

Managing and Protecting our Freshwater Resources – Some Implications for Rural Communities

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1 Introduction

All regional councils must implement the National Policy Statement for Freshwater Management 2011 (NPS-FW) in their region. An integral part of this process will be exploring the relative effects of future management options on people and communities' social, economic, cultural and environmental wellbeing, both for policy development and evaluation, and the reporting requirements under S.32 of the RMA (1991). The proposed National Objectives Framework to the NPS-FW directs that (among other things) the social and economic implications of objectives are considered 'at all relevant points' of the policy process.

Exploring the socio-economic impacts will not be a straightforward task. It will require undertaking a series of economy-environment assessments to investigate the relative magnitude and distribution of short to longer term impacts associated with different management options. Such assessments will be relevant at catchment, regional and national scales. Regions and their communities are a complex system, characterised by feedback loops, shifting cause and effect relationships, time lags and high levels of uncertainty.

In this paper we present the key findings and lessons learned from several studies we have been involved in throughout New Zealand.¹ These studies include the Waikato River Independent Scoping Study (NIWA, 2010), Lake Rotorua Target Study (BECA, 2011), Southland Economic Joint Venture Study (MfE/MPI, 2013), and the Horizon's One Plan Study (DairyNZ, 2013). The focus of our work in these studies, and this paper, is explicitly on understanding the wider economic implications for local and regional communities associated with managing and protecting our freshwater resources. It is worth noting that these studies have been strongly focused on understanding the impacts associated with likely changes in primary industries, including dairying, sheep and beef farming, other farming and forestry.

The paper is structured as follows: Section 2 provides a brief overview of various approaches used in these studies to assess impacts. Section 3 provides selected findings noting similarities and differences between studies, while Section 4 outlines lessons learned to date and directions for future research. Finally, Section 5 provides some concluding comments.

2 Approach

It is important to note that undertaking any assessment of the economic implications associated with managing and protecting our freshwater resources is a substantial task. Importantly, economic assessment is only a small part of a wider process rather than a discrete task in its own right. Based primarily on the above projects this process involves:

- *Determining values.* Clearly establishing community goals, aspirations and value sets for freshwater resources. This, in its own right, is a significant challenge requiring the establishment of transparent engagement processes aligned with legislation through which the public, communities, businesses, industry groups, non-profit organisations may all contribute to. It is characterised by multiple stakeholders with multiple and often conflicting viewpoints.
- *Good science.* To effectively manage and protect our water resources requires a strong two-way collaboration between science and policy practitioners. Both groups need to clearly understand

¹ All of these studies were undertaken jointly with Dr Brian Bell of Nimmo-Bell Ltd.

the potential key trade-offs associated with change: environment/cultural versus economy, short versus long term, and so on. Scientific knowledge is required to aid in translating community values into targets, bottom-lines and thresholds. Given uncertainty this translation is likely to be expressed as a range of possibilities, rather than set of exact or precise values. Scientific insight is also crucial to analysing the implications of any proposed interventions, as might be directly required by farmers, industry, and communities. Of course, this will require engagement not only with planning practitioners, but also other experts including engineers and economists.

- *Mitigation scenarios.* To effectively manage and protect our freshwater resources requires looking into the future. In the above studies, this has been addressed through the use of scenarios. Scenario development requires careful consideration. It is important that scenarios be plausible, internally consistent and, in our opinion, first developed as qualitative narratives (which can be easily understood by all stakeholders, not only by technical experts) before being expressed quantitatively. In the above studies three scenarios were typically utilised: a reference or baseline scenario², an 'achieving current best practice' scenario, and an 'emerging or beyond best-practice' scenario. Each scenario clearly laid out the mitigation measures or interventions required to achieve scientific targets representing the desired value of the communities concerned.
- *Good economics.* Sound economic knowledge is required through all steps in the process. Economics is required, for example, to value the costs and benefits directly associated with implementing mitigations. Economics is also required to assess wider market and non-market impacts. In the above studies, *direct* impacts (as experienced by farmers, industry, municipalities etc) were assessed using Cost-Benefit Analysis, while the *indirect* impacts (e.g. supply chain and flow-on effects) were assessed using a dynamic Multi-Regional Input-Output framework – Figure 1 provides a schematic of the impacts assessed under the Waikato River Independent Scoping Study.³ There are multiple toolkits available to assess these wider implications, including: econometric, Input-Output, Computable General Equilibrium, Partial Equilibrium, System Dynamics and Agent-Based models. While these methods are not discussed here, it is important to note that all have strengths and weaknesses. A 'pluralistic approach' must be taken if impacts are to be fully understood. There is no 'one-size fits all' assessment method.

The approach outline above is, of course, not linear. It is iterative, often requiring several rounds of engagement with stakeholders, experts (scientists, engineers, economists and so on) and politicians. It is also important to note that resultant policy or plan changes be designed with review, flexibility and adaptability in mind – particularly given that community values, scientific findings or economic outcomes are never 'set in stone'.

² Establishing a reference, or counter-factual', scenario is critical as alternative scenarios are typically measured, in net terms, against it. Note that a reference scenario need not be a Business-As-Usual scenario. It may, for example, be assumed that some mitigations or interventions may take place under any conditions.

³ Nimmo-Bell used Cost Benefit Analysis, in the form of a Discounted Cash Flows Analysis, to assess the direct economic losses/gains to key stakeholders under various intervention scenarios. In turn, Market Economics used the Nimmo-Bell's work to estimate the wider community, regional and national economic impacts of the same scenarios.

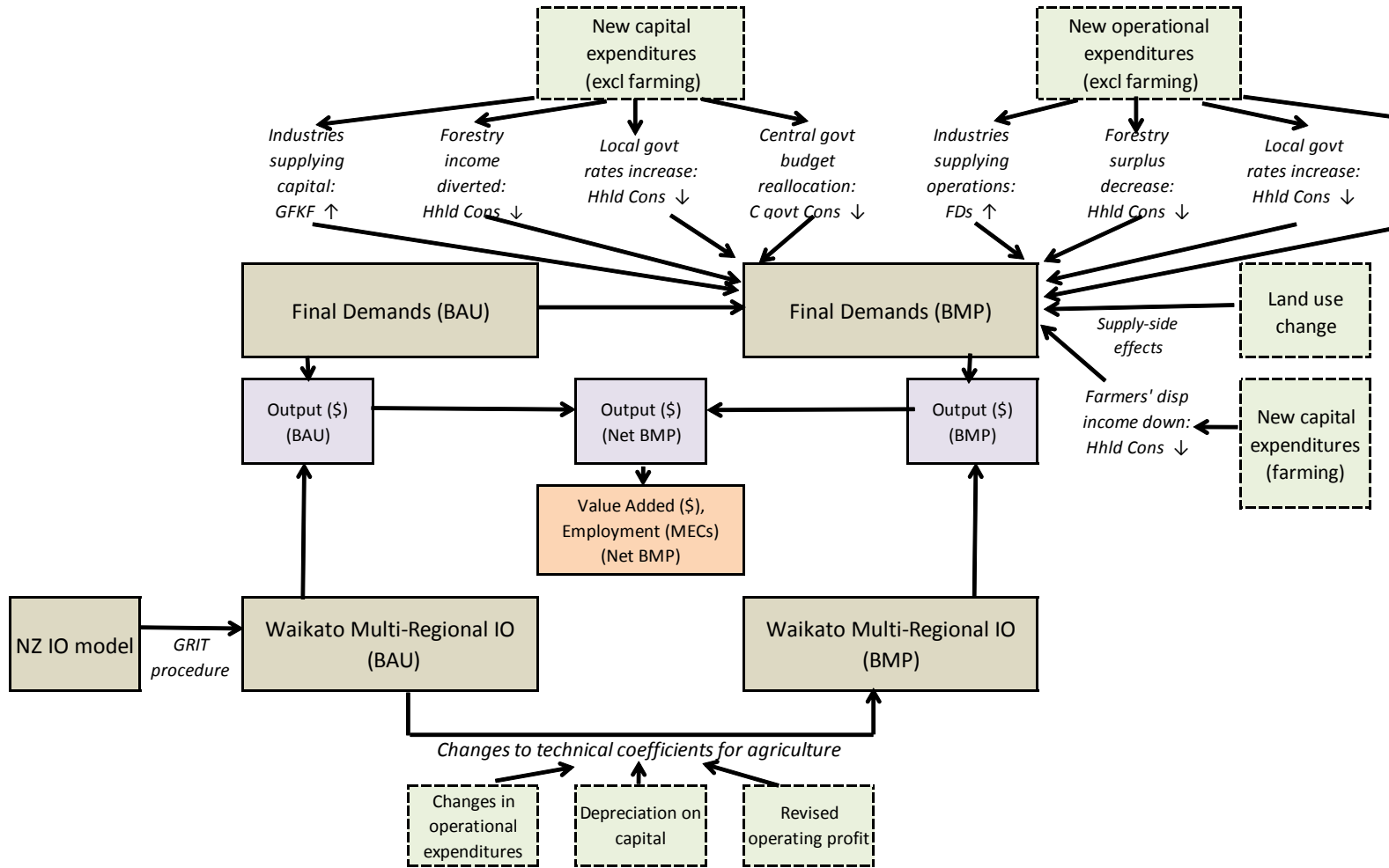


Figure 1 Modelling Framework used to Estimate the Wider Economic Impacts in the Waikato Region Independent Scoping Study, 2010

Notes: BAU = Business-As-Usual, BMP = Best Management Practice, GRIT = Generating Regional Input-Output, IO = Input-Output and MECs = Modified Employment Counts. This figure shows how the direct economic impacts were included in the economic modelling. An up arrow ↑ represents an increase, and down arrow ↓ a decrease.

3 Key Findings

In this Section we outline the key findings from our work. Rather than drilling down into detail, we focus instead on the commonalities, differences and major 'points of interest' in these findings. The full economic impact reports for all of the studies are available in the public arena. Key findings include:

- *Consideration of not only direct, but also indirect or 'higher order' impacts* - Economic impacts extend well-beyond those experienced directly by dairy farmers and other persons directly reliant on the use of water resource. Changes to dairy farming and livestock farming systems result in changes to the purchase patterns of dairy and livestock farms, as well as reductions in the output generated by farms. These changes impact on both upstream suppliers (e.g. feed and fertiliser suppliers, veterinary and breeding services) as well as downstream processors (e.g. dairy product manufacturers). Changes in incomes for dairy and livestock farmers also impacts household expenditure patterns.
- *Consideration of positive as well as negative impacts* – We often focus on negative impacts, as they tend to be more tangible and easier to identify in terms of cause and effect relationships. However, most changes to economic systems result in both positive and negative impacts, and involve both winners and losers. There may be, for example, positive economic impacts for the wider community from reduced nitrogen in waterways associated with increased opportunities for Tourism (e.g. in the case of Lake Rotorua), less health risks from contaminated water, and so on. Higher environmental standards may also enable NZ producers to achieve a higher market price for goods, and so on. A balanced evaluation must give consideration to the full range of likely impacts, even if these are difficult 'technically' to model or rest on significant uncertainties.
- *Decline of small, local centres* – Much of the economic and household growth for NZ has been, and is likely to continue to be, focused in larger urban areas, with often neutral or negative growth anticipated for smaller towns and rural areas. Against this context, consideration of the distribution of economic impacts is important. Despite the 'ripple' of effects throughout the economy, economic impacts are still likely to be largely concentrated within communities and regions directly subject to policy changes. For areas in which declines in household numbers and economic activity is anticipated even without changes in policies to manage water resources, additional disincentives to remain in rural areas (especially reduced employment prospects) could exacerbate projected decline in household numbers and the consequent economic effects of that decline (such as business viability).
- *Maximising benefits received from valuable resources* – Too often the focus of policies and decision making is simply on finding ways to reduce the level of environmental harm caused by economic activities – either by reducing the level of those activities themselves, or reducing the level of harm per unit of the activity. A more broad and innovative perspective is required that fully recognises and the resources and ecological services that underpin our agricultural sectors are scarce, and hence possess significant value for all New Zealanders. To fully realise this potential value, we must continuously seek allocation arrangements that maximise wellbeing, including the wellbeing of future generations.

4 Lessons Learned

An integrated systems approach is required to understand the implications of policy change to help better manage and protect our freshwater resources. Society, economy and environment together are complex systems characterised by feedback loops, shifting cause and effect relationships, time lags and high levels of uncertainty. Studying a particular component of a system in isolation, as has too often been the approach followed to date, is akin to simple omitting or ignoring the influences of other components – the consequences of which could be dire. With this in mind, there are several lessons we have learnt from undertaking the aforementioned studies:

- *Multi-scale analysis.* Addressing water allocation and quality issues requires careful consideration of both spatial and temporal dimensions. Outcomes differ significantly according to the level of spatial resolution. The greatest impacts are felt within local communities, while at the regional or national scale impacts may be insignificant. Similarly, how mitigations or inventions are adopted through time can greatly influence the impacts experienced by communities. A gradual adoption pathway can significantly reduce the impacts experienced.
- *Non-market values.* These are typically overlooked, or put to the side, in economic assessments. This is largely due to the time and financial costs involved with primary research. Benefit transfer studies are commonly used, but NZ specific data to populate such studies is poor. Significant further New Zealand specific research is required to adequately account for non-market impacts.
- *Ecosystem services.* Understanding the benefits received from the environment is crucial to allocating resources between private and public interests. Closing-the-loop between the environment and economy is also critical to building resilient communities in the long term. This requires not only consideration of cultural, social, environment and economy trade-offs, but also how these pan out through time. Significant further research is required in this regard.
- *Strong stakeholder engagement.* This ensures that policy and plans are well aligned with communities, that analyses undertaken are fit for purpose, and trade-offs are clearly communicated. Stakeholders should be directly engaged in the process, this not only helps to inform stakeholders of the trade-offs being considered, but also ensures that stakeholder concerns are incorporated within any assessment.
- *A note on modelling.* Modelling, from many disciplines (science, engineering, economics etc) is increasing being used to inform policy development by assessing ex-ante the implications of policy or plan changes. It is important to realise that all models are inherently imperfect and that it is impossible to predict the future. Any model of a complex system such as an economy or the environment is after all a simplification of reality. This does not mean that models are not useful. It is simply beyond the unaided human mind to trace the consequences of change within a complex system. Models are thus required. Assumptions must be clearly stated; and supporting uncertainty and sensitivity analysis undertaken.
- *Peer review.* It is important that peer review process be put in place from the start. It is better that any inconsistencies, gaps and omissions in analysis be worked out through the process, rather than at the end.

5 Conclusion

Our paper is based on a pragmatic understanding, developed through practical involvement, in several of New Zealand's notable freshwater economic impact studies. We have attempted to synthesize the key process steps, findings and lessons learned from these studies in a concise a coherent manner for the benefit of others. In this regard, it is often useful to reflect on our learning. Our paper has highlighted the complexities associated with managing and protecting New Zealand scarce water resources from a wider economic perspective. Given that freshwater is critical to life, that it is used in almost all agriculture, industrial and service processes, and that it is increasing becoming a scarce global resource the importance of developing rigorous and robust assessment for our freshwater resources cannot be understated.