OFFICE OF THE PRIME MINISTER'S CHIEF SCIENCE ADVISOR

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Remarks to the Local Government NZ Symposium: Freshwater 2017[1]
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Freshwater Management – Challenges for New Zealand, for Local Government and for the Key Sectors

Sir Peter Gluckman, Prime Minister's Chief Science Advisor

Thank you for the opportunity to speak to Local Government NZ regarding freshwater and the challenges of its management. I think you will be all aware of the report[2] I released last month. This is an issue that has been on my mind for a while, as it has been on the minds of many New Zealanders, so I wanted to address the underlying science and try to provide a balanced perspective on the issues. I hoped to release the report much earlier but the complexity of the water ecosystem scientifically, in its multiple dimensions, is magnified immensely by the complexity of other issues that are brought into play, and particularly with regard to how we value our fresh water for different purposes.

And our understandings have changed.

Until relatively recently the issues of conservation and economic development have been largely seen in isolation. We have always treasured our natural environment and the freshwater rivers and lakes within our extensive portfolio of national parks and conservation lands. However, waters outside these areas have not always been tended to with the same view – their value was seen primarily for exploitation and economic development (irrigation, hydropower, etc) – and we did not think enough about the interconnectedness of ecosystems.

We now understand that the freshwater ecosystem is not just about the water and the plants and animals that live in and around it – we as humans are part of the ecosystem and what we do affects ecosystem function (and the health of our waterways) in both subtle and profound ways. And what we do to modify one ecosystem will have effects on many others.

Now, the need for more holistic and integrated practices of ecosystem management – something long recognised by Māori – is more generally understood. But such management practices do create challenges in dealing with legacy issues: to ensure the quality of our freshwater estate on one hand, while balancing development interests on the other. These scientific and policy challenges are compounded by the inherent complexities of freshwater-associated ecosystem maintenance and enhancement. It is these complexities and challenges that my report was intended to elucidate.

And we must be realistic – we cannot count on being saved by "magic bullet" approaches, nor can we keep our heads in the sand and not be innovative (relying on current practices), if we are to avoid an absolute tragedy.

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[1] These comments are presented as a personal perspective and do not represent the position of the New Zealand Government.

[2] New Zealand's fresh waters: Values, state, trends and human impacts (12 April 2017). http://www.pmcsa.org.nz/wp-content/uploads/PMCSA-Freshwater-Report.pdf

It has been inevitable since humans and their accompanying animals and plants came to New Zealand and altered land use by deforestation, draining of wetlands, etc., that there would be impacts on the quality of fresh water. This has been particularly so since the arrival of Pakeha, and subsequent urbanisation, industrialisation and the rapid expansion of pastoral farming. The latter, and particularly its very rapid intensification in recent years, creates enormous challenges. On one hand it is at the core of our economy, and on the other it has led to rapid changes in land use, particularly through dairy expansion, with concomitant major and adverse impacts on the quality of our freshwater estate. Agriculture and horticulture are also creating supply-side issues in some catchments – that is, there are places and times where there simply is not enough water to meet everyone's needs, and these demands are poorly regulated if at all.

The urbanisation of New Zealand is a further factor in reduced water quality. Accompanying issues are created by the impact of hydroelectric and geothermal power, industrialisation and the arrival of exotic invasive species that have all had further impacts on our freshwater and its associated biota.
There are many measures of water quality – reflecting its physical, chemical and biological characteristics. However, no single measure is sufficient to understand the state of fresh water, and the analysis is further complicated by gaps and inconsistency in the monitoring regimes. This is reflected in the current confusion over the proposed new water standards. There is an inherent and pragmatic logic in having nuanced definitions that take into account what is an acceptable risk, consideration of the seasonal changes, the relationship to extreme weather events etc., but the impacts of such complexity must be interpreted and communicated clearly.

Water monitoring in New Zealand is imperfect, with sampling site distribution not fully representative of the environmental variation that occurs, sub-optimal site density in places, and variable quality of sampling and analysis protocols. By far the most important form of monitoring is longitudinal, and this is lacking in many areas. There needs to be science behind the selection of monitoring sites so that the catchments can be understood. Despite these challenges, the data very clearly shows that water quality and quantity is being adversely affected primarily by changes in land use and the diffuse contamination arising from pastoral farming and urbanisation. Climate change can only put additional pressures on our freshwater ecosystems. In a number of regions drought will become more common requiring either better water management and/or changes in land-use.

LGNZ represents crucial components of our democratic system, and you better than I understand the importance of values in your decision-making. Ultimately government at all levels is making tradeoffs, and tradeoffs by definition are imperfect – they cannot fully meet all stakeholders interests or values. The role of science can only be to assist by providing evidence to reduce this complexity.

Fresh water contributes greatly to our economy through its role in tourism, in agriculture, and in industry, and is highly valued by New Zealanders for cultural, social and recreational reasons. Indeed, it is an inherent part of our national identity. The provision and benefits of fresh water to meet economic, social, cultural and environmental needs are referred to as 'ecosystem services', and include water for:

- intrinsic cultural value and a source of mahinga kai;
- potable water supply and household use – and I think councils are now waking up the to the need to be much more aggressive about scientifically directed management
- economic uses (agricultural irrigation and stock use; industrial use; hydroelectric energy generation; fisheries; tourism);
- recreation and social amenity; and
- sustaining our indigenous biodiversity, which in turn delivers its own set of ecosystem services.

All consumptive uses of water have some impact on the freshwater environment, even where water recycling is involved. Some non-consumptive uses have serious impacts through introduced biota, changing water chemistry or hydrology, and other effects on ecosystem services. With increasing use and demand for fresh water, it becomes harder to reconcile varying interests of households, agriculture and industry, and of communities that require other values be catered for, including those of conservation, recreation, tourism and of iwi.

The report points out the scientific understandings of the various forms of degradation of water quality, and in some cases water supply (which may soon get very problematic with climate change), and the associated impacts on freshwater biota and ecosystems. It also looks into the major causes of these declines, some of which are long-standing, such as dams and uncontrolled or poorly controlled extraction, industrial and urban contamination, and the enormous impact of deforestation for pastoral farming – impacts of which are compounded by the application of fertilisers and cow and other animal excreta. It is of course the excessive intensification of dairying that has accelerated the crisis, but others would say the country needed that to survive. I am no economist but the reality is that when the chips are down, economic survival becomes a political priority.

However, two points need to be made: it takes time and a consistent but adaptive approach to clean a catchment and it cannot be done without broad stakeholder engagement. The time involved can be decades long because of the inherent nature of the water cycle, and it is irresponsible if advocates and politicians make unreasonable claims. Water cannot be cleaned without thinking about land use. I shall return to this because this is largely in your hands.

Secondly, I need to talk about standards – lots of political points can and have been made but they are largely irrelevant to what is the core issue. There is a compelling logic to considering the distribution of pollution counts when setting standards, so the low median set for *E. coli* contamination levels is important. But the MOST important thing is consistent and common testing regimes and standards – and repeated measures at the same site so trends can be established over multiple years so we can see what is happening. And the public needs to know.

The title I was given asked me to talk about acceptable solutions: I would put monitoring at the top of the list. I would then suggest land use and land-use practices – which are within LGNZ control – become important. While the public understandably might hope for rapid restoration of water quality across all rivers and lakes in New Zealand, this is unrealistic and scientifically impossible. In some cases we are dealing with contamination that occurred decades ago, and the legacy effects may take a similar time to flush from the system. Moreover, there are no silver bullets in water restoration – multiple actions are needed, requiring partnerships between central and local authorities, iwi, citizens and businesses including farmers.

We need to be aware of the multiple stressors on fresh waters, and that fresh waters are a product of their catchments. Freshwater science advice is increasingly sought to inform catchment management and catchment-scale planning for development of regional policies and plan rules. Evidence-informed policy development is important, recognizing that there is a need to consider how scientific advice on improving water quality and ecological health is placed alongside advice on the economic, social and cultural impacts of implementing that advice.

Some catchments have done a great job in bringing stakeholders together in accord with the direction to regional councils in the National Policy Statement for Freshwater Management – examples that come to mind are the Mangaotama catchment, a sub-catchment within the Waipa River catchment in the Waikato, and the Aorere river in Golden Bay. These examples show that with clear plans and

dedicated stakeholder groups, small catchments can be managed in an integrated way to achieve both environmental and economic goals.

Large catchments such as the Waikato have wide differences in geology, soil types and land uses. This complexity means that some interventions will need to differ in different sub-catchments if the desired improvements in water quality are to be achieved most efficiently. This makes policy and plans (and associated rules) difficult to draft, challenges large scale limit-setting, and leads to 'winners and losers' and varied perceptions of fairness between different types of land use.

We need to bear in mind the reality is that the primary sector is key to our economy, and so is tourism. Both create significant, though different ecological footprints. And farming has effects on water in many ways.

My own bias is we cannot solve the water problem in isolation from thinking about the future of our primary industries. It is naïve to believe that it will not have to change. It is also naïve to think that we can affect great change on farming without impacting on the economics of farming and of New Zealand as a whole, unless we think about new technologies. We need farmers to be partners not enemies in the path ahead, and many farmers are responding positively. We need to find credible ways to diversify our agricultural economy that allow us to grow our small role in global value chains, which is difficult because of where we are in the world.

So we cannot think about the future of water without thinking about the future of farming. Precision agriculture is one part of it but life sciences are also moving at pace. How, if, and when they will be applied is a complex question – one that is not so much about science as it is about society. The issue of GM foods and crops, for example, is not about safety – it is about acceptability. New technologies will emerge and we must be careful that somewhat naïve and non-adaptive regulation does not limit us, while still ensuring that social license is achieved before any technologies are used.

All technologies have upsides and downsides; there will be a point very soon (because it exists in laboratories) when it may become attractive to the NZ farmer perhaps to make synthetic milk and meat from non-animal sources, because of its much lower environmental footprint. There will be a point when new practices will allow equal productivity from 25% less livestock and so forth. I could go on. These possibilities will be addressed in the Primary Sector Science Roadmap, which will be released by MPI in a few weeks, to complement the Conservation and Environment Science Roadmap we released earlier this year. These documents take a long-term, strategic view of research needs so that future policy decisions can be informed by the best possible evidence, taking account of diverse societal values.

On this subject, I worry about the trend for local government to take on decisions that are scientifically complex and have not been subject to appropriate societal discourse. We have seen in the fluoridation and anti vaccine debates how scientifically wrong memes can persist.

In the areas that matter to water quality, New Zealand has superb science in all the relevant domains including the social sciences. Councils should use this better. The science advisory system provides one mechanism to do this, as was done in fluoridation. I have already raised with the Prime Minister the possibility of a science advisor specifically for urban matters. This may make a bridge to councils easier.

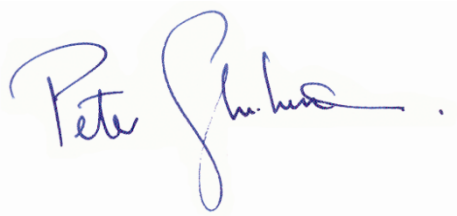
In the end the solutions are about the ecosystem. Councils directly or indirectly control many relevant aspects of an ecosystem, and when they make decisions, they need to understand the breadth of

possible impact. Any decision may have very long-term adverse effects – scientific input may be needed to get a full appreciation.

I have just returned from the Science, Technology and Innovation forum of the UN, which focused on the Sustainable Development Goals, to which New Zealand and all signatories are committed. Goal six simply states: "Ensure availability and sustainable management of water and sanitation for all", but goals 3, 11, 12, 13 and 15[3] are also relevant, and all require attention from multiple stakeholders and particularly elected officials at all levels of government everywhere.

But we do not need these to remind us of the need to move. I would argue that 30 years ago water use was not as well linked in people's minds to environmental quality as it now, because as our society advances, environmental health has become a much more important value to most of us. That value can be best enhanced by marrying science with effective democratic government.

Thank you.



[3] United Nations Sustainable Development Goals https://sustainabledevelopment.un.org/sdgs :
Goal 3 – Ensure healthy lives and ensure wellbeing for all at all ages
Goal 11 – Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12 – Ensure sustainable consumption and production patterns
Goal 13 – Take urgent action to combat climate change and its impacts
Goal 15 – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss