lands, villages and all their treasures. But on the other hand the Chiefs of the Confederation and all the Chiefs will sell land to the Queen at a price agreed to by the person owning it and by the person buying it (the latter being) appointed by the Queen as her purchase agent.

Kaitiakitanga

Ngāi Tahu, as other iwi, consider themselves the kaitiaki of the natural world. We have a historical, genealogical and spiritual

Karaitiana Taiuru whakapapas to Ngāi Tahu (Koukourarata, Puketeraki, Rāpaki, Taumutu, Ngāi Tuāhuriri, Ngāti Waewae, Waihao, Waihopai, Wairewa), Ngāti Rarua, Ngāti Kahungunu (Ngāti Pāhauwera), Ngāti Hikairo (Ngāti Taiuru), Ngāti Tūwharetoa (Ngāti Tamakopiri), Ngāti Hauiti (Ngāti Haukaha) and Ngāti Whitikaupeka.

connection to all aspects of the natural world. As kaitiaki, we respect the natural world and ensure that it is being respected and able to be used for future generations. Yet the water authorities have created new criteria to describe what healthy water scientifically is – such as swimmable. This ignores the fact that water can be polluted and considered to be of a safe standard to swim in, yet still too polluted to harvest food from.

In recent times, kaitiaki has become a common term used by bureaucrats in freshwater policies. A kaitiaki is a person, group or being that acts as a carer, guardian, protector and conserver. The gods of the natural world were considered to be the original kaitiaki; for instance, Tāne, god of the forest, was the kaitiaki of the forest. All other kaitiaki emulate those original ones (Mihinui, 2002).

Tau argues that kaitiaki is a term used with such irregularity that it is now meaningless; that today, 'kaitiaki' is used by Māori and Pākehā bureaucrats as a gap-filler to mean everything and yet nothing (Tau, 2013, p.15). But it is a common belief that you cannot be a kaitiaki without being the owner.

Te Rūnanga o Arowhenua are considered the kaitiaki of the Ōpihi and many other rivers within their boundary. These rivers were once a primary source of mahinga kai. Yet today the water flows are so low that the ability to exercise mahinga kai rights is either non-existent or severely restricted. The impacts on the community are devastating. Current generations of whānau can no longer exercise customary rights and the bonding with their waterways that their parents enjoyed as children. Those experiences are now just stories; perhaps one day they will be called legends and folk stories.

If Ngāi Tahu were genuine kaitiaki of fresh water, then the water would be better quality and iwi would be able to harvest food from their traditional places.

Ngāi Tahu

Migrating from the North Island's East Coast over 800 years ago, Ngāi Tahu thrived in Te Wai Pounamu, the South Island. They intermarried with local tribes and adopted their beliefs. Their lands cover much – 80% – of the South Island, and are New Zealand's largest single tribal territory (Tau, 2015). Ngāi Tahu is the fourth largest Māori iwi.

In the 20 years from 1844, Ngāi Tahu signed formal land sale contracts with the Crown for 34.5 million acres of Te Wai Pounamu. The Crown failed to honour its part of those contracts when it did not allocate one-tenth of the land to the iwi as agreed. It also refused to pay a fair price for the land. Robbed of the opportunity to participate in the land-based economy alongside the settlers, Ngāi Tahu became an impoverished and virtually landless tribe. Its full claim involved some 3.4 million acres of lost land, one-tenth of the total Ngāi Tahu land sold. This was the basis of the Ngai Tahu Treaty claim (Te Rūnanga o Ngāi Tahu, n.d.-a).

> The definitions of a taonga used by the Waitangi Tribunal mean that any taonga is protected under the guarantees in article 2 of the Māori text of the Treaty of Waitangi ...

Today, as an organisation Ngāi Tahu is worth more than $1.7 billion, and has numerous corporate and social organisations with their own management and governance structures that sometimes operate in isolation from each other.

Corporate

Te Rūnanga o Ngāi Tahu (Te Rūnanga), the tribal council, was established by the Te Runanga o Ngai Tahu Act 1996 to be the tribal servant, protecting and advancing the collective interests of the iwi. The Office of Te Runanga o Ngai Tahu is the Ngāi Tahu iwi corporate body.

The Office of Te Rūnanga o Ngāi Tahu is not a traditional iwi structure. It is a Western corporate structure that has ignored tikanga Māori. Eruera Tarena observes that '[a]dopting Western technical tools has unintentionally resulted in also adopting Western cultural values and practices into the organisation'. He further states: 'There is widespread belief that mimicking Western organisational structures and their associated cultural beliefs risks further assimilation' (Prendergast-Tarena, 2015).

The operations of the Office of Te Rūnanga o Ngāi Tahu are managed by a chief executive officer and a management team. One of Te Rūnanga's earliest policy decisions was to employ the 'best person for the job', which gave the iwi credibility in the wider society, but resulted in large numbers of non-Māori staff, executives and governors, especially in the investment arm (Prendergast-Tarena, 2015). This makes Ngāi Tahu different from many other iwi organisations, who predominantly employ their own iwi members and retain a tribal knowledge, so that iwi desires are incorporated into decision-making.

Within the Office of Te Rūnanga o Ngāi Tahu, Te Ao Tūroa is the strategic and policy team responsible for the natural environment, including fresh water and mahinga kai. Its general manager reports to the chief executive officer. Te Ao Tūroa leads the strategic direction of the environmental workstreams and ensures the integration of environmental programmes and workstreams within the wider tribal development strategy to support whānau outcomes (Te Rūnanga o Ngāi Tahu, n.d.-b). Te Ao Tūroa consults with 18 regional papatipu rūnanga, often by way of an email requesting information.

Two of the entities of Te Rūnanga o Ngāi Tahu are the self-governing commercial arms Ngāi Tahu Property and Ngāi Tahu Farms. Ngāi Tahu Property and Ngāi Tahu Farms have a mandate to make the iwi money. Not until recently did their decision-making processes consider any cultural values. By default, both of these entities make commercial decisions about fresh water that may contradict iwi values.

The Ngāi Tahu papatipu boundaries are viewable in the Te Runanga o Ngai Tahu (Declaration of Membership) Order 2001.[1] There are two marae, in Kaikōura – Takahanga – and Mangamanu. The Rūnanga is based at Takahanga.

Decision-making

What one papatipu rūnanga agrees to and enacts could be very different from what a neighbouring papatipu rūnanga does. This is the traditional customary right of mana whenua. For example, Te Ngāi Tūāhuriri is firmly focused on the relationship between the Treaty of Waitangi and the 1848 Canterbury deed of purchase. With the 1848 Canterbury purchase, the Crown gained substantive sovereignty over the land; however, the deed of purchase did not surrender to the Crown the ownership of water, as occurred in other regions of the South Island and in the North Island. For this reason, aboriginal title to water was not surrendered or extinguished (Tau, 2013, p.12).

Of the ten purchase deeds of land and resources in the Ngāi Tahu tribal boundaries, only four mention water. Regarding the remaining six that did not, it could be argued by the relevant papatipu rūnanga that they have customary rights to water within their tribal boundaries. Yet this is not considered with any partnerships with local council or government.

Whānau and individuals

Iwi member registrations are over 56,000. The Office of Te Rūnanga o Ngāi Tahu estimates that only about 10% of registered members are active within a papatipu rūnanga. Member participation is often based on the most influential family at the marae at the time (Prendergast-Tarena, 2015). As a result, experts in various areas of the environment may not necessarily be involved with the rūnanga.

Some whānau have Māori trusts to govern land which has fresh water. The trust authority would override the rūnanga, adding another dimension to the complexities of Ngāi Tahu decision-making around fresh water.

Non-Ngāi Tahu marae

This is another unique aspect of the geographic area of Ngāi Tahu. There are other marae in the Ngāi Tahu district that are not Ngāi Tahu and do not represent Ngāi Tahu views. These marae are Rehua and Ngā Hau E Whā in Christchurch; Hākatere Marae in Ashburton; Te Aitarakihi Multi Cultural Centre in Timaru; and Araiteuru Marae in Dunedin.

Ngāi Tahu and freshwater resources

Freshwater fish were among the most important traditional food sources for Ngāi Tahu. Freshwater species, especially tuna, were an important part of Ngāi Tahu dietary requirements; they were plentiful and nutritious, and accessible all over the South Island when people were travelling between sites. Fishing spots were usually on every bend of a river and stream. These fishing spots were inherited from generation to generation based on whakapapa.

Traditional knowledge was also passed down to new generations and many whānau had their own spiritual connections to their fishing spots. Until recently, with the derogation of water quality, these fishing spots were a primary source of food for families.

As an iwi, Ngāi Tahu considers that its relationship with the waters of its rohe has been eroded over the last 150 years. Evidence produced by Ngāi Tahu before the Waitangi Tribunal documented numerous examples of waterways within the Ngāi Tahu rohe that are now severely polluted by discharges, or where reworking of the hydrological regime of waterways has resulted in unnatural patterns of erosion, sedimentation, drying up of flows and damage to rich mahinga kai habitats on the riparian margins (Te Rūnanga o Ngāi Tahu, 2015).

Ngāi Tahu oppose the Crown's assumption that it can regulate the taking of water without having acquired ownership first, and its assumption that it can create a property right by default, and a commercial value over a resource that can be traded, when it cannot show proof of ownership. Ngāi Tahu protests that the regulations and actual processes have led to the degradation of our waterways and fisheries (Tau, 2013, pp.23).

The vision statement of Te Ao Tūroa, the environment section of Te Rūnanga o Ngāi Tahu, begins:

> Our dream is that our ancestral landscape is protected and our people have living relationships with their whakapapa and traditions through the environment. The goal is that Ngāi Tahu is a principled kaitiaki (steward) of our takiwā (tribal territory). (Te Rūnanga o Ngāi Tahu, n.d.-c)

Current water strategies and policies do not allow for this Ngāi Tahu dream.

If waterways are polluted and unhealthy, then Māori people are spiritually unhealthy, Ngāi Tahu and other iwi are not able to exercise their birthright and Treaty right to harvest food from the fresh water, and taonga species are not protected.

Conclusion

Water is a taonga to all iwi, including Ngāi Tahu. If waterways are polluted and unhealthy, then Māori people are spiritually unhealthy, Ngāi Tahu and other iwi are not able to exercise their birthright and Treaty right to harvest food from the fresh water, and taonga species are not protected.

As the current-day guardians of water, it is our job to ensure that water is healthier than when it was inherited by us.

Current decision-making under the Ngāi Tahu banner may not always be what

the whānau want or believe. It may be a corporate decision, or a rūnanga may have been overwhelmed with other consultations and feedback and a water decision neglected.

If the quality standard for fresh water is based on the fact that food can be customarily gathered, then fresh water will be of a good enough quality for all New Zealanders, Ngāi Tahu will have their Treaty and customary rights reinstated, and the country will be able to know that future generations will have access to fresh water.

1 http://www.legislation.govt.nz/regulation/public/2001/0200/latest/whole.html.

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SPECIAL ISSUE OF *POLICY QUARTERLY*

Policy and Family Well-being

Policy Quarterly invites submissions on a special edition examining the intersection of policy and family well-being. This issue will broadly focus on all aspects of family and whānau well-being, with a particular interest in highlighting the diversity in New Zealand family forms and experiences.

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Timeline:

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Submission guidelines:

- Text length should be 4,000 – 5,000 words including references
- Abstract of 150 words maximum
- APA style in-text citations and references
- Double-spaced lines

Full papers will receive double-blind external reviews (1-2 reviews, in addition to the Editor's reading).
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Anne Salmond, Gary Brierley and Dan Hikuroa

Let the Rivers Speak
thinking about waterways in Aotearoa New Zealand

Abstract

This article explores deep underlying assumptions about relationships between people and the planet, and how these translate into very different ways of relating to waterways in Aotearoa New Zealand. In te ao Māori – ancestral Māori ways of living – rivers and lakes are the tears of Ranginui, the sky father, mourning his separation from Papatūānuku, the earth mother, and people are their descendants, joined in complex whakapapa that link all forms of life together. In modern ways of thinking, on the other hand, ideas such as private property, resource management and ecosystem services can be traced back to the Genesis story of God's gift of 'dominion' to Adam and Eve over fish, birds, plants and the earth itself, including waterways, in which all other life forms are created for human purposes.

In successive Waitangi Tribunal claims, iwi have disputed these assumptions in relation to fisheries, tribal lands and rivers, and, in world-leading legislation, the Whanganui River has been declared a legal person with its own rights. In this article, the authors discuss different ways in which the rights of rivers *as rivers* might be understood in scientific terms, investigating the 'geomorphic rights' of the Whanganui River, for instance, and how rivers as living communities of land, water, plants, animals and people might be understood through 'river ethnography', an approach that aligns a wide range of natural and social sciences with mātauranga taiao – ancestral knowledge of other living systems. They also consider how current policy discussions might be informed by such framings, so that river communities across Aotearoa New Zealand may be restored to a state of ora – life, health, abundance and prosperity.

Keywords water rights, whakapapa, Waitangi Tribunal, awa tupua, mātauranga taiao, commodification, reciprocity, Te Awa Tupua Act, the commons

In Aotearoa New Zealand, since first European settlement in the early 19th century differing assumptions about the relationships among land, sea and ancestors have collided and been contested.

Before the first Europeans arrived, accounts taught in the whare wānanga or ancestral schools of learning traced the origins of the cosmos to a primal surge of energy:

Nā te kune te pupuke
Nā te pupuke te hihiri
Nā te hihiri te mahara
Nā te mahara te hinengaro
Nā te hinengaro te manako
Ka hua te wānanga
Ka noho i a rikoriko
Ka puta ki waho ko te pō Nā te kore i ai
Te kore te whiwhia
Te kore te rawea
Ko hau tupu, ko hau ora Ka noho i te atea
Ka puta ki waho ko te rangi e tū nei
Te ata rapa, te ata ka mahina
Ka mahina te ata i hikurangi!

From the source of growth the rising
From rising the thought
From rising thought the memory
From memory the mind-heart
From the mind-heart, desire
Knowledge becomes conscious
It dwells in dim light
And Pō (darkness) emerges ...
From nothingness came the first cause
Unpossessed nothingness
Unbound nothingness
The hau of growth, the hau of life
Stays in clear space
And the sky emerges that stands here.
The early dawn, the early day, the mid-day
The blaze of day from the sky!
(Te Kohuora of Rongoroa, in Taylor, 1855)

From that first surge of energy, thought, memory, the mind-heart, desire and knowledge emerged. As knowledge became conscious, the world took shape in te kore, nothingness, and te pō, darkness, through aeons of ancestral space-time. When the winds of life and growth began to blow, the sky and the earth emerged. At first Ranginui the sky father and Papatūānuku the earth mother were one being, locked together, and as their children were born they lay cramped between them, living in darkness. Frustrated and constricted, they decided to separate their parents, and one after another they tried until at last Tāne, the ancestor of forests, lay on his back and pushed them apart. As Rangi wept for his wife, Papatūānuku sent up mists to greet him, and Rangi's tears became rivers and lakes, bringing life to the land (Te Rangikaheke, 1849).

> … the introduction of ideas of land as 'property' owned by individuals or corporations … cut through the intricate, entangled strands of whakapapa (ancestral connection) that wove people, land, waterways and the sea together.

In this cosmological account, water is a source of ora (well-being and abundance). The water cycle is placed at the heart of the relationship between sky father and earth mother,[1] who eternally exchange mist and rain, giving life to their children – the ancestors of forests (Tāne-mahuta), wild food plants (Haumia-tiketike), cultivated food plants (Rongo-mā-tāne), the ocean and waterways (Tangaroa), winds (Tāwhiri-matea) and people (Tū-matauenga). When Tāwhiri-matea, enraged by his brothers' violence against their parents, attacks his brothers, only Tū-matauenga stands strong. Because of Tū's courage his descendants, human beings, inherit the mana (ancestral power) to harvest the offspring of his brothers – birds and forest foods, wild and cultivated plants, fish and other creatures. Because they are kinfolk, though, they must ask permission from Tū's brothers in the seasonal rituals of fishing, birding, agriculture and other forms of harvest. The aim is to keep these exchanges in balance, so that the life force of birds, fish, plants and people remains strong and healthy (mauri ora). If particular species became depleted (mauri noho), those who have the right to conduct such rituals placed a rāhui or ritual restriction on them until their life force had recovered.

In this way of living, kin groups moved across land, waterways and the coast in seasonal cycles, harvesting particular foods as they became abundant. Rights to take particular species were passed down genealogical lines and through relationships of alliance and friendship, tangling across the landscape in overlapping patterns of seasonal residence and harvest. Only by staying close to land and sea and lighting one's fires (ahi kā) could these relationships (which involved both rights and responsibilities to care for other life forms) be kept 'warm', instead of lapsing and going 'cold' (ahi mātaotao).

Since the first Europeans settled in Aotearoa, these kin-based ways of living have been radically disrupted. Most fundamentally, the introduction of ideas of land as 'property' owned by individuals or corporations, fragmented into measured, bounded areas by survey and

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mapping, in which almost all rights can be exchanged with strangers for a price, cut through the intricate, entangled strands of whakapapa (ancestral connection) that wove people, land, waterways and the sea together.

This way of understanding was first enacted by the first explorers and surveyors who were sent to Aotearoa to grid the land by latitude and longitude, quantify it and cut it into 'blocks', irrespective of mountains, rivers and valleys; abstract it and empty it of life and people. The notion of land as a commodity was authorised by the Old Land Claims Commission following the signing of the Treaty of Waitangi between Māori kin group leaders and the British Crown in 1840; enforced by acts of confiscation following the New Zealand Wars in the early 1860s and by the establishment in 1865 and operation of the Native Land Court; and enacted by the incremental assumption of the rights of the nation state to 'manage' all 'resources' in Aotearoa, most recently in the Resource Management Act 1991. These ideas about the rights of human beings, in particular 'civilised' people, to control land, waterways and the ocean were also underpinned by ancient cosmological framings, including the origin story recounted in the Book of Genesis, in which God creates Adam and Eve in his own image, telling them to be 'fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth' (King James Bible, Genesis 1:28).

If one examines the emergence of modern ideas about private property, their cosmological underpinnings are obvious. In *Two Treatises of Government,* for instance, John Locke devotes the first treatise to arguing about Adam's rights over land, sea and people, based on this biblical passage. While he does not dispute that God granted Adam and Eve dominion over fish, plants and animals (a unilateral, 'command and control' relationship), Locke contends that this did not extend to other human beings. Dominion over land and sea could not thus be claimed by absolute monarchs as Adam's inheritors, but rests in humankind in general. In Locke's framing, the origin of private property can be traced back to the act of an individual investing his own labour in improving and cultivating the land and 'enclosing it from the common' (Locke, 1821).[2]

Likewise in his *Commentaries on the Laws of England,* William Blackstone, the influential 18th-century British jurist, cites the Genesis story:

> In the beginning of the world, we are informed by holy writ, the all-bountiful Creator gave to man 'dominion over all the earth, and over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.' This is the only true and solid foundation of man's dominion over external things. (Blackstone, 1770, book 2, p.18)

At the same time, Blackstone expands on Locke's account of how private property and 'civil society' developed:

> It was clear that the earth would not produce her fruits in sufficient quantities without the assistance of tillage; but who would be at the pains of tilling it, if another might watch an opportunity to seize upon and enjoy the product of his industry, art, and labour?
>
> Had not therefore a separate property in lands as well as movables been vested in some individuals, the world must have continued a forest, and men have been mere animals of prey, which, according to some philosophers, is the genuine state of nature …
>
> Necessity begat property; and, in order to insure that property, recourse was had to civil society, which brought along with it a long train of inseparable concomitants, – states, government, laws, punishments, and the public exercise of religious duties.

In the Treaty of Waitangi Act 1975, the Waitangi Tribunal was specifically prohibited from recommending the return or purchase of private land, or from inquiring into historical breaches of the Treaty relating to commercial fisheries …

Ideas of ancestry are still significant here, tracing the origins of human 'dominion' over land, sea and other species back to God's gift to Adam and Eve, and 'sovereignty' to those who share God's attributes of judgement and wisdom (ibid., introduction, p.48).[3] Land, sea and other life forms are not seen as kinfolk, however. Rather, these are understood as the passive recipients of human labour, which 'improves' and encloses the land, converting it into private property which can be traded on a market.

At the same time, in Blackstone's formulation, waterways largely escaped this framing. Like light and air, water was in a 'state of nature' and part of 'the commons' (ibid., book 2, p.13):[4] 'For water is a movable, wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient, usufructuary, property therein' (ibid., p.18).[5] Nevetheless, according to Blackstone, if a man fouls a waterway shared with his neighbour, or diverts it so that this neighbour loses the use of that water, this is an injury to be redressed under the law. Interestingly, this restraint upon the use of fresh water was not given legal force when British law was introduced to Aotearoa New Zealand. Rather, the freedom of a person to use their own land (understood as private property) overrode Blackstone's framing of their responsibility to protect the rights of their

neighbours to the use of fresh, free-flowing streams and rivers.[6]

This powerful emphasis on private property was also evident in the processes established to give Māori kin groups redress against the Crown for breaches of the Treaty of Waitangi. In the Treaty of Waitangi Act 1975, the Waitangi Tribunal was specifically prohibited from recommending the return or purchase of private land, or from inquiring into historical breaches of the Treaty relating to commercial fisheries (s6(4A) and (7)). Only Crown land, forests or other properties, as well as taxpayer funding, could be recommended as remedies for these breaches.

Nor was the Tribunal given powers to inquire into historical breaches of the Treaty until 1985, hot on the heels of the election of a Labour government. At the same time, however, the government embraced neo-liberal economics, including an extensive programme of privatising state properties, including forests, fisheries and lands. Almost immediately there was a series of clashes with Māori. In June 1985, for instance, Matiu Rata, then the minister of Māori affairs, wrote a letter to the Tribunal claiming that the Treaty rights of his Muriwhenua people had been breached by the Crown's presumption that their rights to their ancestral fisheries had been extinguished. A quota management system for Aotearoa New Zealand fisheries had been proposed which assumed that fish stocks in New Zealand's territorial waters were 'owned' by the Crown, quantifying the stocks of particular species and turning them into quotas to be traded on the market. In 1987 the Muriwhenua kin groups lodged a claim with the Waitangi Tribunal that succeeded in establishing that their rights to their ancestral fisheries, guaranteed under the Treaty, had never been legally extinguished (Waitangi Tribunal, 1988). As a result, a significant proportion of quotas in the new quota management system was awarded to Māori kin groups around the country.

While this Waitangi claim was fought on the grounds that the Crown's claim to 'own' New Zealand fisheries was unfounded, the remedy was still framed in terms of property rights, including both cash and quotas. These gave only partial compensation and did little to restore fish stocks to a state of ora. In the case of rivers, in keeping with Blackstone's dictum that water is part of the commons, however, the Crown did not claim to 'own' these waterways, but to govern them on behalf of the people of New Zealand. In the case of the Waikato River, the longest river in Aotearoa, when the government proposed to build a power station at Huntly adjacent to the Māori Queen's marae in the early 1970s (Whittle, 2013), this assumption was also contested. As Robert Mahuta, the Māori Queen's brother, declared in 1975, 'Noo taatou te awa. Noo te awa taatou. E kore e taea te wehe te iwi o Waikato me te awa. He taonga tuku iho naa ngaa tuupuna. E whakapono ana maatou ko taa maatou, he tiaki i taua taonga moo ngaa uri whakatupu' (The river belongs to us. We belong to the river. The Waikato people and the river cannot be divided. It is a treasure handed down from the ancestors. We believe it is our role to take care of this treasure for future generations) (Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010, preamble).

> In successive Treaty claims against the Crown, iwi challenges against modern framings of relations among land, waterways and people have become increasingly fundamental.

This idea of the river as a treasure, the lifeblood of the earth mother from whom the ariki (high chiefs) of Waikato-Tainui descend, was powerfully expressed in a waiata composed by Tāwhiao, the second Māori King, farewelling his ancestral lands, confiscated (raupatu) by the Crown after the wars of the 1860s:

> I look down on the valley of Waikato
> As though to hold it in the hollow of my hand ...
> See how it bursts through
> The full bosoms of Maungatautari and Mangakawa,
> Hills of my inheritance:
> The river of life, each curve
> More beautiful than the last,
> Across the smooth belly of Kirikiriroa,
> Its gardens bursting with the fullness of good things,
> Towards the meeting place at Ngāruawahia
> There on the fertile mound I would rest my head
> And look through the thighs of Taupiri.
> There at the place of all creation
> Let the King come forth.
> (quoted in Muru-Lanning, 2010, p.45)

In the event, when the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act was passed in 2010 as partial reparation for the confiscations, it was agreed that authority over the river should be shared between Waikato-Tainui kin groups and the Crown. In the preamble to the act, the ancestral relationship between these kin groups and the river was legally recognised: 'To Waikato-Tainui, the Waikato River is a tupuna (ancestor) which has mana (prestige) and in turn represents the mana and mauri (life force) of the tribe. Respect for te mana o te awa (the spiritual authority, protective power and prestige of the Waikato River) is at the heart of the relationship between the tribe and their ancestral river.' The history of the disruption of this relationship was also recorded in the act's preamble, from the decision of Governor Grey to send an iron steamer down the river in 1862 to invade the Waikato and the confiscations that followed, to the Crown's assumption of

jurisdiction over the river and the harm done to the Waikato by 'farming, coal mining, power generation schemes, the discharge of waste, and domestic and industrial abstraction'.

In this case, the remedies included a recognition of 'te mana o te awa' (the mana of the river), along with an agreement that the Crown would work with the Waikato-Tainui kin groups to restore their 'mana whakahaere' (governance, authority, jurisdiction) over the Waikato River and bring these groups together to protect te mana o te awa.

In successive Treaty claims against the Crown, iwi challenges against modern framings of relations among land, waterways and people have become increasingly fundamental. In the case of the Te Urewera Act 2014, for instance, the mana of Tūhoe's ancestral lands in the former Te Urewera National Park, including waterways, was given a higher priority than the mana of people. In this act, Te Urewera is declared to be a legal entity, inalienable and independent. As Tamati Kruger, a leader of the Tūhoe people, has declared, 'The Urewera owns itself'. This understanding is elaborated in the background section of the act:

> Te Urewera is ancient and enduring, a fortress of nature, alive with history; its scenery is abundant with mystery, adventure, and remote beauty. Te Urewera is a place of spiritual value, with its own mana and mauri. Te Urewera has an identity in and of itself, inspiring people to commit to its care …
>
> Te Urewera expresses and gives meaning to Tūhoe culture, language, customs, and identity. There Tūhoe hold mana by ahikāroa [long having their fires alight on the land]; they are tangata whenua [land people] and kaitiaki [guardians] of Te Urewera. (Te Urewera Act 2014, s3)

In their guardianship of Te Urewera, Tūhoe kin groups have rejected ideas of human dominion over land and waterways as reflected in the doctrines of sovereignty, property rights and possessive individualism. Historically, although Tūhoe were promised considerable autonomy by the Crown, these promises were broken. Their territory is relatively remote, mountainous and forested, and a heartland for the preservation of tikanga (ancestral customs) and te reo, and their expressed ambition is to govern their own affairs in their own way on their own lands. Decisions about the future and uses of Te Urewera are made by consensus at hui on marae, rather than by voting, for instance.

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This same kind of thinking is also evident in the Te Awa Tupua (Whanganui River Claims Settlement) Act 2017. Like Waikato-Tainui, the Whanganui iwi have kept their 'fires alight' by maintaining marae along the length of their ancestral river, the third longest in New Zealand. Like the Waikato, too, there is extensive non-Māori settlement on the river, with the city of Whanganui around the river mouth. In their Tribunal hearings, Whanganui kin groups have demonstrated their ongoing relationship with the Whanganui River, arguing that their life and well-being and that of the river are inextricably entangled. As a Whanganui elder, Turama Thomas Hawira, lamented:

> It was with huge sadness that we observed dead tuna [eels] and trout along the banks of our awa tupua [ancestral river]. The only thing that is in a state of growth is the algae and slime. Our river is stagnant and dying. The great river flows from the gathering of mountains to the sea. I am the river, the river is me. If I am the river and the river is me – then emphatically, I am dying.[7]

In their Treaty settlement, the Whanganui kin groups insisted on honouring the rights and life of the river. In the event, their relationship with the river was recognised in the act, which declared that 'Te Awa Tupua [literally, a river from the ancestral realm] is a legal person and has all the rights, powers, duties, and liabilities of a legal person' (s14(1)). In this act, two individuals, one appointed by the Crown and one by the Whanganui iwi, were established as Te Pou Tupua, the human face of Te Awa Tupua, authorised to act in the name of the river to protect its health and well-being, using funding dedicated for this purpose.

Like the Te Urewera Act, this act was world-leading in acknowledging the legal rights and responsibilities of a territory in the first instance, and a river in the second, in relation to those of people. The framing of it is still anthropocentric, however, since it defines the river as a legal person. In effect, this diminishes the mana of the Whanganui, since, in ancestral understandings, waterways emerge from the exchange of rain and mist between sky and earth, and are more ancient and powerful than people. At the same time, setting up Te Pou Tupua as its 'human face' limits the river's agency, its independent power to act, by providing the river, like children or those who are incapacitated, with guardians who speak and act in its name. Likewise, framing the mana of the river as 'rights' fails to respect the principle of reciprocity (utu), which aims to generate ora through balanced exchange. When this balance fails, this leads to a state of mate (illness, failure, death), which is arguably

what has happened to waterways across Aotearoa New Zealand.

This limited legal framing has inspired attempts in New Zealand to explore what it might mean for a river (or a territory) to have its own life, in its own terms, with its own rights to health and well-being. In the case of the Whanganui River, for instance, a recent article arising from the Te Awaroa: Voice of the River project (Salmond, Tadaki and Gregory, 2014) has explored the rights of the river by juxtaposing 'geomorphic understandings of a river's agency' with 'ancestral Māori relations to the river based upon mutual co-dependence (reciprocity)'. The aim of this exercise is to bring together ancestral insights with the findings of contemporary geomorphological science to assist in restoring the health, well-being and life force of the Whanganui river, along with other waterways across the country.

In this article, the authors give a bleak view of the impact of utilitarian and 'command and control' framings of rivers as introduced to Aotearoa through colonial processes:

> Notions of progress and improvement brought about the wholesale clearance of native vegetation, the drainage of wetlands, and the creation of large grassland areas for pastoral farming. Rivers were treated as drains or sewers, conduits for the disposal of waste with a seemingly limitless capacity for self-cleansing and self-renewal.
>
> Impacts on rivers from mining, forestry, sawmilling, pastoral farming, flax milling and the operation of tanneries, dairy factories, and meat works were accentuated in the 20th century by the implementation of a 'command and control' management ethos.
>
> Major hydroelectricity schemes, irrigation projects, and artificial stop banks (levees) transformed virtually all alluvial rivers in the country. Civil engineers were tasked with harnessing the powers of nature for human benefit, straightening, diverting, and culverting rivers to separate them from people. Catastrophic biodiversity losses ensued. Channels and harbours filled with sediment, pollutants and contaminants, and aquifers and waterways were depleted beyond sustainable limits. (Brierley et al., 2018, p.2)

Drawing on ancestral Māori framings, the [Te Awaroa] team focused on hearing 'the voice of the river', the behaviour and health of the river over time, as reflected in 'river stories'.

Extractive approaches, one-way relationships and radical failures of reciprocity have resulted in fundamental ecological damage to many waterways across New Zealand. After exploring Māori ideas about relations between rivers and people, seven geomorphic 'rights' are described that a river *as a river* might enjoy in its quest for ora: a right to flowing water; a right to transport sediment; a right to be diverse; a right to adjust; a right to evolve; a right to operate at the catchment scale; and a right to be healthy (ibid., p.4), and these rights are applied to the Whanganui River in a case study.

In the 1960s, as the authors note, the headwaters of the Whanganui River were diverted by the Tongariro Power Scheme, without consultation with Whanganui kin groups and in spite of their protests:

> The turbulent, glacial-blue flows of the Whakapapa River were reduced to a trickle, transferring 97% of its water. An iwi representative, Gerrard Albert, later described it: '… the head of our river has been cut off, and it no longer exists as a whole river … and so we continue to bleed as a people, as it bleeds as a river .' (ibid.)

This scheme has had powerful impacts on the river, diminishing its rights to flowing water, to transport sediment, to operate at catchment scale and to be healthy. This river, with its deeply incised headwaters and confined valleys, has little room to move, and this has been further constrained by stopbanks, the drainage of wetlands and the clearance of riparian vegetation. Further downstream, the impacts of flooding have become increasingly severe, with residents in parts of Whanganui city having to be relocated.

In the article, the authors trace powerful resonances between the insights of mātauranga taiao (ancestral knowledge of the living world) and contemporary geomorphological science, and argue that by working together, these can enrich understandings of rivers as living systems with unique properties, and assist in devising better ways of handling the relations between people and waterways. What happens, however, if rivers are not regarded by Māori as ancestors, or if the relationships between kin groups and waterways have been radically disrupted?

In the case of another river studied by the Te Awaroa team, the Waimatā River on the east coast of the North Island, Māori occupation of its upper reaches largely ceased soon after European settlement. In order to understand the long-run life of the river, its geomorphological character, the arrival of Māori and European settlers, their uses of and impacts on the river system, and its ecological history were investigated. This approach, styled 'river ethnography', aims to bring together a wide range of disciplines (including history and the social sciences) with mātauranga taiao (ancestral knowledge of living systems) in an attempt to explore the Waimatā River as a living community through time, with its land, water, plants, animals and people. Drawing on ancestral Māori framings, the team focused on hearing 'the voice of the river', the behaviour and health of the river over time, as reflected in 'river stories'.

The inquiry began by exploring the relationship between land and the river. Like the Whanganui River, the channel of the Waimatā is confined and acts as a flume, transporting sediment and waste materials from source to the ocean. From its headwaters the river runs through highly erodible, steep country, through forests, pastoral farmland and suburbs, where it joins the Taruheru River to become the Tūranganui River, the shortest river in Aotearoa New Zealand, which runs through Gisborne city and the port (Cullum, Brierley and Marden, 2016).

Unlike the Whanganui and Waikato rivers, in ancestral Māori times the upper reaches of the Waimatā were largely used as a highway to the east coast and for access to forest resources, and were not permanently settled (Phillips and Salmond, 2017). During the early phase of European settlement the land around the river passed into European control and then ownership, and Māori occupation of the upper and mid catchment largely ceased (Gundry, 2017). No doubt for this reason, the Waimatā has not been subject to a specific Treaty claim, although several kin groups have submitted statements of their ancestral relationships with the river as part of the Treaty claim process. Occupation continued on the northern banks of the Tūranganui, however, where the Waimatā joins the Taruheru and flows into the sea. Both the local hapū, Ngāti Oneone, and their ancestral river experienced major impacts, including the development of the port along with other industrial uses; the relocation of their marae, Te Poho-o-Rāwiri; the blasting of Te Toka-ā-Taiau, a sacred rock near the mouth of the river; and the loss of Te Wai o Hīharore, a place set aside in ancestral times so that inland kin groups could go fishing, declared an inalienable fishing reserve by the Native Land Court in 1875 (Phillips and Salmond, 2017, pp.4, 21).[8]

The introduction of pastoral farming by European settlers in the mid and upper reaches of the Waimatā catchment led to the clearance of hill and riparian vegetation, severe erosion, and major flooding in the lower reaches of the river and Gisborne city, so that major engineering works were carried out to divert the mouth of the river into a separate channel from the port.

> The kin networks that bind people with other living systems resonate with the science of complex networks, key to understanding many 'wicked problems' of our time, in which the exchanges between people, land, rivers, plants, animals, the sea and the atmosphere are inextricably entangled and mutually implicated.

Nevertheless, the lower Waimatā has been heavily used for recreational purposes, with rowing, kayaking and more recently waka ama paddling as major activities. With the introduction of plantation forestry in the headwaters and mid reaches of the river in the late 1960s to deal with severe erosion, followed by recent clear-felling, the lower reaches of the river have been affected by aggradation and flooding, putting these activities at risk.

Finally, the team examined the ecological history of the river, and the impacts of these activities over time upon plants, animals and people, many of which have been devastating (Salmond, 2017). The research process, which involved interviews with many individuals with different kinds of knowledge about the life of the river, from local residents to iwi members, foresters, farmers, scientists, local body engineers, and waka ama and kayak paddlers and rowers, was a way of empowering different voices to speak *from* as well as *about* the life of the river. Once the reports were written, meetings to share their findings with local communities were held. With no formal Treaty process to draw specific attention to the degradation of the river and the associated risks to local people, and a short-term utilitarian approach that largely ignores the downstream impacts of upstream activities, the Waimatā River had been relatively neglected. This is despite a close relationship between local residents and the lower reaches of the river, and the fact that it runs through Gisborne city and port. The public meetings were very well attended, including by those who had participated in the research process, and many of those present expressed a strong desire to play an active role in ensuring a healthy future for the river.

Here, too, an approach that brings together mātauranga taiao with contemporary sciences to understand rivers as unique, dynamic living systems that include plants, animals and people, and to seek balanced, life-enhancing exchanges among them, has the potential to lead to better outcomes for waterways, people and other life forms. This requires a shift from short-term, utilitarian, anthropocentric framings, because if rivers are more ancient and powerful than people, then all waterways have rights to flourish, not just those that are the focus of current human preoccupations.

Here one can begin to glimpse the strength of ecological perspectives based on ancestral Māori insights as well as contemporary sciences. In Aotearoa New Zealand, after perhaps 80 million years of independent evolution[9] – aeons of ancestral space-time – the first human beings arrived. Human occupation is brief, beginning about 800 years ago. As the saying goes, 'Toi tū te whenua, whatungarongaro te tangata' – the land stands, while people come and go; the land, with its rivers, mountains and forests, is indeed more ancient and powerful than

people. Just as the tears of Ranginui and the mists of Papatūānuku bring life to the world, Tangaroa, the ancestor of the sea, is also the ancestor of waterways and their creatures, confounding the division between the marine and river sciences, since water itself and so many life forms move between them. The kin networks that bind people with other living systems resonate with the science of complex networks, key to understanding many 'wicked problems' of our time, in which the exchanges between people, land, rivers, plants, animals, the sea and the atmosphere are inextricably entangled and mutually implicated. When waterways become ill and polluted, people also fall ill, with very high rates of water-borne diseases in parts of Aotearoa. As Whanganui people say, 'If the river is dying, so am I'. In such a situation, the fragmentation of disciplines and radical divisions between the 'natural' and 'social' sciences make little sense, since human activities have profound impacts on all the other life forms, including losses of biodiversity, the degradation of rivers and the ocean, and climate change; and these transformations in turn have profound implications for human communities.

At present, freshwater policy is under active debate in Aotearoa New Zealand. It will be fascinating to see how far the challenge to possessive individualism, property rights and short-term profits proceeds in practice. The framing that defines human interests in terms of 'fresh water' rather than waterways is already laden with utilitarian assumptions, since it is precisely the process of abstracting, enclosing, quantifying and pricing that leads to the commodification of 'the commons', whether this is applied to land, fish stocks or water. Likewise, talk of 'ecosystem services' is underpinned by the idea that springs, wetlands, streams and rivers were created to serve human purposes, denying the need for reciprocity and life-enhancing exchanges. The emphasis on waterways as living systems or communities, more ancient and powerful than people, on the other hand, resonates with mātauranga taiao and the findings of contemporary science, and is more likely to lead to healthy, sustainable relations between people, waterways and other life forms into the future.

Te Hauora o te Wai is understood as the fundamental right of a river to flourish *as a river*, with clean water, plentiful flows and flourishing ecosystems.

A move towards these kinds of perspectives should be possible in Aotearoa New Zealand. This will require some conceptual shifts, for instance in the Resource Management Act (RMA), which aims to promote the 'sustainable management' of 'resources' in Aotearoa by:

> managing the use, development, and protection of natural and physical resources in such a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –
> (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
> (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
> (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment. (s5(1), (2))

Here the emphasis is still on the 'management' of 'resources' for human uses.

One key instrument in the RMA, the national policy statements, state objectives and policies for matters of national importance, such as coastlines, forests and water. These national policy statements must be given effect in regional policy statements, and regional and district plans. In 2014 the National Policy Statement for Freshwater Management was released. In the 23 years since the RMA was first enacted, reliance on it to protect waterways had clearly failed. Assertions that the 'market' would drive positive change in the management of waterways proved misguided, and faith that technology would provide solutions had yet to deliver.

Predictably, the National Policy Statement for Freshwater Management provided direction to manage water quality and quantity, using techno-scientific rationales. Nevertheless, this national policy statement took a significant step by acknowledging the Treaty of Waitangi as the underlying foundation of Crown and Māori relationships, and recognising 'Te Mana o te Wai' in setting freshwater objectives. Te Mana o te Wai, inspired by precedents in the Waikato and Whanganui River acts, recognises a range of tāngata whenua values, including the kin relationship through whakapapa between iwi and hapū and the natural environment, including fresh water, and that as kaitiaki, iwi and hapū have a reciprocal obligation to ensure that freshwater ecosystems are healthy (including human health).

In an appendix to the national policy statement, Te Mana o te Wai is further elaborated by defining these relationships in terms of Te Hauora o te Wai – the health and mauri of the water; Te Hauora o te Tangata – the health and mauri of the people; and Te Hauora o te Taiao – the health and mauri of the environment. Te Hauora o te Wai is understood as the fundamental right of a river to flourish *as a river*, with clean water, plentiful flows and flourishing ecosystems. Once that is secured, people can derive health and sustenance from the waterway (Te Hauora o te Tangata), in ways that ensure Te Hauora o te Taiao, wider ecosystem and environmental health.

In the 2017 amendment of the policy statement, Te Mana o te Wai was further defined as 'the integrated and holistic well-being of a freshwater body' and as an integral part of freshwater management (Ministry for the Environment, 2017, p.7).[10] This was a major step towards placing particular waterways at the heart

of freshwater management approaches in Aotearoa. When the current coalition government comprising Labour, the Greens and New Zealand First was formed in late 2017, fresh water was identified as an issue of urgent public concern. As a result, the minister for the environment, David Parker, initiated an Essential Freshwater reform programme, which included a critical reappraisal of the National Policy Statement for Freshwater Management.

This review included the establishment of Kāhui Wai Māori – the Māori Freshwater Forum – who in their April 2019 report to the minister argued that Te Mana o te Wai offers a positive way forward in realising better outcomes for waterways in Aotearoa New Zealand. They framed the kaupapa (issue) in terms of mana atua–mana tangata–mana whenua, the relationships between the mana of creator ancestors, people and the land. They proposed that obligations are first 'to the water, to protect its health and its mauri'; second, 'providing essential human health needs such as drinking water'; and third, 'for other consumption provided that such use does not adversely impact the mauri of freshwater'. The first obligation aligns with Te Hauora o te Wai, the second with Te Hauora o te Tangata, and the third with Te Hauora o te Taiao.

Although the relative order of particular hauora may vary in different formulations, the mauri and mana of the waterways always comes first. If the values articulated in Te Mana o te Wai can be effectively integrated with practical objectives for the care of waterways across Aotearoa New Zealand, there is a real chance that degraded waterways can be returned to a state of health, prosperity and abundance.

Although it is never explicitly stated, and indeed has been vehemently denied by successive governments, the underlying assumption is that a form of ownership rights to water exists in Aotearoa New Zealand. In contrast, ancestral Māori philosophies take it for granted that humans belong to Papatūānuku, earth mother, not the other way round, and that waterways arise from the living relationship between earth and sky. So, although recognition of Te Mana o te Wai in the National Policy Statement for Freshwater Management is a significant step forward, incorporating a Māori approach and privileging the use of Māori knowledge, the policy statement is still linked with legislative instruments based upon ancient Western ideas about a divine gift to Adam and Eve of command and control over 'nature', which also underpin 19th-century definitions of 'property rights' and 20th-century ideas about 'resource management' and 'ecosystem services'. It tries to reconcile two different ways of framing reality, with no guidance about how to negotiate the contradictions between them, or the significant power imbalances that have marginalised Māori understandings of relationships between people and waterways over time.

Indeed, conceptual framings are key to the future of waterways in Aotearoa and elsewhere. While notions of a 'holistic' ecological lens are often envisaged, they have proved exceptionally difficult to meaningfully capture, let alone apply (Capra, 1983). Fragmentation continues to reign supreme, satisfying vested interests while marginalising more generative and inclusive prospects. Working across worlds, on the other hand, enhances our capacity to envisage and create new ones. In Aotearoa, where lived realities already inform legislative, scientific and technical endeavours, there is an opportunity to recognise that each and every river is a living community with its own hauora, mauri and mana, where water, land, plants, animals and people are inextricably entangled, shaping each other across the generations in kin-based exchanges. At the same time, automated monitoring and measurement procedures, alongside ethnographic inquiries, present unprecedented capacities to tell the stories of each river, recorded through system-specific forms, rates and patterns of adjustment, and the study of long-run relationships and interactions of these life forms at the catchment scale (Brierley et al., 2013; Fryirs et al., 2019).

Such convergent place-based framings highlight the potential to generate insights into the emergent properties of each waterway, fostering a genuine prospect to live with rivers in ways that respect bonds of mutual interdependence, reciprocity and co-evolution. Exciting legislative and scientific endeavours are increasingly in hand as we envisage encounters that weave across laws, narratives and data sets, between people, plants, animals and rivers, letting the rivers speak, restoring vitality to the lifeblood of the land.

1 For an elegant account of the fundamental role of the water cycle in making the planet habitable for people, plants and animals, see Mauser, 2012.
2 Book 2, chapter 5, section 32: 'As much land as a man tills, plants, improves, cultivates, and can use the product of, so much is his property. He by his labour does, as it were, enclose it from the common.'
3 'In general, all mankind will agree that government should be reposed in such persons, in whom those qualities are most likely to be found, the perfection of which is among the attributes of Him who is emphatically styled the Supreme Being; the three grand requisites, I mean, of wisdom, of goodness, and of power: wisdom, to discern the real interest of the community; goodness, to endeavour always to pursue that real interest; and strength, or power, to carry this knowledge and intention into action.'
4 'But, after all, there are some few things, which, notwithstanding the general introduction and continuance of property, must still unavoidably remain in common; being such wherein nothing but an usufructuary property is capable of being had; and therefore they still belong to the first occupant, during the time he holds possession of them, and no longer. Such (among others) are the elements of light, air, and water.'
5 'The proprietor of each bank of a stream is the proprietor of half the land covered by the stream; but there is no property in the water. Every proprietor has an equal right to use the water which flows in the stream; and, consequently, no proprietor can have the right to use the water to the prejudice of any other proprietor.'
6 For a discussion of Blackstone's dictum and the doctrine of 'public trust' in relation to the governance of waterways in Aotearoa, see Salmond, 2018.
7 Turama Thomas Hawira, brief of evidence for the Whanganui District Inquiry (do B28), 11.
8 Many of these wider impacts are documented in Coombes, 2000; Waitangi Tribunal, n.d.; Spedding, 2006.
9 Zealandia separated from Gondwanaland in the late Cretaceous period: Mortimer et al., 2017.
10 'Upholding Te Mana o te Wai acknowledges and protects the mauri of the water. This requires that in using water you must also provide for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people)' (p.7).

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Betsan Martin

WATER LAW
a new statute for a new standard of mauri for fresh water

Abstract

A new statute for fresh water has been proposed by the New Zealand Māori Council to give legal stature to water as elemental to life. This would remove fresh water from governance through the RMA, where it is managed as one among many resources. A new law would also remove water from neo-liberal settings and the wider context of commercial interests that have pervaded the interpretation of the RMA. An independent Freshwater Commission would be the centrepiece of the regime, with iwi/Māori representatives included as commissioners. Mauri is proposed as the standard for water quality, and allocation and commercial use to be accommodated within this standard of ecosystem health. New water councils at catchment and rohe levels would engage hapū interests and have implementation responsibilities. This is a vision with pathways for facing challenging issues that have escaped resolution: Māori rights and interests, equity of allocation and wider public good interests.

Keywords new statute, fresh water, freshwater commission, hapū, Māori, mauri, precautionary principle, internalise costs and impacts, shared authority, te Tiriti o Waitangi, legal plurality

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The New Zealand Māori Council has presented a compelling case for a new law for water governance (New Zealand Māori Council, 2019). The proposed law strengthens Māori and public good interests in Aotearoa New Zealand's waterways, safeguarding the mauri (life force) and intrinsic values of fresh water, and provides for commercial use through shared authority for governance.

A separate freshwater law would recognise water as elemental to life, thus calling for a standard of mauri, to safeguard the health of people and nature. Rather than enhance, strengthen or reform the Resource Management Act 1991 (RMA), the intention is to escape from it.

The proposal introduces a national framework with regional implementation which incorporates Māori and hapū relationship with water and envisages an economy of water in which the environmental effects of commercial use and pollution are accounted for and internalised. A funding stream incentivises restoration and enables public education and capability for Māori to contribute to management.

The RMA has failed to safeguard water ecosystems, and their declining state is of wide public concern (Fish and Game New Zealand, 2019). The Essential Freshwater

programme currently being undertaken by the Ministry for the Environment aims to reverse past damage and achieve fair allocation (Ministry for the Environment and Māori Crown Relations Unit, 2018; Ministry for the Environment and Ministry for Primary Industries, 2018). However, the incremental changes to the RMA will not substantially alter the philosophy and practice of the existing regime.

The proposed law is of another order from that of the RMA. The precautionary principle, which is at the heart of the new law, is designed to take the governance of fresh water in a new direction, with specific purposes of protection, provisions for equity of access and resource distribution to correct the overriding of Māori interests. This is an order in which the intrinsic values and economic resource benefits are held through concepts of mana and mauri.

Mana, usually interpreted as authority and status (Durie et al., 2017, paras 23, 28), is realised through governance that is charged with responsibility for ensuring sustainable standards for quality and use. The mana of water can be understood in terms of the vesting of the Whanganui River as a person, Te Awa Tupua. Mana is invested with an ethical quality associated with relational values of well-being for the common good (O'Connell et al., 2017, p.16). Mauri is a multidimensional life force incorporating spiritual and physical dimensions: it is inherent in all life forms and arises from the characteristics and qualities of an entity, as well as its interconnection with other life forms (Durie, 2014). By extension, governance that accords mana to fresh water through protecting mauri requires that an account of the full costs of water use are built into the system of use, storage and protection so that all dimensions are incorporated into assessments and outcomes and that the interests of peoples and the waterways are held together.

This article considers how social, cultural and economic interests may be best served by a specific law for fresh water, and identifies areas of legal development needed to support such a law.

A new governance structure

This radical proposal for a new act of Parliament in regard to fresh water is designed to give overarching special status to water and replace the multiple and competing resource interests of the RMA. The water act would provide a distinctive orientation to governance, specifically to give effect to Māori interests, including with reference to Treaty settlements, to safeguard the mauri of water, and thus provide for future generations and strengthen the public good value of water.

A national waterways commission is the centrepiece of the water governance structure, with representation of iwi and the Crown providing shared authority through this body; it is suggested that representation should be 50% Māori and 50% Crown. The commission would provide national direction and grant allocations, with call-in powers for consent applications at catchment levels. It would administer funds for restoration and for Māori economic development to compensate hapū that are unable to access water resource allocations, and also have an education role (Land and Water Forum, 2018).

Regional and rohe catchment-based water councils[1] would implement national policy, with specialist guidance on local and contextual regulation on water, land use and protection. These councils would sit outside regional councils, which would be required to consult with water councils. The water councils would enter into agreements with hapū that have interests in water bodies. Establishing rights and interests could be complex, and would require a mana whenua consensual process as far as possible. Contestation over hapū interests in rohe or across rohe would be referred to a dispute resolution procedure, and ultimately may have to be settled in the Māori Land Court. A registry of Māori rights and interests in catchments would be prepared to support resolution of Māori rights and interests. The councils would have a role of information gathering on water quality, allocation and data for public use. Furthermore, an education role would enable these councils to contribute to community interest and knowledge, and thus bring a further dimension to their responsibilities for ensuring the mauri of water.

An overarching precautionary and guardianship approach is protective of the biophysical limits and regenerative capacity of the water ecosystem (New Zealand Māori Council, 2019). Principles guiding the legislation would include tikanga and mātauranga Māori (Māori knowledge/wisdom). A hierarchy of purposes gives priority to upholding the mauri of the waterways and, if that were adversely affected, the power to restrict use. The second priority would be to provide water for domestic and customary uses, including water for marae or papakāinga. Commercial use then follows on and is constrained by the priorities of mauri and human needs.

This hierarchical framework sets out the basis of a paradigm shift in water governance. The law is designed to express Crown governance and tino rangatiratanga (governing authority), as envisaged in te Tiriti o Waitangi. While Treaty settlements inspire unprecedented innovation in advancing Māori interests in water and resource management, these are specific to individual iwi and are derived from the need to redress grievances through restitution and compensation. Although they provide a new basis for iwi self-governance and enterprise, they only partially restore property and assets that originally spanned the land, waters and seas of Aotearoa.

> A separate freshwater law would recognise water as elemental to life, thus calling for a standard of mauri, to safeguard the health of people and nature.

The water law would be a bold first step in a shared governance framework in which two traditions of knowledge and law work side by side. Its mauri foundations would be a welcome advance and a radical shift from the pressures and compromises of commercial and agricultural priorities. In providing for customary rights, the law would move beyond the entitlement of rights to water towards guardianship of the resource, underlining decision-making responsibilities for the present and future well-being of waterways and their ecosystems.

Examples from elsewhere

Prioritising the mauri of water, or water quality, is not unprecedented. Such a hierarchy identified here has precedence in other jurisdictions. While the detail and the knowledge systems are specific to Aotearoa New Zealand, safeguards for water quality have precedents in Hawaii and South Africa.

In Hawaii water is governed through public trusteeship. The concept has been highlighted through the *Waiahole* case, brought by indigenous Hawaiians to return to waterways fresh water diverted for the sugar industry in order to restore, use and protect the water. In a landmark ruling in 2000, the Hawaii Supreme Court decided in their favour, citing the public trust doctrine contained in the state constitution and in Hawaiian traditions of spiritual association with water as a resource to be managed for future generations (Sproat, 2015; Sproat and Tuteur, 2019, p.196). The State Water Code reinforces the constitutional requirement that '[t]raditional and customary rights of ahupua-a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778 shall not be abridged or denied by this chapter' (Hawaii Revised Statutes §174C–101(c)). It sets out a similar hierarchy of purposes to the one proposed for Aotearoa New Zealand, with water quality as the first purpose, then meeting the needs of indigenous Hawaiians, and domestic use, with commercial use and allocation subject to meeting water quality standards, indigenous interests and domestic use. The long fight to achieve the implementation of these public trusteeship principles continues in an environment where interests in water are highly contested.

Water law in South Africa is of particular interest in its purposes. Although the post-apartheid context is specific to South Africa, the National Water Act 1998 states that its purpose is that the nation's water resources 'are protected, used, developed, conserved, managed and controlled' (s2). It reiterates that water is a national resource which has 'different forms' which are interdependent, and that water belongs to all people but has been subject to discriminatory laws or allocations. The act provides a framework of integrated management. To quote the preamble, the 'aim of water resource management is to achieve the sustainable use of water for the benefit of all users', and the government has the 'overall responsibility and authority' for 'equitable allocation of water for beneficial use' and 'redistribution of water', while enabling local implementation and decision-making.

The priorities for the health of water in Hawaii and South Africa, and the achievements in water quality and indigenous interests through water-specific legislation, correspond with the aspirations of the proposed water law in Aotearoa New Zealand: they provide reference for further research into considering a framework to meet similar aspirations here.

The genealogy of a new law

The case for a new water law has a long whakapapa. It is sourced in the evidence of Waitangi Tribunal hearings in respect of rivers.[2] The Whanganui report (Waitangi Tribunal, 1999) gives vibrant accounts of the centrality of the river to iwi living along the river's reaches. The river is the means of transport, livelihood, tradition and identity, and it defines systems of authority and access by Te Atihaunui a Paparangi and associated iwi. Most eloquently, the report elaborates the system of rangatiratanga as a highly integrated system for the use, protection, access and limits to use of land and rivers and their associated resources. This system has been undermined and broken through the regime of land alienations and Crown governance, which, most notably through legislation, has introduced a fragmented system to regulate different aspects of resource interests.

> The precautionary principle, which is at the heart of the new law, is designed to take the governance of fresh water in a new direction, with specific purposes of protection, provisions for equity of access and resource distribution to correct the overriding of Māori interests.

The *Whanganui River Report* documents a clear system of authority over the river; it also substantiates that authority as equivalent to ownership. The concept of Māori ownership of fresh water was introduced into the public arena during the first stage of the Waitangi Tribunal Fresh Water and Geothermal Resources Claim in 2012 (Waitangi Tribunal, 2012), yet the grounds for this view were laid over the series of river claims mentioned above. In its rebuttal of Māori interests, the Crown's position that 'no one owns water', the assumption of water as a commons, is based on a weakly founded precedent in English common law (Salmond, 2019, p.185 and note 15) which leaps over te Tiriti o Waitangi guarantees.

The mantra that 'no one owns water' disguises the property interests built into the system of consents and obscures the pressing issue of government protection of commercial access to freshwater resources.

Section 122(1) of the RMA seems consistent with the view of non-ownership – '[a] resource consent is neither real nor personal property' – although the following subsections qualify this statement ('vests … as if the consent were personal property', 'shall be treated as property'). It can be argued that property interests that arise from the benefit of the consent, whether for coastal space, irrigation or bottling, for example, lead to a logic of property and ownership (Barton, 2009). Richard Fowler QC argues that the RMA does create property rights in water, although not for land (personal communication, 18 February 2019). The issue of ownership is not at the centre of this discussion, but it is a discourse that is important to the context of tension and debate about the governance of fresh water in Aotearoa.

This radical proposal for a new act of Parliament in regard to fresh water is designed to give overarching special status to water and replace the multiple and competing resource interests of the RMA.

Why a new law?

An issue that emerges from preliminary research and discussions with key stakeholders is that our environmental and conservation legislation has been developed in a neo-liberal economic setting in which economic advantage is weighted against environmental values. Neo-liberal economics are inadequate for guardianship and integrated governance, in particular because the externalising of environmental and social factors discounts the costs of damage, cumulative impacts of resource use and destruction, and social inequities (Raworth, 2017).

Although they are not a focus of this article, property rights are a matter of ongoing importance. In some respects, they could be surmounted by introducing a framework that gives effect to rangatiratanga with appropriate authority, conditions for decision-making and safeguards with recognition of relationships with the waterway, guardianship responsibilities and resource interests of hapū.

Customary proprietary systems sit uneasily alongside liberal property rights and interests, which, in respect of water, are given effect through consents and through the pragmatics of access through land ownership, but don't have a pre-eminent sanction against harm. Legal academic Prue Taylor refers to the neo-liberal economic context of 'law that continues to facilitate and incentivise forms of economic activity that cause widespread ecological harm' (Taylor, 2011; Grinlinton and Taylor, 2011). Taylor identifies the principle of wealth creation in the context of an economic model of growth that externalises and does not measure impacts on ecological systems. For example, the environmental standards in the RMA have been seen by those with aggressive investment interests as an impediment to property development, and they have succeeded with revisions to the legislation to free up the process of consents to further their own interests. (These are in the process of being revoked through the Ministry for the Environment's Essential Freshwater programme (Parker, 2018, 2019).)

In policy documents, Land and Water Forum reports, Waitangi Tribunal claims, Iwi Leaders Forum documents and other literature there is an underlying binary between economic development and environmental values. This is not the intent of the proposed water act. The purpose of the RMA, as stated in section 5, 'is to promote the sustainable management of natural and physical resources', 'sustainable management' being defined as providing 'for their social, economic, and cultural well-being'. However, the comment of the Board of Inquiry into the Proposed National Policy Statement for Freshwater Management that the RMA's purpose of 'sustainable management' implies use of resources for economic gain (Board of Inquiry into the Proposed National Policy Statement for Freshwater Management, 2010, p.11) is supported by the declining state of water despite the safeguarding provisions of section 5.

As early as 1981, before the RMA was passed, and as recently as 2017, the OECD environmental review identified New Zealand's lack of national-level strategic planning. The weighting of decisions about water resources in favour of the economy while ignoring the long-term implications has been documented in several studies, most recently by Catherine Knight and Forest & Bird (Knight, 2018; Forest & Bird New Zealand, 2018). Knight's important historical analysis of environmental legislation identifies many issues that undermine the effectiveness of what appears to be, to all intents and purposes, legislation intended for integrative policy and sustainable development (Te Aho, 2018; Joy, 2015; Knight, 2018). Marie Brown's research showed the failures in the implementation of the RMA at the regional council level (Brown, 2016).[3] Linda Te Aho, Mike Joy and Catherine Knight have identified ways in which the RMA has been interpreted to enable economic development to proceed in the vacuum of clarity about environmental limits. There has been some attempt to rectify this with the National Policy Statement for Freshwater Management and provisions for the management of point source discharges (Te Aho, 2018), but in the wake of land use changes away from forestry towards intensified dairy, and the related investment in irrigation, added impacts of abstraction and diffuse discharges from run-off and leaching, and lags or delayed effects are evident with cumulative effects intensifying freshwater degradation (Knight, 2018, pp.123–4).

The RMA's direction to balance development with environmental protections offers equivocal and contestable guidance and has proved to be inadequate

in enforcing a coherent national regime and stopping degradation. Provisions in the RMA for the Treaty of Waitangi and public access are further sources of conflict. Part 2, section 8 directs 'all persons' to take account of the principles of the Treaty in 'managing the use, development, and protection of natural and physical resources'. In section 6 Māori interests are provided for as: '(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga' and '(g) the protection of protected customary rights'.

At the same time, section 6(d) provides for 'the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers'. There is no clarity about different cultural values, nor a Treaty framework to address such differences.

Within the RMA regime there have been incremental changes further recognising Māori interests, specifically of kaitiakitanga, the relationship of Māori to their ancestral lands and protection of customary rights. The inclusion of Te Mana o te Wai in 2014 in the National Policy Statement for Freshwater Management was a response to tangata whenua urging improved recognition of the health and well-being of fresh water (Te Aho, 2018; Ministry for the Environment, 2017). The Mana Whakahono a Rohe provisions were added to the RMA in 2017 to provide a system for regional council and iwi authorities to work together under the act (ss58L–58U),[4] including provisions for the involvement of tangata whenua in decision-making processes. This initiative came after a long history of Māori protesting against the decline of water quality and exclusion from regional council processes. This is clearly exposed in the evidence to hearings on the Wai 2358 Freshwater Claim, at which the Ministry for the Environment was questioned about increases in nitrates, decreases in invertebrates and the low engagement of Māori in various regions (De Malmanche, 2018).

Although these RMA measures show evolved engagement with Māori, they are add-ons to the mainstream Western model of resource management. None of them provides sufficiently for a system-wide structure for iwi authority and mātauranga. Safeguards and improved provisions for Māori/iwi engagement, including via water conservation orders, have been implemented in an ad hoc manner through amendments to the RMA in response to emerging crises.

Prioritising ecosystem health and value

The New Zealand Māori Council proposal sets out a design for internalising the costs of freshwater use through charges for commercial use and for pollution. It proposes calculating the charge based on a commercial resource holder's consent for an allocated volume of water. Outcomes from this policy include the likely surrender and relinquishment of unused allocation, with the provision of more room for Māori to be offered allocations. It would ensure the economically beneficial use of water (reducing water banking), provide for trading and remove uncertainty over commercial rights. A charge for the discharge of wastewater and pollutants is included in these proposals.[5]

> The proposal is for a te Tiriti-informed law utilising Māori knowledge to develop integrative approaches to the governance of fresh water.

Further bold and far-reaching approaches to economic value need to be reviewed for internalising environmental costs and impacts. Some possibilities are discussed in the 'Environmental and ecological outcomes' section of the *Future of Tax* report, which identifies negative externalities as a means to incorporate the value of ecosystem services into the costs of resource use: 'Environmental taxes can be a powerful tool for ensuring people and companies better understand and account for the impact of their actions on the ecosystems on which they depend.' The report notes that Aotearoa New Zealand is exceptional in not having such taxes. It recognises natural capital as a non-substitutable basis for the economy and identifies possible avenues for tax as methods to reduce pollution, achieve intertemporal fairness and incentivise a circular economy (Tax Working Group, 2019, pp.9, 35, 53).

Another approach is to attach ecosystem values to economic investment in fresh water (Emertin and Bos, 2004). Such an approach encompasses environmental, social, economic and spiritual values and could mean payment for non-exploitation. Those with permits to discharge or use water and with land use consents that impact negatively on waterways would be paid for diminishing their use to offset loss of income. Equally, Māori interests in allocation could be via direct access to resources for sustainable exploitation (with access made available through surpluses of existing consents), as well as via the ecosystem benefit of 'under-development' with an associated payment.

The International Union for the Conservation of Nature (IUCN) has investigated valuing water ecosystems in governance and law (Grieber and Schiele, 2011), and through responsible investment preventing degradation. Valuing ecosystems with associated land management includes the intrinsic value of healthy waterways, flood and sediment control, development opportunities such as diversified agriculture and tourism, and spiritual values. Responsible investment may have wider benefits. For example, conserving or planting an upstream forest may cost less than investing in a new water treatment plant or managing the expense from silting; maintaining wetlands is usually less expensive than repairing roads, bridges and buildings that get damaged by floods (Emertin and Bos, 2004, p.23). Working with private sector investors can secure the ecosystem value: the IUCN gives the example of a mineral water bottling business at risk from contaminated aquifers caused by nutrient

and pesticide run-offs from surrounding farms, where an ecosystem valuation determined that reforesting sensitive zones and financing farmers to convert to organic farming was more cost-effective than building treatment plants, resulting in reduced chemical use and sustainable land use management and maintaining high water quality standards (Smith et al., 2006).

Further development of valuation methods needs to retain critique of the commodification aspect of ecosystem services. The proposed new water law includes the framework for internalising resource use and costs.

Fresh water and climate change

Climate change is a cross-cutting issue par excellence, and pre-eminently in relation to water. Changing patterns of rainfall will affect domestic supply and agriculture, and the drive to zero carbon emissions puts further pressure on water as our primary source of renewable energy (Long, 2017). The Climate Change Response (Zero Carbon) Amendment Bill 2019 introduced in May signals whole-of-system accountabilities which are to take shape in policy. The bill anticipates a climate change commission to take forward carbon budgets and whole-of-government planning and accountabilities for net zero carbon by 2050. A preliminary suggestion would be for this commission to be linked with the water commission with provision for sharing research and consulting on matters relevant to both and linked to responsive and adaptive management for water and climate (Godden, Ison and Wallis, 2011; Godden, 2005).

Conclusion

The proposal is for a te Tiriti-informed law utilising Māori knowledge to develop integrative approaches to the governance of fresh water. The proposed law offers a new trajectory for public policy and the multiple dimensions of freshwater governance. Remedies that focus on one component, such as quality or allocation, bring a risk of failure to an ecosystem. A whole-of-system approach counters 'stationarity', or more static legal and governance structures, and offers an enabling environment for the responsibilities of guardianship and for commercial interests and access.

Māori rights and interests have been upheld by courts in principle but are yet to be given substance and shape in practice. The NZMC, through the Waitangi Tribunal, offers an architecture for law specific to fresh water, at the same time bringing the wider lens of a mauri standard beneficial to water bodies and human health, along with a more integrative economy of fresh water. The role of a commission will need to encompass systems specific to water governance as well as to other policy areas which interact with water. Regional implementation through local boards or water councils is designed to be contextually responsive with provisions for expert advice, public engagement and procedures for recognising Māori relationship with water. Such a statute can be seen as enabling Māori rights and interests in fresh water to be given effect.

It is worth noting that beyond the Tribunal process, frameworks informed by tikanga, manākitanga, waiora and ōhanga are being proposed to inform governance for well-being. Outstanding contributions are already on the table for the Living Standards Framework with the report *He Ara Waiora* (O'Connell et al., 2018), and in *Whakamana Tāngata*, the report of the Welfare Expert Advisory Group, which uses the notion of kia piki ake te mana tangata, or raising the dignity or mana of people (Welfare Expert Advisory Group, 2019).

A standard of mauri for the health and well-being of freshwater bodies requires intersectoral policy design and dialogue, cultural respect and capacities to recognise and account for complex systems with much more open, dynamic, adaptive approaches to law and governance. Water flows into every dimension of life. At the most vital level, it is the source of human and environmental health and well-being. A new water law brings the prospect of lifting water from the reform agenda of the RMA and according it premiere status with its own statute.

1 These are referred to as catchment boards in the original document, but should not be confused with the earlier system of catchment boards.
2 Rangitikei ki Rangipo Inquiry (Wai 2180), Whanganui River Inquiry (Wai 167), the National Fresh Water and Geothermal Resources Claim (Wai 2358), Kaituna River (Wai 4), and Motonui–Waitara River Claim (Wai 6), Manukau Claim (Wai 8), Mohaka River (Wai 119), Rangitaiki and Wheao Rivers (Wai 212).
3 Throughout the life of the RMA, court cases taken by the Environmental Defence Society, Forest & Bird and Fish and Game have created pressure on regional councils to deliver on the RMA: Joy, 2018, p.8.
4 The provisions were inserted into the RMA by the Resource Legislation Amendment Act 2017.
5 New Zealand Māori Council (2019) 'Closing submissions in reply to Waitangi Tribunal National Freshwater and Geothermal Resources Inquiry Wai 2358, #3.3.52', 22 February.

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Eric Crampton

Refreshing Water and Valuing the Priceless

New Zealand's freshwater allocation system has run its course

Abstract

The most promising way of reducing water use and nutrient load in overburdened catchments builds on the same kind of policy New Zealand is developing to reduce greenhouse gas emissions: cap-and-trade systems that operate at the water catchment level. Because cap-and-trade approaches are more cost-effective than other regulatory approaches, they allow us to do more good at less cost than other alternatives. Developments in smart-market technology and geospatial mapping allow for smart-market solutions that overcome barriers to success in existing trading arrangements. And, if initial rights allocations respect both the existing use rights of current users and incipient iwi water claims, they build a powerful constituency in favour of environmental management institutions that can withstand changes in government.

Keywords cap-and-trade, smart markets, environmental economics, just transition, Pigovean taxation, agricultural economics

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Everything is easy in the absence of scarcity. The first fishers did not need to worry about catch limits or who owned the fishing grounds; fish were in abundance, with many more left in the sea for each one caught. The first industrial coal users did not need to worry about global atmospheric carbon dioxide concentrations; the world could easily handle those small-scale emissions. And the first to pump water from the aquifers did not need to worry about water allocations; their pumping was but a drop in the bucket.

But that kind of abundance rarely lasts. As scarcity begins to bite, new institutional arrangements emerge to manage it. But the path is rarely easy.

In fisheries, communities develop traditional fishing grounds and manage access. When the management task extends beyond the near-shore waters more easily amenable to community self-governance, regulatory measures work to limit catches. And when the race to fish becomes yet more intense, tradeable quota systems create durable institutions with an interest in conservation.

For greenhouse gases, sector-specific regulations around power generation or automotive fuel economy eventually give

way to comprehensive carbon pricing through either a carbon tax or an emissions trading scheme, when public opinion finally catches up with the science. Having a price on greenhouse gas emissions can be remarkably cost-effective, encouraging those most able to reduce their own emissions to do so.

As scarcity bites in more places, we need better allocation solutions designed with sustainability in mind

In water, riparian rights are traditionally the first to emerge: 'reasonable use' standards require that your use have no particular effect on other users. But those solutions have a harder time working as scarcity comes to bite more strongly. In those cases, either other water users give way, or the environment does, and too often the cost has fallen on the latter.

Regulatory solutions emerge to manage conflicting uses, but those solutions come at a cost. It is far too easy for water allocations that were determined through the history of use to become locked in, with newcomers barred from further draws. And regulatory policy has a difficult time in weighing the merits of different potential water uses. If two users come to a council with a request to draw water from an aquifer nearing its capacity, and there is only enough water for one, difficult decisions need to be made.

These regulatory mechanisms for managing water allocation and for managing nutrient outflow become both increasingly important and increasingly cumbersome in catchments under very strong pressure. They have resulted in outcomes where many landowners, and particularly owners of Māori-held land, are locked out of land use changes, even if their uses of water would provide far more value than some existing uses.

Cap-and-trade solutions can let us do the most good for the environment

Far better management solutions are possible, bringing better environmental outcomes, effecting a just transition for those whose water uses have to change in response to increased scarcity, and allowing precious water to flow to its most highly valued uses in the process. Environmental quality is too often cast as being in conflict with economic growth. The system I propose can unlock economic value while doing more to protect the environment. And, in catchments where the environmental burden must drop by enough that there are real trade-offs against economic outcomes, the mechanism works to ensure that that improvement in environmental quality comes at the lowest possible cost.[1]

Improvements in economic market design and in hydrological sciences mean it is now possible to build smart-market systems to manage fresh water at a catchment level.

My argument comes in three parts. First, I explain why smart-market systems are uniquely positioned to manage freshwater and nutrient outflow in catchments sufficiently large for trading to be effective. I then argue that political constraints, rather than science or economics, are the largest barrier to getting there. Finally, I argue for a way of sharing the burden of getting towards more environmentally sustainable outcomes that, I hope, can make it easier for New Zealand to implement the changes necessary to protect our common future.

> … allowing there to be a price on water would encourage conservation in times of scarcity, and would ensure that those most able to reduce their own use would have the strongest incentive to do so.

Why cap-and-trade? Why prices rather than rules?

First up, a refresher lesson in Economics 101 and the merits of using prices in places where prices can work well. Prices and money were never really invented by anyone. Rather, they emerged spontaneously as the product of human interaction in response to scarcity. They have persisted over millennia because they are uniquely able to coordinate between humans' infinite wants and our finite means. When something becomes relatively more scarce, whether because of changes in demand or changes in supply, the price of that thing increases. The price increase, as described by economist Alex Tabarrok, provides a signal wrapped in an incentive. The signal tells everyone that the item has become relatively more scarce; the incentive encourages those who find it easiest to avoid using the more scarce thing to do so.

Imagine if we tried managing other scarce resources through regional council consenting processes. If aluminium became more scarce, new potential aluminium users would need to apply to council demonstrating that their use was consistent with the overall shortage in supply, potentially with the agreement of another user to reduce that user's draw on supply. It would not work well. Instead, an increase in the price of aluminium encourages those most able to switch to tin to do so, and allows those who derive the most value from aluminium to continue using it.

The point seems obvious, but is not nearly as intuitive as it should be – as has become somewhat obvious after too many conversations on the topic. Prices on carbon dioxide emissions through the emissions trading scheme encourage those most able to reduce their own greenhouse gas emissions to do so. While many motorists pay little heed to the current $0.07/litre ETS charge on petrol, a price on carbon that is comprehensive across sectors hardly requires each and every user in each and every sector to respond in the same way. Instead, the system reduces emissions in the places where emissions reductions are least costly.

Similarly, allowing there to be a price on water would encourage conservation in times of scarcity, and would ensure that those most able to reduce their own use would have the strongest incentive to do so.

Of course, it is more complicated than that. Prices on water would work within a regulatory structure; they are not a complete substitute for regulation. But they are a very good way of sorting out which water uses should continue in times of scarcity, and which should abate.

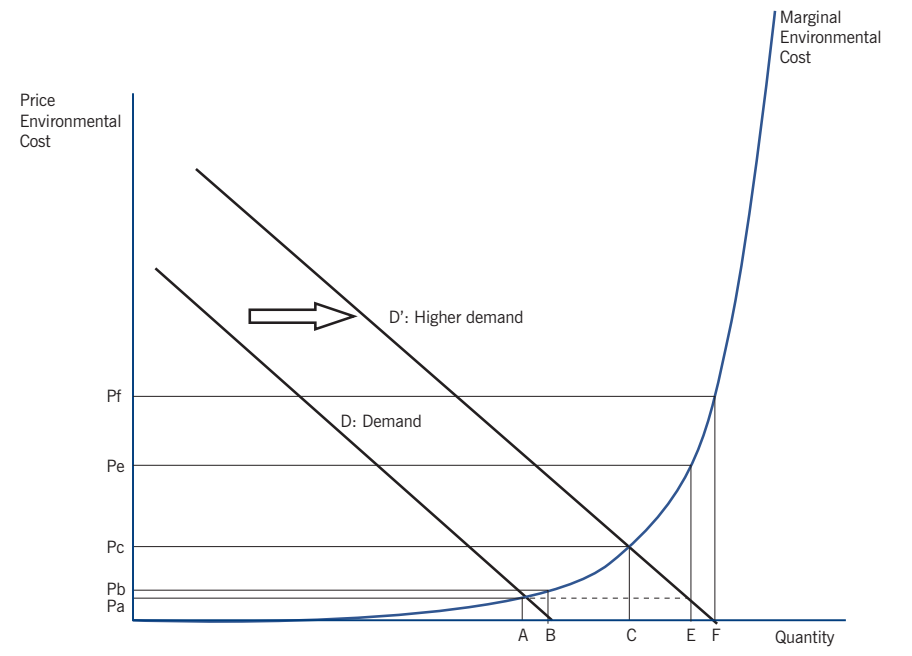
Trade beats water taxes when overuse is costly …

Shifting from Economics 101 to Environmental Economics 225, we find a strong general consensus that price mechanisms are the best way of dealing with environmental externalities like greenhouse gas emissions. Pricing environmental externalities is a very good way of encouraging everyone to consider the full costs of their activities.

But there are two different ways of putting a price on environmental costs. Government can impose a tax equivalent to the external cost of the activity, or it can set a binding limit, or cap, on the total amount of the externality produced. The former is generally considered a Pigovean tax: a tax intended to internalise external costs. The latter, when accompanied by tradeable permits for the activity within the cap, is a cap-and-trade system. In the perfect world of the economics blackboard, the two mechanisms can yield identical results: any price on an activity will result in an equilibrium amount of that activity, so choosing a price is a lot like choosing a quantity.

The two mechanisms differ when the world provides uncertainty about demand, and when the environmental costs of an activity are too sharply rising if we have got things wrong.

When thinking about greenhouse gas emissions, we have a pretty clear idea about the environmental cost of each tonne emitted, but we are less certain about firms' costs of mitigating emissions. In that case, simply setting a carbon tax makes the most sense. If we have got things wrong about people's costs of avoiding emissions, and the per-tonne cost of emissions is flat over the relevant ranges, then the costs of having got things wrong is not too high. Or, at least, the costs of getting things wrong are lower if we pick the wrong carbon tax than if we pick the wrong cap on total emissions.



When the environmental costs of an activity are unpriced, demand for the externality-generating activity will be high. Suppose that, in an early period, demand for the activity follows the schedule D. It is downward sloping: if there were a price on the activity, people would undertake less of it. The downward-sloping nature of the curve reflects that some agents will have higher costs than others for reducing their own externality-generating activity, and that different activities provide different amounts of value to the acting agent. If the price levied on the activity were high, agents would find it effective to use measures to reduce that activity until the point that the costs of those measures exceeded the pollution charge.

In the initial state, D, agents would undertake quantity B of the activity because there is no cost faced by the actor for undertaking the activity. Environmental costs associated with the activity would be Pb. The socially optimal quantity of the activity, A, and associated environmental cost, Pa, is lower than B and Pb. But the distance between Pa and Pb is relatively small.

When demand for the activity increases from D to D', perhaps because of a change in demand for the goods provided through the activity in question, associated environmental costs can begin to increase sharply. The socially optimal amount of the activity, C, is only somewhat lower than the amount F that obtains in the absence of a price on the externality. But the environmental cost Pf is far in excess of Pc.

We can now compare a cap-and-trade system to a pollution or water extraction charge. At demand level D', an environmental charge of Pc per unit of the activity would result in the socially optimal amount, C. Similarly, setting a cap under a tradeable quota system of C would result in no more than C, and would result in a per-unit value of the tradeable permit of Pc. The price and quantity are simultaneously determined. If we have a lot more certainty about the curvature of the blue curve demonstrating the marginal environmental costs of the activity than we do about the location of the demand curve, setting a quantity cap can be far better than setting a pollution charge. Suppose a council estimated that the catchment could withstand no more than C amount of the activity, and estimated that underlying demand for the activity followed the initial demand curve D. If it set a pollution charge of Pa, it would achieve the optimal amount of the activity – unless demand were actually D'. If demand were actually D', quantity E of the activity would be undertaken at the far higher environmental cost of Pe. Using a tax can be very risky where environmental costs can be sharply increasing in the amount of the activity and when demand is uncertain.

If the council had instead set a catchment-level cap of C when underlying demand for the activity were D', the cap would be optimal. If actual demand were higher than D', the trading price for permits would increase, but no more of the activity could be undertaken. If actual demand for the activity followed D rather than D', the cap would not bind – there would be no price on the activity, but the excess environmental cost is relatively small.

While it is possible to construct a tax that mimics the effect of any cap on a quantity of output, or a cap that mimics the effect of a tax, caps are preferable when the environmental costs of overshooting an expected quantity of output are very high.

That, at least, is the upshot of seminal work by Martin Weitzman in 1974 comparing the cases for controlling environmental externalities by targeting prices versus targeting quantities. Ideally, climate change would be handled through carbon taxes and mitigation subsidies rather than a cap-and-trade system.

But water is not like carbon dioxide. If we picked a wrong price on greenhouse gas emissions and wound up with emissions a bit higher or lower than had been expected, and the cost curve relating annual emissions to global climate change is fairly linear in any year's emissions, things are still pretty close to correct. The costs of abstracting too much water from an aquifer or river start rising sharply, and quickly, for water takes above the environmentally sustainable level. If the government or regional council set a price for water in a catchment that it expected would yield a demand for water consistent with an environmentally sustainable take, and if it got that price wrong, rivers could run dry in the absence of further intervention.

In those kinds of cases, uncertainty about demand and reasonable certainty that costs escalate sharply with overuse mean that quantity limits make more sense.

… and that is especially true when relevant effects are local

Weitzman's prices versus quantities result depends on the relative costs of getting things wrong under either mechanism, which depends on underlying uncertainty. When considering New Zealand's emissions in the global context, it is absolutely important that New Zealand does its part. But if forecasting failures mean that New Zealand set a carbon tax at a level a dollar per tonne lower than the socially optimal carbon tax, the social cost of that failure is rather predictable. It is the extra cost of the additional tonnes consequently emitted, less the amount collected in tax for those units: a dollar per tonne for each excess tonne.

The social cost curve does not bend appreciably if New Zealand overshoots or undershoots its targets because New Zealand is a small part of a very large and global problem. That makes it very unlikely that per-unit external costs can rise substantially with small changes in New Zealand's quantity of emissions.

Where greenhouse gases have global effects, freshwater abstraction and pollution have effects far more sharply confined to a local water catchment. Almost by definition, a water catchment under substantial demand pressure is one in which the cost of drawing an additional megalitre of water from the aquifer is much higher than the cost of drawing the first megalitre, and in which the cost of the next tonne of effluent is far higher than the cost of the first tonne. It consequently becomes far more likely that errors in setting a water or nutrient tax push a catchment into parts of the cost curve where the social cost far exceeds the tax charged on the last units. Getting things wrong in setting prices is then far more likely to have adverse consequences.

Nothing described thus far is particularly controversial among environmental economists. And many reports, from the Land and Water Forum and others, have pointed to the benefits of cap-and-trade systems.

While cap-and-trade may be excellent in theory, transaction costs in trading can be very important. Lake Taupō's nutrient management regime has seen disappointingly little trading. Similarly, transaction costs limit the potential of Canterbury's Hydro Trader system, which allows trading of irrigation consents. Buyers and sellers have to find each other – and that can be complicated where buyers and sellers may vary in the time periods over which they wish to buy and sell water or nutrient allocations.

In both cases, would-be traders need to undertake substantial and costly evaluation work demonstrating that a shift in the location of an activity does not increase the amount of burden placed on the catchment. It is far more like placing an advert in the classifieds for something that is very complicated to ship to different places than like trading shares on the NZX.

Smart markets can make trading easier while building in environmental bottom lines …

Developments in smart-market technology and progress in mapping New Zealand's hydrology, topography and geology can allow revolutionary change in our ways of managing water take and nutrients.

Accurate mapping can allow better modelling of the effects of changes in the intensity of land use on the environment. Land differs in sensitivity. Cows wintered on hillsides near rivers have very different effects on the environment than the same cows on a flat paddock with well-draining soils. Those effects will also vary with the depth of the local aquifers and subsoil geology. Those complexities are an important reason that Taupō's nutrient management system requires council evaluation and sign-off on trades in nutrient emission rights: nitrate emissions implicit in a proposed trade may be comparable, but the environmental effects will depend on where those emissions obtain.

Similarly, the effects of drawing water from an aquifer can depend on the location of the bore. A megalitre drawn near the sea will differ in effect from a megalitre of water drawn far upstream.

John Raffensperger and Mark Milke, an operations research scholar formerly of the University of Canterbury's management science department and now with the

Developments in smart-market technology and progress in mapping New Zealand's hydrology, topography and geology can allow revolutionary change in our ways of managing water take and nutrients.

RAND Corporation, and a hydrological engineer at Canterbury, developed a smart-market system for trading rights in water abstraction while respecting those environmental bottom lines (Raffensperger and Milke, 2017). The system works as follows. First, the underlying environmental constraints are set. One potential environmental constraint would be that no more water can be drawn from an aquifer over the medium term than flows into that aquifer. Another is that minimum river flows cannot fall below a set threshold during normal hydrological years. And, aquifer pressure at sea level must remain high enough to prevent saltwater incursion into the aquifer.

Water users at different node points – spots on the map corresponding to bores or locations of draws from the river – use a computerised trading interface to tell the system how much water they would like to purchase or to sell from their existing allocation at different prices. If the price of water is very high, a water user may wish to sell water back into the system for others to use. If the price is low, that same user may wish instead to buy.

The system collects all of the bids and asks before running a linear optimisation to find the set of trades that delivers the most overall value while making sure that the environmental constraints built into the system are respected. Users are then presented with the likely trading price and their consequent position as either buyer or seller. Users confirm their willingness to trade at those prices and trades are effected. The system can run as frequently as suits user demand, and there is no reason that futures markets in water allocations could not be established through the same system.

Because all trading is based on users' locations and the underlying hydrology is mapped and accounted for in the system, the price of water at different nodes can vary to reflect that it is more costly to draw water in some places than in others. This modelling then replaces the regional council's role in checking that trades have comparable environmental effects.

Nutrient management is more complex. While nitrogen has drawn greatest focus, phosphorus, sediment, E. coli and other pollutants will matter as well. And while drawing water from the aquifer can have different effects at different nodes, geological complexity can introduce substantial variation in the period over which nitrogen might reach a lake or aquifer from different properties.

> … a trading regime allows value-enhancing changes in land use while respecting and strengthening environmental bottom lines …

But there, too, the science has progressed. A team led by Clint Rissmann at Land and Water Science in Invercargill has combined fine-grained geospatial maps of elevation, soil type, underlying geology, hydrology, land cover and land use with data from thousands of water sample results to model the effects of land use intensity on environmental outcomes (Rissmann et al., 2019).

This work can be extended to form the basis for nutrient management through smart markets. Each targeted pollutant can be capped within the catchment, with each cap providing a constraint within the linear programme.

A well-developed trading system would not require users to separately purchase allocations against each cap. Instead, a trading interface[2] would capture details of on-farm practice. The system would tell users whether those uses would require purchase of a greater overall quantity of emission permits than the user holds or whether the user could sell units back into the system. It could also provide suggestions for alterations of practice that could allow the user to either reduce the number of permits they might need to purchase or to sell more units into the system. For example, shifting grazing areas to exclude areas subject to erosion would require the purchase of fewer rights within the sediment cap.

With accurate modelling underlying the trading system, the council's role would shift from evaluating trades to ensure the comparability of effects, to auditing on-farm practice to ensure that practice corresponded to the details provided into the system.

… and so we face less of a trade-off between economic considerations and environmental priorities. We can have both!

Managing water abstraction and pollutants through smart-market systems can make trading far easier. Trading is important because it allows those who can most easily change their practice to reduce the environmental burden on a catchment to be the ones to do so. Changes in practice are rarely costless, and costs can vary substantially across users.

Integrated catchment-level systems incorporating all substantial water uses, whether agricultural, industrial, commercial or residential,[3] help ensure that change happens in the places where the costs of change are lowest. In some places, the price on water through the trading system may encourage marginal dairy farms to consider selling their irrigation rights back into the system for others to use if their irrigation infrastructure were already reaching the end of its life, and to shift into lower-intensity pastoral agriculture instead. In other places, a council may be encouraged to upgrade leaking trunk water infrastructure, or leaking wastewater infrastructure, to reduce the costs it faced in the trading system or to allow it to sell valuable rights back into the system.

And decoupling water rights from the underlying land can open up still further opportunities. In catchments at their environmental limits and where no further water drawing consents are issued, historic water allocations lock in existing land uses. Even if a new horticultural operation near town could derive far greater value per litre of water used than a farm on marginal land further afield, it is currently simply too difficult for the

current water user and the potential water user to effect that exchange.

Because a trading regime allows value-enhancing changes in land use while respecting and strengthening environmental bottom lines, it ensures that there is less of an economic cost to achieving those environmental objectives.

But we have to allocate to get there. Economic theory since the 1960s says it's the tradeability of rights that matters rather than who has the rights ...

Tradeable rights systems require not only the definition of the tradeable unit; they also require taking a position on who is provided with those initial rights. Should rights revert to the Crown or council, with regular sales at auction through the trading system? Or should they rest with existing users?

The political economy of the initial allocation problem is non-trivial – and we will come to that part. Fortunately, the economics of the matter is far simpler. In short, so long as the trading system works well and trading is easy, the initial allocation of rights makes no difference to the final allocation of rights (Coase, 1960). If one potential user of water derives more value from that use than do other potential users, that user will either outbid others for the water, or will decline to sell water rights at a price anyone else is willing to pay.

Now, the world is more complicated than the blackboard, and it is commonplace to expect that change in farming practice can sometimes be generational rather than speedy. But, again, reasonable outcomes do not require that everyone respond quickly to the incentives provided by price signals. We do not condemn housing markets because some people would be reluctant to sell the house that they were born in at just about any price. Those who are most able to change are the ones incentivised to do so. And, under a cap-and-trade system with binding caps on overall use, every bit of use is paid for either explicitly through purchase or implicitly by using rather than selling an allocated use right.

We should not expect large differences in changes in land use under cap-and-trade that depend on the initial rights allocation. If a litre of water really is more valuable if used by a horticulturalist near town than by a marginal irrigated farm farther away, the horticulturalist would outbid the irrigator for it if the Crown auctioned off initial rights, would purchase it from the irrigator if the irrigator held the initial right, or would fail to sell it to the irrigator if allocated it in the first place.

Once we recognise that the final uses of water among users will not vary considerably with the initial allocation, we can instead focus attention on the real issues in initial allocation.

Any initial rights allocation that simply ceased renewing current consents or that expired existing consents to draw water would wipe substantial amounts of value ...

... but political economy matters too. Current users have a stake

If we want the improved environmental outcomes that can obtain through better water management systems, then initial allocation decisions should be based on the political constraints that might prevent us from otherwise achieving those environmental goals.

For decades, many activities have been undertaken by right. While irrigation and water draws are now managed through resource consenting processes, having a cow in a paddock has not traditionally been something requiring specific consent. Irrigation consents are of limited duration, but are typically renewed rather than expiring. And those expectations form part of the current prices of agricultural land.

Work by Arthur Grimes and Andrew Aitken a decade ago showed that irrigated land could sell for up to 50% more than non-irrigated land; the value of water has not decreased since then (Grimes and Aitken, 2008).

Any initial rights allocation that simply ceased renewing current consents or that expired existing consents to draw water would wipe substantial amounts of value, immediately, from the fair price of that land. Farms would quickly go bankrupt, unable both to make the mortgage payments on what was supposed to have been a land purchase that included water rights, and to buy those water rights separately. This raises two obvious and related problems.

If a farm has made substantial investments in land and irrigation infrastructure based on a policy environment in which irrigation consents are renewable in near-perpetuity, and in which farms abiding by good environmental practice faced no charges for nitrogen emissions, that investment could easily be wiped out if water and effluent rights suddenly needed to be purchased every year. It may be considered morally unjust to bankrupt through a policy decision farms which have played fairly by the rules as they found them and complied with every environmental regulation they have faced.

Second, and relatedly, even if you view an irrigation consent as an administrative permission that can be withdrawn at will by the Crown or council, and are inclined to view this kind of policy change as a risk that should have been considered by the farm in the first place, not everyone feels that way. It would not take many television news specials on bankrupted farm families for the system to fall over, whether immediately or with a change in government.

And the prospect of those effects can stymie change in the first place. Anyone wishing to build environmental institutions that can deliver good outcomes across several changes in government should have an eye on the political conditions allowing those institutions to be durable. Initial rights allocations are critically important in building those institutions.

Recognising current uses can help enable a just transition

Ultimately, changes in land use should be invariant to initial rights allocations. In some places that could involve substantial changes in land use. If some farms are viable only because water effectively has no price, we should expect land use change if water comes at either an explicit or an implicit cost.

If current users' rights are recognised through an appropriate allocation of initial rights, then anyone shifting to less environmentally burdensome land uses is immediately compensated for that change in land use. Their change will have been consequent to a sale of valuable rights into the trading system that can help enable a transition to other land uses.

If there exist legitimate iwi claims to water in particular catchments that were not extinguished by the Treaty, contract or sale, then there is a strong moral case for resolving those claims.

We have the opportunity, in considering building a better water management system for a cleaner environment, to work a just transition into the calculus at the outset through the allocation of initial rights.

But current users' rights are not the only ones at play.

We also have to recognise iwi rights

The case for cap-and-trade in freshwater management is hardly novel. Researchers have argued for cap-and-trade solutions for decades, as detailed in my recent report (Crampton, 2019). In water abstraction, the case has been clear for a rather long time. In nutrient management, it is only more recently that geophysical mapping has developed sufficiently to allow the kinds of smart markets that can work most effectively.

Fear of triggering Treaty claims has stymied progress …

But the main barrier has not been in economic or scientific modelling. Rather, it is the following. Cap-and-trade systems require an allocation of rights, whether they are framed as tradeable property rights or tradeable administrative permissions that look a lot like property rights but are not officially considered property rights. The position of the government has been that water is unowned or, if not, is owned by the Crown. Any variation from that position has been seen as risking claims under Waitangi Tribunal processes.

The more that a tradeable permission looks like a property right, the more likely it has been seen as being legally risky. And so fear of opening difficult and potentially costly cans of worms has prevented moves towards better freshwater management. Getting catchments to operate within sustainability limits requires moves towards allocation-based systems, but allocation means litigation.

… but the costs of failing to address those claims head-on are mounting

If there exist legitimate iwi claims to water in particular catchments that were not extinguished by the Treaty, contract or sale, then there is a strong moral case for resolving those claims. But even holding the moral case to one side, the case for now resolving iwi claims, ideally through negotiation, is becoming pressing.

When scarcity and environmental limits did not bite, perhaps it was defensible to pretend that water was unowned and, in so pretending, avoid Treaty issues. However, the costs of continuing to attempt to manage water resources through suboptimal regulatory vehicles is rising.

As catchments come under increasing pressure, first-in allocation systems come at far greater economic cost as potentially higher-valued water uses are blocked by limits on further consenting. Often, that cost falls on the owners of Māori-held land who have been late to consider dairy conversions and have consequently been locked out of water allocations.

And attempting to manage environmental harms of existing uses through best-practice regulations that do not adequately recognise the heterogeneity of conditions across catchments means greater environmental cost, greater regulatory compliance cost, or, more likely, both. Cost-effectiveness in regulatory regimes simply matters more when the regulatory constraints become more binding. We can no longer afford to maintain second- or third-best management systems.

A framework solution: sharing the burden

The allocation issue is difficult enough in catchments that are not beyond their environmental limits. Once we consider that overall catchment level burdens must reduce in some places, and that iwi rights may also need to be attended to, the issue becomes more difficult. Awarding rights to existing users based on their historic consents and use rights, and additional rights to iwi, would mean that even catchments that are not currently beyond their limits would quickly be over-allocated relative to any environmentally sustainable cap.

We suggest a framework for a way forward.

We all benefit from more sustainable outcomes, so we should share the burden

The burden of reducing overall use rights in over-allocated catchments, or in catchments that would be over-allocated if all iwi-awarded rights were put into use, cannot fall on existing users alone. Doing so would bankrupt many and effectively block the implementation of a far better management system. Sharing the burden is appropriate.

That means existing water users will have to do their part, but so will the public as a whole

Consider a catchment where current use is in excess of environmentally sustainable limits: the catchment can sustain only 80% of its current burden. And suppose that, for the moment, there are no iwi water claims.

An allocation solution that places the entire burden on existing users would allocate to all users rights consistent with 80% of their existing consents (for water abstraction) and 80% of their existing pollutant burden (for nutrients). Users unable to easily change their own practice would need to purchase rights through the system to make up the difference; users more easily able to change their own practice would sell rights through the system. And users would experience a loss in the value of their properties equivalent to the loss of a fifth of their existing use rights, less any increase in the value of those use rights provided through the ability to trade in water and nutrient rights.

An allocation system that places the entire burden on the Crown would allocate rights to all users consistent with 100% of their existing use. The Crown would then buy back and retire rights within the system until the cap was achieved. Users most easily able to change their own practice would sell their rights to the Crown. There would be no reduction in the value of existing properties and would instead be the potential for an increase in value: decoupling water and nutrient rights from the underlying land can increase the value of the bundle of rights.

A sharing of the burden would involve an under-allocation of rights to current users relative to their established rights, or a time limitation on awarded rights, or both, coupled with Crown buy-back of rights through the system to get the rest of the way to environmentally sustainable limits.[4]

The proportion of the burden that should fall on current users relative to the Crown is simultaneously a question of politics and of values; economists are not well placed to adjudicate across those. If all of the burden falls on existing users, the system may not withstand a change in government if the required reduction in the environmental burden is substantial. If all of the burden falls on the Crown, costs to the Crown could prove substantial – and especially if substantial additional rights should be awarded to iwi in some catchments.

My report suggests a combination of time-limited rights for existing water users, an awarding of rights to iwi that builds over time, and Crown buy-back of rights.

Doing it well builds a system that can endure, and that can maintain a sustainable environment over the long term

New Zealand needs a freshwater management system that can withstand changes of government, has the buy-in of existing users, and makes environmental sustainability be in the interest of those in the sector.

Cap-and-trade systems can help ensure that any desired improvement in environmental quality comes at the smallest possible economic cost. But they also build a constituency for the preservation of good environmental outcomes and better environmental practice. Improvements in one's own environmental practice become profitable when a user is allowed to sell valuable rights back into the system. Systems can be more strongly self-policing if a neighbour's cheating of the system means the value of your own rights is eroded.

Putting town, industry, commerce and agriculture on the same footing by requiring town and country alike to be accountable for the environmental burden they impose, through the same system, reduces the current adversity between town and country. Farmers should face the same cost for the breach of an effluent pond as a town council would face for an equivalent discharge from a broken sewage system.

And requiring water bottlers to purchase water rights through the trading system would help in mitigating currently contentious decisions around consenting for that water use.

We suggest that central government should consider developing the kind of cap-and-trade smart market here described for trial use in Canterbury. The burden of reducing use to sustainable limits should be shared between water users and the broader community through a combination of Crown purchases and retirement of allocations, and by a structure of initial allocations that reduce current users' rights over time. A smart market in water abstraction, following the model established by Raffensperger and Milke, would require defining minimum river flows. Why not recognise that minimum river flow as the self-owning river, following the precedent in Whanganui, and recognise iwi trusteeship rights over the river as part of Crown–iwi negotiations?

Water management in New Zealand has to change. The environmental and economic costs of continuing with blunt regulatory approaches will continue to rise. Dealing with the issue will likely require the Crown to confront potential iwi claims over water. But the costs of failing to do so will only rise. We can and must do better for our environment, for our communities that rely on water use, for any legitimate iwi water claims that have been ignored by current practice, and for our future.

1 These issues are discussed in greater depth in Crampton, 2019.
2 The Overseer farm management system is currently being upgraded and could form the basis for this interface.
3 We do not expect that small residential bores would need to be covered by the trading system. Rather, council drawing consents for residential water supply would be encompassed.
4 This mechanism is developed in more detail in Crampton, 2019.

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Chris Perry

Learning from Water Footprints who loses, who wins, and who cares?

Abstract

The 'footprint' concept is widely used as an indicator to assess CO_2 emissions and the water embodied in crop production. A comparison of key features reveals that CO_2 footprints are a global concern no matter their location or source; water footprints only have local relevance, being locally generated and impacting only at local levels. As such, addressing excessive water use is a local concern. Where excessive use is not managed, a process of 'chaotic disallocation' from irrigated agriculture ensues, resulting in reduced local production and, through market mechanisms, increased demand elsewhere. Those areas where water scarcity is managed sustainably will see more profitable opportunities for irrigated production, though the impact on prices will be of little concern to consumers in the developed world.

Keywords footprints, sustainable water resources management, chaotic disallocation

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In 1993, Tony Allan introduced the phrase 'virtual water' (Allan, 1993), setting out the concept that all goods – but, most importantly, agricultural products – utilise water in their production. Thus, trade in agricultural commodities can also be viewed as a trade in the water embodied in the production process – 'saving' the importing country from allocating its own water resources. This concept of virtual water provided the underpinning for the development of water footprints (Hoekstra et al., 2011).

Water for agriculture dominates demand in most water-scarce regions (Richter et al., 2017), so that the primary focus of attention has been on crops and trade in agricultural commodities. Crop water footprints – the water that a crop transpires through its foliage as part of the process of biomass formation – have gained acceptance as a revealing indicator of the pressure on a resource that is overexploited in many countries. Many see a parallel between carbon footprints and water footprints (Ercin and Hoekstra, 2012).

At first glance, the parallel with carbon footprints seems obvious: reducing our carbon footprint reduces the damaging

impact of CO_2 on the world's climate. Good! Similarly, reducing our water footprint alleviates pressure on a scarce and critical resource. Good? Not necessarily.

Water is more complicated than carbon in several respects. CO_2 emissions are an unambiguous and universal metric: one gram of emissions from a car driven in Canberra equates to one gram of emissions from a power station in Cape Town. In contrast, the water footprint of a crop is typically composed of one or more of several diverse components: non-renewable water pumped from a fossil aquifer; water diverted from a river; water 'harvested' from local run-off; and/or water that landed directly on a field as rainfall. And the water that landed as rainfall would, in the absence of a crop, have been utilised just as fully by natural vegetation, so that the 'footprint' of the crop when compared to the natural alternative may be zero.

In sum, where water comes from is complicated; how we use it is complicated; and where it goes after use is complicated. These complexities have profound implications for the relevance of water footprints to water policy at local, regional and global levels, which are explored in more detail below. Using the attributes of carbon footprints provides important insights into what the future holds for areas where water is currently overexploited.

Carbon footprints are global; water footprints are local

Perhaps the most important difference between carbon footprints and water footprints is that water is a *local* resource whose use has local impacts. Scarcity or excess, seasonal supply and demand, the customs and institutions governing allocation are all local variables and the range of possible combinations of these is almost infinite. No doubt the domain that constitutes 'local' may range from two neighbours sharing a well to several countries sharing a basin, but the 'water' domain is never global, and in that sense is always local. In contrast, CO_2 emissions are CO_2 emissions no matter what the source, where they occur, or when; they are always global and never local.

The fact that water footprints are local has important implications: 'my' local water use for washing, cooking or watering my garden does not affect a water user anywhere outside my 'locality'. More generally, if I give up sugar in my coffee, the resulting fall in global demand for sugar will result in reduced production, somewhere. It may result in reduced production in Maharashtra, where sugar cane production depends heavily on unsustainable groundwater use. If so, pressure on the local groundwater resources will be reduced, which is a good outcome for the local water economy. Alternatively, if the reduction in production occurs in the West Indies, where sugar cane production is based on rainfall that will wet the ground and vegetation, there will be no benefits to the local water economy: the rain will continue to fall, and vegetation of some type will capture and transpire a proportion of that rainfall. There is no guarantee that the reduced global demand for sugar will result in an economically or environmentally rational response. The local and the global are not logically connected (Perry, 2014).

> Mismanagement of water … is leading … to chaotic disallocation of water from agriculture.

This is not to say that widespread failure of water systems (aquifers too saline or too deep for exploitation; rivers seasonally dry causing environmental collapse, etc.) will not have implications for global food production; there is clearly a link, but disaggregating the local impacts of water management from global concerns about food security and the ecosystem reveals the heterogeneity of the likely losers (and winners) from problems in the water sector.

Water (mis)management is case by case

If a country, like New Zealand, mismanages its water, the sectors that currently depend on that water will eventually and inevitably suffer 'disallocation' of water – first from the environment, which is what we already commonly observe, and then, typically, from irrigated agriculture. Human interference in the water cycle, especially to support irrigation, has as its objective the increased local consumption of water by crops. This artificially induced increase in consumption, supported by abstraction from an aquifer, or diversion from a river, affects the balance between inflows and outflows, and will have consequences. Mother nature will combine forces with the law of conservation of mass to ensure that this happens: wells will go dry, or saline, or too deep for economic exploitation; downstream abstractors from rivers will increasingly frequently find the river is dry or too saline for use. This process is already widely evident (Falkenmark, Lundqvist and Widstrand, 1989; Leblanc et al., 2011; MacDonald et al., 2016; Perry, Steduto and Karajeh, 2017).

As long as water demand is constrained to be well within the average renewable supply, with acceptable environmental outcomes, the water economy (and irrigated agriculture) can to some extent absorb shocks. On the supply side, aquifers can be over-drafted in times of drought and allowed to replenish in times of above-average precipitation; surface water reservoirs can be operated to carry over storage to mitigate low-flow years (for example, Aswan can retain about twice the average inflow to Egypt from the Nile). Equally importantly, on the demand side, if farmers plant a significant proportion of annual crops (grains, cotton, forage, etc.), they can reduce the area planted when advised that water is scarce, or even abandon a crop in mid-season at relatively minor cost. Once perennials are established (vines, orchards, nuts), this flexibility is severely constrained because farmers will protect their long-term investment using whatever water source they can access – usually unsustainable groundwater (Dinar, 1994). Similarly, irrigating forage for a dairy enterprise supports a demand that cannot be abandoned temporarily during

a drought. Demand is thus less flexible, while the supply is at or beyond the margin of sustainability so that the capacity to absorb variations in precipitation is limited.

What we have observed over recent years is that water resources are being widely exploited beyond the renewable margin (Panda, Mishra and Kumar, 2012; Famiglietti, 2014; Leblanc et al., 2011; OECD, 2015; MacDonald et al., 2016). The observed depletion of aquifers and damage to river ecosystems – and farmers are tending to move to higher value, perennial crops that they are unwilling to abandon in times of drought – is almost universal. The consequence, inevitably, is shocks to the system – isolated, short-term and usually local shocks rather than the progressive global catastrophe envisioned in some global warming scenarios, which again highlights the difference between CO_2 emissions and water footprints.

In the water sector, this local process is likely to be – indeed often is – chaotic. The sequence in which wells become unusable is determined in part by the resources of individual farmers – how deep is his well? What are the neighbours doing? – and in part by the specific hydrogeology of the location – one farmer sits over an area of fresh groundwater; the next has to tap a deeper aquifer. A similar process will unfold with surface water: upstream abstraction and consumption will render downstream areas dry or supplied sporadically, perhaps only with increasingly saline water. These processes will not be orderly, prioritised or predictable.

Add to this the short-term variations in the weather: Australia in 2018 was experiencing a severe drought; simultaneously, California was experiencing excessive precipitation. The previous year was essentially the reverse. Who will not have water next year? We really do not know.

And the process is already ongoing. In some regions, farmers, their families and the local economy are suffering badly. Migration from agriculture to cities has many drivers, but unstable and decreasing availability of water is certainly one of them. The 'environment' in many areas is already suffering, very badly. And the pursuit of individual and entirely rational self-interest when the resource is open-access ensures that the 'tragedy of the commons' (Hardin, 1968) is a powerful explanatory paradigm.

> Those most affected by chaotic disallocation … are also those least able to afford the associated increases in food costs.

While this long-term imbalance between how much water there is and how much we would like to have is unavoidable, the process of chaotic disallocation as the law of conservation of mass plays out is primarily a *local* issue, depending on how close to the renewable margin the water system is operating, and how flexible the response to scarcity is. Does the system have the capacity to absorb short-term fluctuations in supply, complemented by some flexibility in demand? Increasingly, neither is the case.

Water management is also case by case

Mismanagement of water will lead – is leading – to chaotic disallocation of water from agriculture. An alternative process of *managed* disallocation driven by local policies, regulations and institutions is possible, however. Whether countries opt to adopt such approaches is within their own power. When implemented effectively, disallocation will be policy driven, transparent, prioritised and scheduled over time, thus minimising costs, allowing progressive adjustments, and providing compensation where appropriate.

If (for example) water consumption in specific irrigated areas must fall by 20% in order to re-establish the local average balance between renewable supply and demand, we can anticipate that agricultural production will fall. Chaotic disallocation will probably maximise the impact on production for several reasons: first, a given level of *uncertain* supply will be less productively used than the same average level of *assured* supply because the farmer will invest more in inputs to maximise the productivity of assured water. Second, disallocation will randomly remove water from all farmers, including the most productive. Managed disallocation, by contrast, can be planned over time, and targeted on the least productive farmers or crops, and will consequently have a lower impact, encouraging the most rational responses to reduced supply. These could include abandoning the least productive uses of water through adjusted commodity policies, market mechanisms such as buying out water rights, or allowing trade of water allocations among farmers.

Thus, we see that individual countries and regions have it largely in their own hands as to whether the water resources relevant to their livelihoods are managed sustainably – a clear and substantial difference from the global carbon economy.

Winners and losers

Looking beyond the local water economy and turning to the global picture, we see a second important difference between the water and the carbon economies: the potential for at least some winners to emerge (somewhere else) as a result of local water management failures.

The impact of reduced production in some areas will be an increase in crop prices both locally and, to a lesser extent, more widely. This will induce a new equilibrium as those farmers who still have access to water are incentivised to farm more productively, and some farmers who were previously uncompetitive, despite having access to renewable water supplies, are able to enter the market.

This last outcome is again a fundamental difference between the water and carbon footprint paradigms. Inadequate management of carbon emissions is bad for those emitting excessive levels of CO_2

and bad for everybody else in the world. There are no benefits and no winners – we all lose.

There will be winners from the disallocation of water from irrigated agriculture, and some of those winners are currently relatively poor rain-fed farmers. Consumers of agricultural produce will experience a small increase in prices; farmers 'captured' by the chaotic disallocation will suffer a large fall in income, while farmers involved in managed disallocation will also lose, but in a more predictable way (and still be farming as crop prices rise).

So the water crisis will have losers and winners, and a prime determinant of which category farmers fall into will be governance. Where governments fulfil their obligation to manage a nation's resources sustainably for the common good, the outlook for irrigated agriculture remains positive. Where governments fail in that duty, the prospects are poor, and the negative consequences are potentially very long-term.

Once an aquifer is exploited to destruction, some or all of three things can happen: first, the remaining water is so deep that recharge takes many years to reach it and initiate replenishment; second, the residual water is saline and depends on extensive recharge to re-establish a usable freshwater layer above the saline residue; and third, the previously porous aquifer-supporting soil structure compresses so that the storage potential and permeability are destroyed. This last condition is permanent. River ecosystems are perhaps more complicated, but again the challenges to restoring damage rise exponentially with the extent and duration of over-exploitation of upstream water.

And lastly: who cares?

If the climate does spiral out of control as a result of global warming, driven by excessive CO_2 emissions, few dispute that all of us will suffer severely, directly or indirectly, from the consequences of these events. The impacts will not be evenly distributed across nations or citizens, but the impacts will be dramatically negative for the vast majority of life on this planet. We all should care about this, and most people do.

How will water crises play out? Locally, as argued above, there will be substantial negative impacts for those directly affected, in terms of production and income. Elsewhere, some farmers will be better off, and, more generally, the global market for commodities will adjust.

The precise scale of the changes in commodity prices as a result of disallocation of water from irrigated agriculture is beyond the scope of this article (and this author). However, an IFPRI study (Rosegrant, Cai and Cline, 2002) provides helpful guidance, as interpreted by this author. The study concluded that eliminating over-abstraction from aquifers would reduce global irrigated cereal production by 35 million metric tonnes, which would be partially offset by an increase in rain-fed production of 17 million metric tonnes, stimulated by average price rises of around 7%. This *average* price increase is greatly ameliorated by the impact of world trade (Liu et al., 2014). In the areas where production is directly affected by reduced water availability – often remote and distant from markets – the impact will be much more severe.

At one end of the spectrum, for those urban and rural poor who depend on buying commodities for their staple diets, this will be a severe impact as they spend as much as 35% of their income on food – rice, wheat, vegetables, etc. At the other end of the spectrum, it is estimated that New Zealanders spend 14% of their after-tax income on food (Cronshaw, 2014), and that the commodity component of that food (i.e. excluding processing, packaging, transport, etc.) accounts for only 10% of the total cost of food. So a 7% rise in commodity prices would imply a 0.1% rise in food prices, corresponding to a 0.14% rise in the cost of living. The relevance of the 'who cares?' question becomes obvious.

To sum up, CO_2 emissions constitute a local contribution to a global concern, such that we 'all' care. Thus, there is obvious and effective scope to invoke peer pressure at a global scale. However, mismanagement of water is a local issue based on local failure of government to exercise its appropriate function for the specific benefit of those in that same domain of mismanagement. Beyond that domain, in areas where water is not scarce, or where it is properly managed, producers of agricultural commodities will benefit from failures elsewhere as demand for their production increases.

At the global scale, most consumers of agricultural produce will barely notice the change in prices induced by the progressive collapse of some water systems. Those most affected by chaotic disallocation of water from their agricultural incomes are also those least able to afford the associated increases in food costs. The priority is thus to promote good governance of water resources in advance of scarcity.

The upside of this gloomy picture is, of course, that local interventions can lead to better local outcomes independently of the wider picture of water mismanagement.

That more optimistic scenario is another contrast with the CO_2 story.

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Measuring the Effectiveness of New Zealand's Local Government

Abstract

Local Government New Zealand's recently introduced CouncilMARK™ scheme assesses local councils' effective management of finance and resources, their leadership and their responsiveness to their communities, and enables them to be compared and the prospect for collaboration towards improved performance explored. Other measures of reputation and ratepayer participation suggest that CouncilMARK may be over-emphasising managerial capability relative to stakeholder engagement, which may have implications for the scheme's value if community well-being is introduced as a prominent measure of performance.

Keywords local government, quality enhancement, stakeholder engagement, reputation, localism

Local Government New Zealand (LGNZ) has established a voluntary quality enhancement programme – CouncilMARK – for local authorities in New Zealand. The programme assesses councils' comparative performance in aspects of governance, financial management, service delivery and asset management, and stakeholder engagement. This article compares the results of this assessment for the participating councils and also discusses the results of another instrument that makes an overall judgement on the sector's reputation. Taken together, these results reveal an emphasis on assessing managerial activity, with less attention being paid to effective engagement with ratepayers. A reorientation of the programme to better meet current expectations of central government and ratepayers for improved community well-being is suggested.

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Setting the scene for a quality enhancement regime

Local governments in New Zealand own $119 billion in fixed assets, employ 25,000 staff and spend annually nearly $10 billion (Productivity Commission, 2018, p.4). Seventy-eight local authorities, which vary considerably in size, deliver about 10% of total public services. A small proportion of spending is locally allocated compared to most OECD countries, but many central government services rely strongly on local authorities for delivery. In response to its reputation research (discussed later in this article), Local Government New Zealand developed a 'Local Government Excellence Programme', of which CouncilMARK is a component.

On its website, LGNZ previously identified three issues that needed attention: 'Residents, ratepayers, businesses and central government all expect the best services and value from councils, but most

Table 1: Priorities and performance indicators for CouncilMARK*

Priority areas			
Priority 1: Governance, leadership and strategy†	**Priority 2:** Financial decision-making and transparency‡	**Priority 3:** Service delivery and asset management‡	**Priority 4:** Communicating and engaging with the public and business†
Performance indicators for Priority 1§	*Performance indicators for Priority 2§*	*Performance indicators for Priority 3§*	*Performance indicators for Priority 4§*
• Vision, goals and strategy • Professional development for elected members • Performance of elected members • Relationship/culture between elected members and the Chief Executive • Health and Safety Framework • Management • Audit and Risk Committee • Information and Advice	• Financial strategy • Financial data • Risk and control function • Budgeting • Financial control of councils • Transparency	• Aligning services with strategy • Environmental monitoring and reporting • Determining, monitoring and assessing service levels • Service delivery models • Service delivery capability and capacity • Service delivery quality – asset management • Service delivery quality – breakdown of individual services and infrastructure • Policy planning/spatial planning • Compliance with regulatory requirements • Accountability reporting • Capital investment decisions and delivery • Operational risk management	• Communication and engagement strategy • Digital engagement • Reputation • Media • Engagement with iwi/Māori • Engagement with diverse communities • Engagement with the general public • Civil defence and crisis communications • Engagement with business and key stakeholders¶

* From: Draft performance assessment framework for regional councils as at 21 December 2016. This document would have been used by councils participating in the CouncilMARK reports referred to in this paper. Although this document is no longer publicly available, similar information is currently provided in CouncilMARK (2019, pp.23-35)

† Consistent with one of the dual roles for local government prescribed in the Local Government Act 2002: 'to enable democratic local decision making and action by, and on behalf of, communities'

‡ Consistent with the other of the dual roles of local government prescribed in the Local Government Act 2002: 'to meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost effective for households and businesses'

§ The framework document suggests documents and other information (including stakeholder interviews) to guide the assessment panel

¶ Specifically mentioned are: 'primary sector, industry, residents and environmental organisations'; significant omissions include: community organisations (other than environmental organisations), District Health Boards, and relevant Government ministries, departments and agencies

of these customers don't believe this happens'; 'Most customers don't fully understand or value what we do for them every day'; and 'However well some councils perform, there are strongly negative perceptions of local government performance, which affects us all.' As solutions to these issues LGNZ suggested that: 'A continuous cycle of performance assessment and improvement ensures a lift in service and value from councils and the sector'; 'LGNZ will provide tools, services and share best practice to help councils lift performance'; 'Igniting a responsive culture improves engagement and accountability for results, taking our customers and communities with us'; and 'A new era of transparency will lift performance and reputation.' Although no longer readily available online, these aspirations have been recast recently in more corporate terms (CouncilMARK, 2019).

Cycles of continuous improvement are often an outcome of a quality assurance system and LGNZ's aspiration for this to occur as a result of CouncilMARK is reasonable. Whether CouncilMARK can influence the reputation of councils – currently assessed through the New Zealand Local Government Survey – is less certain. The methodologies and results of the two assessment components in the Excellence Programme – CouncilMARK and the Local Government Survey – are discussed in this article.

Involvement by councils in the CouncilMARK scheme is voluntary, with 21 councils originally committed to the principles of the scheme through being 'foundation members'; a few of these were involved in a pilot scheme. Although 28 councils are currently participating, a challenge for LGNZ will be to raise this participation rate: LGNZ has yet to convince the more than 30 other potential participating councils of the value of CouncilMARK in demonstrating their commitment to the continuous improvement of their management and governance procedures and systems. Presumably with that in mind, LGNZ indicated in the position description for the programme manager of CouncilMARK that the appointee would spearhead a marketing and promotion campaign.

Table 2: Ranking for priority areas for city, district and regional councils participating in CouncilMARK, arranged in order of scores

Priority areas			
Leading Locally (LL)	Investing Money Well (IMW)	Delivering What's Important (DWI)	Listening and Responding (LAR)
8 Hauraki District Council	8 Dunedin City Council	7 Greater Wellington Regional Council	8 Greater Wellington Regional Council
8 Waimakariri District Council	8 Waikato Regional Council	7 Hauraki District Council	8 Hauraki District Council
7 Environment Canterbury	8 Greater Wellington Regional Council	7 Waikato Regional Council	7 Central Hawke's Bay District Council
7 Hastings District Council	7 Matamata-Piako District Council	6 Dunedin City Council	7 Dunedin City Council
7 Napier City Council	7 Napier City Council	6 Environment Canterbury	7 Hastings District Council
6 Central Hawke's Bay District Council	7 Rangitīkei District Council	6 Hastings District Council	7 New Plymouth District Council
6 Dunedin City Council	7 Waimakariri District Council	6 Napier City Council	7 Porirua City Council
6 Greater Wellington Regional Council	6 Environment Canterbury	6 Ruapehu District Council	7 Queenstown Lakes District Council
6 New Plymouth District Council	6 Hastings District Council	6 South Taranaki District Council	7 Ruapehu District Council
6 Waikato Regional Council	6 New Plymouth District Council	6 Waimakariri District Council	7 Waimakariri District Council
6 South Taranaki District Council	6 Porirua City Council	5 Masterton District Council	6 Far North District Council
5 Masterton District Council	6 Queenstown Lakes District Council	5 Matamata-Piako District Council	6 Matamata-Piako District Council
5 Matamata-Piako District Council	6 South Taranaki District Council	5 Nelson City Council	6 Napier City Council
5 Porirua City Council	6 Tararua District Council	5 New Plymouth District Council	6 Tararua District Council
5 Queenstown Lakes District Council	6 Taupō District Council	5 Rangitīkei District Council	6 Taupō District Council
5 Rangitīkei District Council	5 Far North District Council	5 Tararua District Council	6 Waikato Regional Council
5 Tararua District Council	5 Hauraki District Council	5 Taupō District Council	6 Whakātane District Council
5 Taupō District Council	5 Horowhenua District Council	5 Upper Hutt City Council	5 Environment Canterbury
5 Upper Hutt City Council	5 Mackenzie District Council	5 Wairoa District Council	5 Horowhenua District Council
4 Far North District Council	5 Masterton District Council	5 Whakātane District Council	5 Mackenzie District Council
4 Horowhenua District Council	5 Whakatāne District Council	4 Far North District Council	5 Masterton District Council
4 Mackenzie District Council	4 Central Hawke's Bay District Council	4 Horowhenua District Council	5 Nelson City Council
4 Nelson City Council	4 Nelson City Council	4 Mackenzie District Council	5 Rangitīkei District Council
4 Ruapehu District Council	4 Upper Hutt City Council	4 Porirua City Council	5 South Taranaki District Council
4 Whakatāne District Council	4 Wairoa District Council	4 Queenstown Lakes District Council	5 Upper Hutt City Council
3 Wairoa District Council	3 Ruapehu District Council	3 Central Hawke's Bay District Council	5 Wairoa District Council

Score =1	Score = 2	Score = 3	Score = 4	Score = 5	Score = 6	Score = 7	Score = 8	Score = 9
Description: Struggling	Description: Under-performing	Description: Areas for improvement	Description: Variable	Description: Competent	Description: More than competent	Description: Performing well	Description: Standout	Description: Exemplary

Table 3: Overall CouncilMARK scores, and type of council

Overall rating*		Type of council‡			
		RE	LM	SM/LP	SP/RU
AA	Greater Wellington Regional Council (Y2)†	●			
	Waimakariri District Council (Y1)			●	
A	Dunedin City Council		●		
	Hastings District Council (Y1)			●	
	Hauraki District Council				●
	Napier City Council (P)			●	
	Waikato Regional Council (Y1)	●			
BBB	Environment Canterbury (Y2)	●			
	Matamata-Piako District Council (P)			●	
	New Plymouth District Council			●	
	Porirua City Council (P)			●	
	Queenstown Lakes District Council (P)			●	
	South Taranaki District Council (Y1)				●
	Taupō District Council (Y2)				●
BB	Central Hawke's Bay District Council (Y2)				●
	Masterton District Council (Y1)				●
	Nelson City Council (Y1)			●	
	Rangitīkei District Council (Y1)				●
	Ruapehu District Council (P)				●
	Tararua District Council (Y2)				●
	Upper Hutt City Council (Y2)			●	
	Whakatāne District Council (Y1)				●
B	Far North District Council (Y1)			●	
	Horowhenua District Council (P)			●	
	Mackenzie District Council (Y2)				●
CCC	Wairoa District Council (Y1)				●

*Ratings:

C	CC	CCC	B	BB	BBB	A	AA	AAA
Description:								
Under-performing	Areas of improvement (more than 2 areas)	Areas of improvement (2 areas)	Areas of improvement (1 area)	Competent	Some areas of strength; overall competent	Some areas of strength and leadership	Strong grades in most priority areas	Exemplary

† Council involvement in CouncilMARK: (P), council involved in pilot programme; (Y1), council involved in first year of implementation; (Y2), council involved in second year of implementation

‡ LGNZ distinguishes the following types of council: **RE**, regional; **LM**, Large metro; **SM/LP**, Small metro and large provincial; **SP/RU**, Small provincial and rural

Figure 1: Stakeholder orientation score vs management orientation score for CouncilMARK participants

		Number of councils								
Stakeholder-orientated score (LL+LAR)/2	8.0						1			
	7.5							1		1
	7.0						1			
	6.5	1				1		1	1	
	6.0				2		1			1
	5.5			1		2	2			
	5.0			2	2		1			
	4.5			3						
	4.0			1						
		3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
		Management-orientated score (IMW+DWI)/2								

CouncilMARK: the process

CouncilMARK is a scheme wherein a team of external assessors rate the ability of local government councils to meet government compliance requirements and provide services to the communities they serve.

The scheme identifies four 'priority areas' or 'pillars', which are simplified on LGNZ's website: the priority 'Governance, leadership and strategy' is referred to on the website as 'Leading locally' (abbreviated here as *LL*); 'Financial decision-making and transparency' is referred to on the website as 'Investing money well' (*IMW*); 'Service delivery and asset management' is referred to on the website as 'Delivering what's important' (*DWI*); and 'Communicating and engaging with the public and business' is referred to on the website as 'Listening and responding' (*LAR*). Underpinned by performance indicators (Table 1), these priority areas are assigned a grading during the assessment process, which can be graded and scored, as shown later in Table 2. The average of the scores of these priority areas defines the rating for the council's overall performance (see Table 3).

The assessment is undertaken by a panel whose draft report is provided to the council for comment, with the final report being reviewed and released by an 'independent assessment board' comprising a chairperson and two other members with corporate management backgrounds (CouncilMARK, 2019, p.15). As expected, some councils have been pleased with their ratings (e.g. Hauraki District Council: see Local Government New Zealand, 2019); others less so (e.g. New Plymouth District Council: see Persico, 2019). Although there is no formal requirement to address recommendations and suggestions made in the report, some councils choose to do so. The overall process is typical of the traditional non-financial audits that are input-driven or process-driven, rather than of more contemporary output/outcome-focused evaluations.

CouncilMARK: the results

The presentation of the CouncilMARK data on LGNZ's website is in alphabetical order of councils. While this arrangement readily enables ratepayers and customers to look at the scores of 'their' council, it does not facilitate comparison between them. If it is truly the intention of LGNZ that the public does 'browse councils' programme gradings across the country' (LGNZ, n.d.-a), then it may have been more helpful to have presented the information in a way that facilitates such comparison. Examples of such a format are the Tertiary Education Commission's performance ratings for educational success criteria of institutes of technology (e.g. Tertiary Education Commission, 2015), and the Ministry of Health's portrayal of health outcomes achieved by district health boards (e.g. Ministry of Health, 2011). This type of format is used in Table 2 to display the scores for *LL*, *IMW*, *DWI* and *LAR*, as well as in Table 3 to show the overall score for the 26 councils for which results were available at March 2019.

The distribution of scores for the priority areas in Table 2 suggests that the scheme may provide opportunities for the enhancement of performance through the sharing of best practice across all councils, considered by LGNZ to be a potential benefit of CouncilMARK. For *IMW* and *DWI* the regional councils do score slightly higher than the district councils, and so there might be some opportunity for the former to share experience of these areas with the latter. However, for *DWI* such activity is likely to be constrained because the matters of importance for district councils are likely to be very different from matters of importance for regional councils. No participating council is said to be 'underperforming', but no council is rated 'exemplary' either. While Table 3 suggests that the rating for overall performance has a tendency to increase for councils that serve larger communities, the currently small data set means that such a relationship may not be representative of all councils.

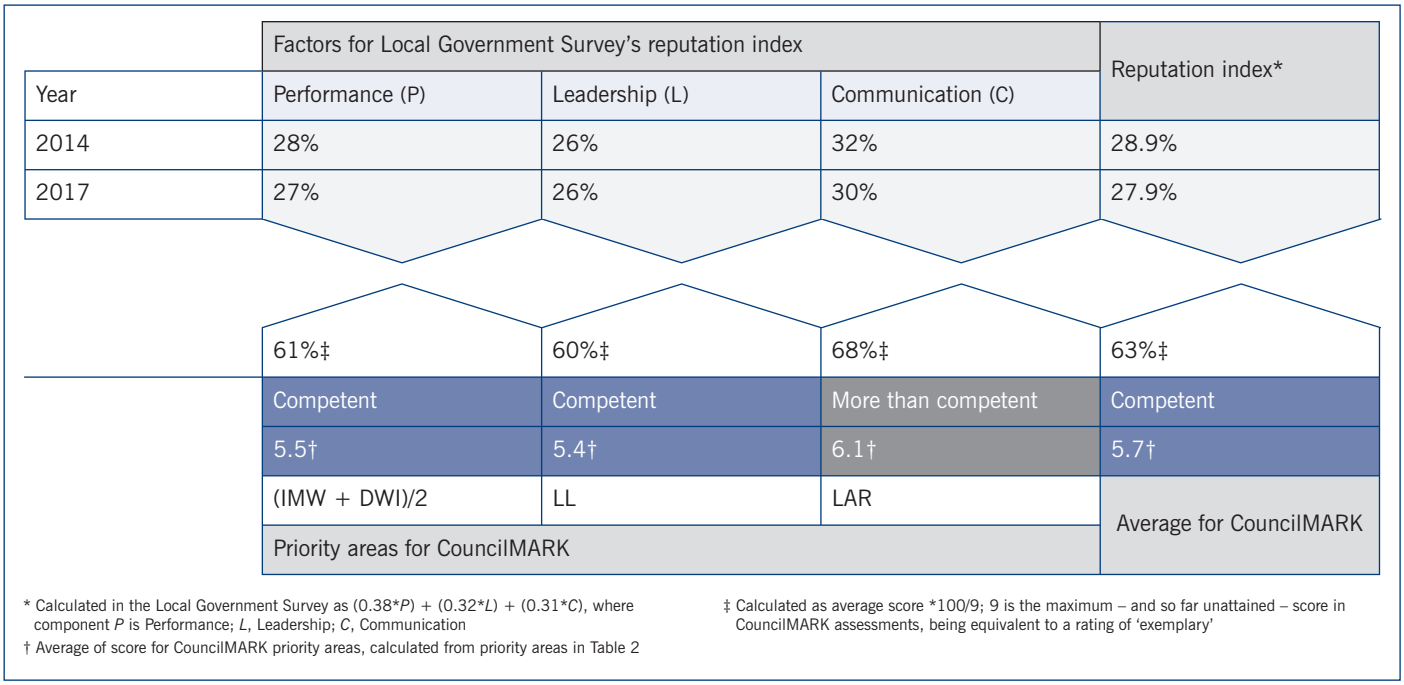
CouncilMARK was developed before the current emphasis of government on 'promot[ing] the social, economic, environmental, and cultural well-being of communities', proposed in the Local Government (Community Well-being) Amendment Bill 2018. Similar provisions had been included in its predecessor act (the Local Government Act 2002), but were subsequently removed by a National-led government (Grimes, 2019). Even though

Table 4: Perceptions of public and business about importance and performance of councils

Perception of importance of council	Public	Business
Inferred high importance in daily life	44%*	-
Inferred high importance of local government and services to business	-	55%*
Inferred high importance of the collective effort of local government for the prosperity and well-being of New Zealand	77%	85%
Perception of performance of council	**Public**	**Business**
Improved performance over last three years	32%	31%
Steady performance/unsure over last three years	54%	50%
Worse performance over last three years	14%	19%

* A diagram in the 2017 survey report implies that these percentages can be compared; in fact, slightly different questions are asked of both groups of participants, which means that strictly speaking the results cannot be compared

Figure 2: Association of the factors for reputation index with ratings for CouncilMARK priority areas and their contributions to a 'reputation index'



* Calculated in the Local Government Survey as (0.38**P*) + (0.32**L*) + (0.31**C*), where component *P* is Performance; *L*, Leadership; *C*, Communication

† Average of score for CouncilMARK priority areas, calculated from priority areas in Table 2

‡ Calculated as average score *100/9; 9 is the maximum – and so far unattained – score in CouncilMARK assessments, being equivalent to a rating of 'exemplary'

'well-being' was not a legislative requirement at the time of the CouncilMARK assessment, councils may have continued to include well-being in their discussions of aspirations for their city, district or region, and in their strategic planning processes. For these councils well-being would be expected to be reflected in their performance assessment framework (LGNZ, n.d.-b) as well as the CouncilMARK assessments.

A way of representing the current emphasis on communities and their well-being in the councils participating in CouncilMARK is to consider the rankings of the average of the management-orientated scores (i.e. [*IMW* + *DWI*]/2) and the average of the stakeholder-orientated scores ([*LL* + *LAR*]/2). Figure 1 shows that ten councils are more stakeholder orientated than management orientated (i.e. the data points are above the dark grey band); six councils are more management orientated than stakeholder orientated (i.e. the data points are below the dark grey band; while ten councils are comparably management orientated and stakeholder orientated (i.e. the data points are along the dark grey band). Using this approach, Central Hawke's Bay District Council has the highest stakeholder orientation, while Waikato Regional Council has the highest management orientation. It might be anticipated that councils with higher stakeholder orientation scores might be more amenable to the introduction of greater participatory local government ('localism' as described in McKinlay, 2019) envisaged in the revision of the Local Government Act.

The 'Listening and responding' measure is expected to be of particular interest to ratepayers, and this is one 'priority area' for which a complementary measure is available, as is discussed in the next section.

Reputation index from local government surveys

Complementing CouncilMARK, LGNZ contracted the market research agency Colmar Brunton to conduct a local government survey in 2014 and 2017 (see Local Government New Zealand, 2017),

in which representatives of the public and businesses across the country were interviewed. Although the sample size was stated as statistically valid – around 2,500 from the public and 400–600 businesses, giving levels of confidence of ±2% and ±4.9% respectively – the known variability of local council activities casts doubt on whether a single survey across the country is likely to yield results pertinent to any particular council. This type of survey would be more usefully undertaken by individual councils, as indeed some councils do already. As an example, Waikato Regional Council notes that there have been 'Poorer perceptions of community engagement – [shown as a] decrease in the percentage of Waikato survey respondents who agreed that the public has an influence over the decisions their local Council makes (down from 62% in 2006 to 36% in 2018)' (Waikato Regional Council, 2018, p.3).

Both the 2014 and 2017 surveys record that the public and businesses have different perceptions of the relative importance of the areas on which councils should focus, but these are unranked and so cannot be compared. The surveys also identified that businesses recognise to a greater extent than the public that councils have a greater part to play in everyday life and contribute to national prosperity and well-being, although the perceptions of these groups of overall council performance show little difference (Table 4). It is not possible from the information provided in the report to determine a helpful measure of the satisfaction with council performance, partly because the report uses a 'net satisfaction' measure, calculated as the difference between the percentages of those satisfied and those dissatisfied, but these percentages are not included in the report.

The report of the 2017 Local Government Survey concludes by outlining the development of a reputation index, asserting that '[p]ositive reputation is achieved when an organisation's leadership, service provision and communications work in unison and the organisation is seen to do the right things, for the right reasons, in the right way'. The report notes that the reputation index is strongly influenced by performance, leadership, and communication and interaction, although neither the score for each of these factors is determined nor the rationale for the weightings of the factors to obtain the index is provided. Although the report recognises, 'The overall reputation of local government remains relatively low with a score of 28 [out of 100]. This is consistent with 2014 (a score of 29), and the one point difference is not meaningful. As in 2014, the public continues to have a better view of local government compared with businesses', it does not provide any information to support the asserted difference in perceptions between businesses and the public (Local Government New Zealand, 2017, p.16).

The factors contributing to the reputation index – 'performance', 'leadership' and 'communication and interaction' – can be associated with the 'priority areas' discussed for CouncilMARK – 'investing money well' combined with 'delivering what's important', 'leading locally' and 'listening and responding', respectively, as shown in the lower part of Figure 2. The comparison of scores and calculated reputation index in Figure 2 indicates that the CouncilMARK assessors are more positive about councils' performance than the reputation index suggests would be the perception of ratepayers.

During 2017 and 2018 there was extensive media coverage of activities in which the performance, leadership or communication of local body staff and elected councillors are likely to have been damaging to the individual and collective reputation of councils, four examples of which are given below:

- Environment Canterbury initiated no prosecutions resulting from reported incidents of stock in waterways since 2016 (Tyson and Eppel, 2016a, 2016b), but the council prosecuted itself for pollution in March 2018 (Lee, 2018).
- Hastings District Council and the Hawke's Bay Regional Council were both criticised in the formal government inquiry following contamination of public water supply in Havelock North causing illness and death in mid-2017 (Government Inquiry into Havelock North Drinking Water, 2017).
- Greater Wellington Regional Council's reform of bus routes and timetables, compounded by new contracts with bus companies and agreements with unions, and exacerbated by poorly conceived and managed post-implementation communication with ratepayers (from July 2018), caused chaos on the city streets and intense public opprobrium (some of which was incorrectly directed at the Wellington City Council). An independent review of the process drew attention to a lack of staff capability at the regional council (George, 2018; LEK Consulting, 2018).
- Radio New Zealand in August 2018 reported that Auckland Council had misinterpreted its own planning rules for heritage areas, and was requiring property owners to reapply for consents already issued for renovations and development (RNZ, 2018).

Conclusion

CouncilMARK is focused on inputs and processes, with the indicators suggestive of a tick-box approach to assessing performance. Moreover, its involvement of external stakeholders in the process appears limited. It could be argued that much of priority area 2 is essentially material routinely presented in annual reports and is of less value to the objectives of CouncilMARK than matters which more directly affect ratepayers, citizens, and those providing services to a council or undertaking business and community functions in the area of a council's jurisdiction.

The distribution of scores for the priority areas and the overall grades suggest possibilities for using CouncilMARK in sharing best practice. However, there may also be benefit in reviewing the individual reports generated in the process on a regular basis with a view to seeking common themes and issues prevailing across councils and using these as an insight into the future prospects for the improvement of the performance of councils. This resembles the financial management comparisons currently undertaken by the Office of the Auditor-General in respect of councils' annual reports (e.g. Controller and Auditor-

General, 2018). However, in order to ensure that such a process complemented rather than duplicated the work of the Office of the Auditor-General, the process would need to focus on non-financial and engagement-related metrics.

Overall, CouncilMARK implies that engagement with citizens – the clients and customers who are surely councils' most important stakeholders – is 'more than competent'. However, this is not consistent with the low public response via submissions to annual and long-term community plans. For the 17 councils participating in the CouncilMARK scheme for which information was available as at January 2019, on the outcomes of consultation in respect of the most recent long-term council community plan, the number of submissions received by a council ranges from 125 (to the Rangitīkei District Council) to 1,125 (to the Hastings District Council); the average number of submissions was 444. As a percentage of the population served by councils, the lowest submission rate is 0.08% (to the Waikato Regional Council) and the highest submission rate is 1.6% (to the Ruapehu District Council); the average submission rate is a mere 0.94%. Such a competence rating in CouncilMARK ignores the lack of publicly available information about the fate of those submissions that are made and it is not consistent with the poor reputation index derived from the more customer-focused Local Government Survey.

Although the Local Government Survey is targeted at two important stakeholders (the public and business), its nationwide scope is too broad for its results to be meaningful to individual councils. Rather than continuing with this measure, LGNZ could encourage individual councils to develop a reputation index – compiled in a standardised way – which could be used both as a key performance indicator and as a complement to the CouncilMARK rating for 'listening and responding'.

A reorientation of the CouncilMARK priority areas (and the key performance indicators that underpin them) to better reflect outcomes of significance to stakeholders might enhance uptake of the scheme by councils and increase the perceived value of the assessment to stakeholders. Such changes are reflective of innovative thinking elsewhere (Needham and Mangan, 2018). They might also make the scheme more relevant to the expectations of central government for New Zealand's local government to restore a focus on community well-being (Grimes, 2019; McKinlay, 2019), for which the priorities for the 2019 'well-being' budget (Robertson, 2018) have been declared to be:

- creating opportunities for productive businesses, regions, iwi and others to transition to a sustainable and low-emissions economy;
- supporting a thriving nation in the digital age through innovation and social and economic opportunities;
- lifting Māori and Pasifika incomes, skills and opportunities;
- reducing child poverty and improving child well-being, including addressing family violence; and
- supporting mental well-being for all New Zealanders, with a special focus on under 24-year-olds.

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Jonathan Boston is a Professor of Public Policy in the School of Government at Victoria University of Wellington.

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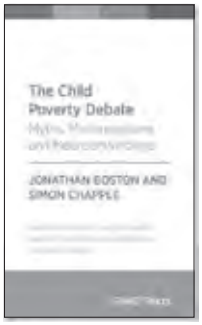

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Andrew Coleman and Girol Karacaoglu

Listening to Voices of the Future

an invitation to contribute to a special issue of *Policy Quarterly* on cohort-based or generation-based policies

The future is hostage to the past

It has long been observed – since Heraclitus, at least – that change is the only constant in life. In some spheres of life, change is easy, as it is gradual and continuous. Scientific discoveries are made and novel products are developed. Fashions come and go and come again. New music is introduced and old standards are gradually displaced. Yet in other spheres of life change is difficult. Things are done in the same old ways, and change is vigorously opposed by groups who want to act as they have always acted.

Public policy is an area where change can be slow. When stability and continuity are prized, deference to the past is perfectly desirable. Even when change is desirable, however, societies often continue with policies based on their previous choices rather than future possibilities. The need to honour commitments to older generations and observe their traditions slows the process of change and limits a society's ability to respond to new opportunities. Change, when it eventually occurs, takes place in intense and messy periods of reform.

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Girol Karacaoglu is head of the School of Government, Victoria University of Wellington.

Does it have to be this way? Are there public policy issues where the pace of change could and should be accelerated? Are there reasons why change in some areas of public policy is so slow and difficult? These questions have underpinned intergenerational debate and conflict for generations immemorial.

We would like to invite people to explore ways that public policies can be designed to facilitate the process of change. Our focus is specifically and deliberately on generational change – how society can best enable change when younger and older generations have very different views on what is important, what is possible and what is desirable. We want to explore how successive generations can shape the future so that it better reflects their issues and concerns. These changes do not concern just age, but can cover a broad canvas of themes related to issues such as gender or ethnicity, or the environment.

Why is policy change difficult?

We all know change can be difficult because old habits die hard. It can be difficult for individuals to change their careers, for families to change where they live, or for firms to change the ways they operate. Many attempts at change fail even when the costs and benefits of change are 'internalised' to the decision-making entities because they affect the same individuals, families or companies who make the decisions. When some people find change more costly than others, society-wide attempts at change may fail because of resistance from those who have the biggest costs or the fewest benefits.

The difficulties and complications associated with change are larger when the changes initiated by some people affect others. If the costs and the benefits associated with change fall on different people, it is natural that some people will be opposed and will resist. Change in such circumstances requires negotiation or force. Negotiation is seldom simple, as few people find it easy to see the bigger picture and search for opportunities that make all parties better off (Foster, Mansbridge and Martin, 2013).

Most public policy changes initiated by government are of this nature. It is especially difficult to implement public policy changes when the costs of a policy that benefits one generation are borne disproportionately by another generation. There are many examples of public policy changes that affect different generations in different ways, including changes to education, retirement income or health spending. People may resist paying for services obtained by other generations that they never received, or they may object to new rules outlawing activities they enjoy or had long anticipated doing. If these conflicts cannot be resolved, societies can fail to adapt with the times. The problem becomes more acute when several related policies are involved, for big, system-wide changes are more difficult to negotiate and implement than policies that can be changed at the margin, one at a time.

Exploration

We wish to explore whether a society can design and implement public policies in an alternative way as its preferences evolve. One possibility is to find processes that enhance the voice of young people in the policy development process. Society may still apply a single policy for all people, but this policy will better reflect the preferences of young people. This type of approach is reflected, for example, in efforts to encourage higher voter participation by young people in national elections.

Cohort-specific policies enable a country to adopt different policies for different cohorts, so that policies better reflect each generation's changing preferences and changing circumstances.

A different possibility that we wish to consider is a system of cohort-specific policies – policies that are designed to be different for one generation than for another. (In this context, a 'cohort' refers to a group of people born in a particular year, while a 'generation' is a related collection of cohorts. A person born in 1985 belongs to the 1985 cohort, the 1980s generation and Generation Y.) Cohort-specific policies enable a country to adopt different policies for different cohorts, so that policies better reflect each generation's changing preferences and changing circumstances.

Consider, for example, education. Traditionally, older generations have paid for the education of younger generations, but younger generations have received a disproportionately large fraction of the return on these investments. As education became more valuable, and more was demanded, older generations found they were paying more and more relative to the amount spent on their own education. New Zealand has already adopted a cohort-based policy to help deal with this issue: cohorts born after 1970 have been expected to take out student loans to pay part of the costs of the higher education expenses they incur, to reduce the taxes paid by cohorts born before 1970. But future cohorts may want a different solution; they might want free education funded by higher cohort-specific taxes, for example, or they might want higher student loans to pay for a better quality of education. A cohort-based policy would enable each cohort to choose the mix it wanted, while reducing the impact on other generations.

Retirement income policy is another example. New Zealand's pay-as-you-go scheme requires working-age people to pay taxes that are transferred to older people. Younger people may wish to change the current system, not just because the benefits they can expect to receive are lower than the costs they expect to pay, but because the form of the system may not be suited to their circumstances. Young people may want a system of personal retirement accounts because it enables them to receive a pension if they spend a lot of their time working abroad, or because it provides them with a larger pension for the contributions they make. New Zealand's current system makes change difficult as young people cannot reduce the amount they pay without reducing the amount older generations receive. But it may be possible to design and adopt a set of retirement policies that are different for different cohorts, enabling change to occur now, and enabling change to occur in the future should future cohorts want something different again. People born after 1980 could have a compulsory retirement saving scheme and low income taxes, for example, while those born before 1980 could retain the current system.

Other examples exist. Younger generations may want to live in cities amply supplied with bus lanes, walkways and cycleways, for example. Older generations have had a preference for living in suburbs and driving cars. The architectural and environmental effects of these preferences will be borne by today's younger generations as the use of land for roads and

parking places prevents the expansion of other forms of transport. Some policies try to address these issues at the margin, by altering the incentives to use (say) bicycles and petrol-fuelled cars. However, young and future generations may want more radical solutions – for example, completely redesigned cities that enable people to live and work in close proximity so that there is far less need to travel. Is it possible to adopt cohort-based policies to reshape the cities of the future so they reflect what young people want? You can imagine a policy that prohibits people born after 1980 from owning petrol-fuelled cars, for example, but would it work?

We do not pretend to know what young people want. However, it seems clear that three conditions are necessary for cohort-based policies to be an effective method of enabling change. First, different cohorts must want different things. Second, it must be feasible to have different policies for different cohorts. A solution requiring people born after 1980 to drive on the left and people born before 1980 to drive on the right obviously would not meet this criterion. Third, some additional intergenerational transfers may be necessary to reach a practical political solution if cohort-based policies make some generations better off and others worse off. If these conditions hold, cohort-based policies may be possible to better enable society to change in the face of changing circumstances or changing preferences. Moreover, not only will cohort-based policies enable current cohorts to obtain policies that they want, but a great advantage of such policies is that they more easily accommodate continuous change as future generations make their own policy modifications.

The invitation

We would like to know if there is any demand for cohort-based or generation-based policies among young people. As a first step, we would like to know what young people want. Are there issues where their views are distinctly different from those of older people? Are there policies that they would really like changed to enable them to better live the lives they wish to live? Are there current policies that they think are antithetical to their interests? Are there cohort-based policies that might enable their children to make different choices from their own?

We are seeking essays from people born after 1985, coming from all kinds of background, to be published in a special issue of *Policy Quarterly*. We are looking for examples of major systemic changes involving public policy that will have significant effects on their lives now and in the future.

To make a meaningful contribution to this intergenerational conversation, these examples need to involve policies where young people want very different options from the ones currently on offer and could be amenable to distinctive policies for current cohorts.

We are looking for thoughtful and structured contributions relating to specific examples that describe the changes that are desired, and the ways a new set of policies might enable these changes. Some thought should be given to how a feasible transition might be arranged and, if the policy imposes big changes on older cohorts, how the new policy options might be negotiated, funded and managed. Would you be willing to pay higher taxes, now or in the future, to adopt the policy? A possible test you could consider is whether you could imagine holding a referendum, or set of referenda, among people born after 1985 on a policy that applied only to people born after 1985. The policies can be about anything; indeed, our hope is that you come up with some issues that we do not normally think about.

An analogy may be helpful. Suppose your parents took you to a restaurant and said that as they were paying they would order for you. Would you eat differently if you could choose your own meal? How would you order if you could choose your own meal but also had to foot a big chunk of the bill? We are interested in whether there are policies that you would definitely like to be different from those chosen by your parents' generation, and maybe how you might arrange to split the bill.

Conclusion and next steps

If you wish to participate and contribute to this exploration, individually or with a group of people you wish to work with, please submit a 500-word (maximum) abstract of your basic idea and proposal by the end of October 2019 to: Girol.Karacaoglu@vuw.ac.nz.

If you wish to participate and contribute to this exploration, individually or with a group of people you wish to work with, please submit a 500-word (maximum) abstract of your basic idea and proposal by the end of October 2019 to: Girol.Karacaoglu@vuw.ac.nz.

We will select ten submissions, and invite the authors of these selected submissions for a conversation. Following that, you will be invited to write a 2,000-word article to be published in *Policy Quarterly*. A final version of the article will be needed by the end of February 2020.

We will then submit the various ideas generated through this process to a national survey based on a sample of people who are under the age of 35. Eventually, this whole process, including your articles (possibly extended), will be published as an edited book.

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